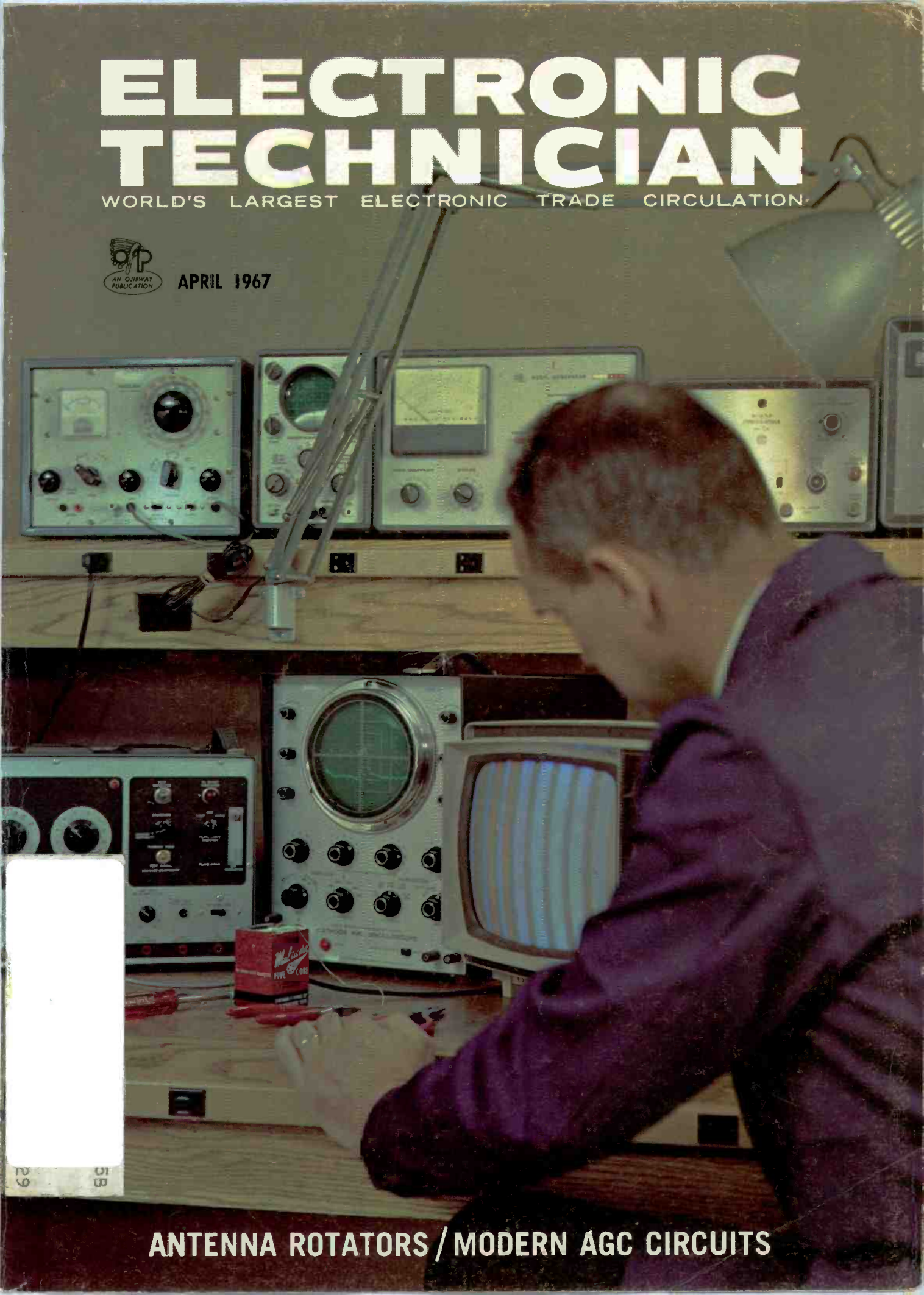
ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

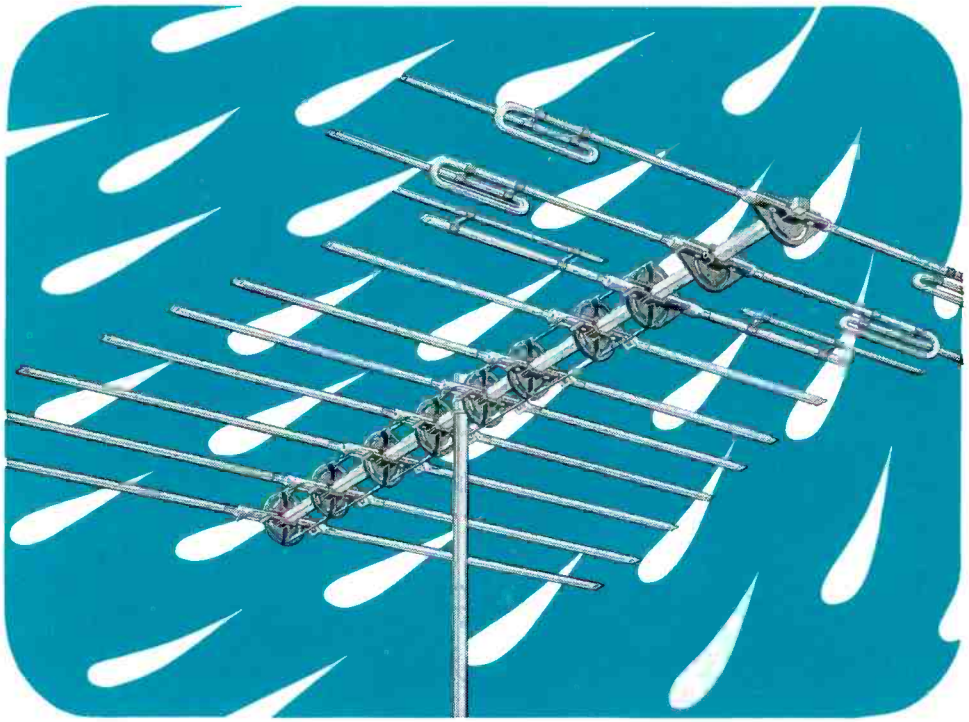
AN OJIBWAY PUBLICATION

APRIL 1967



ANTENNA ROTATORS / MODERN AGC CIRCUITS

New Jerrold Colorpeak™ VHF Antenna weathers any reception problem



Here's one outdoor antenna that stays put—even in a howling storm. The new Jerrold Colorpeak 300-ohm VHF-FM Antenna.

Colorpeak is a high gain antenna with unusual flatness across the entire VHF-FM band. It picks up strong, clear signals—even in difficult reception areas—because of its excellent front-to-back ratio. And it's built as rugged as a tank.

Vibration-proof point-contact element locks, corrosion-resistant Golden Armor Coating and tough Cycolac insulators make each insulating mount a strong point. No shorting out because of icing. No wavering image as wind whips through the antenna. No flimsy criss-cross conductors for transfer of the signal. Jerrold Colorpeak quality construction sees to all that.

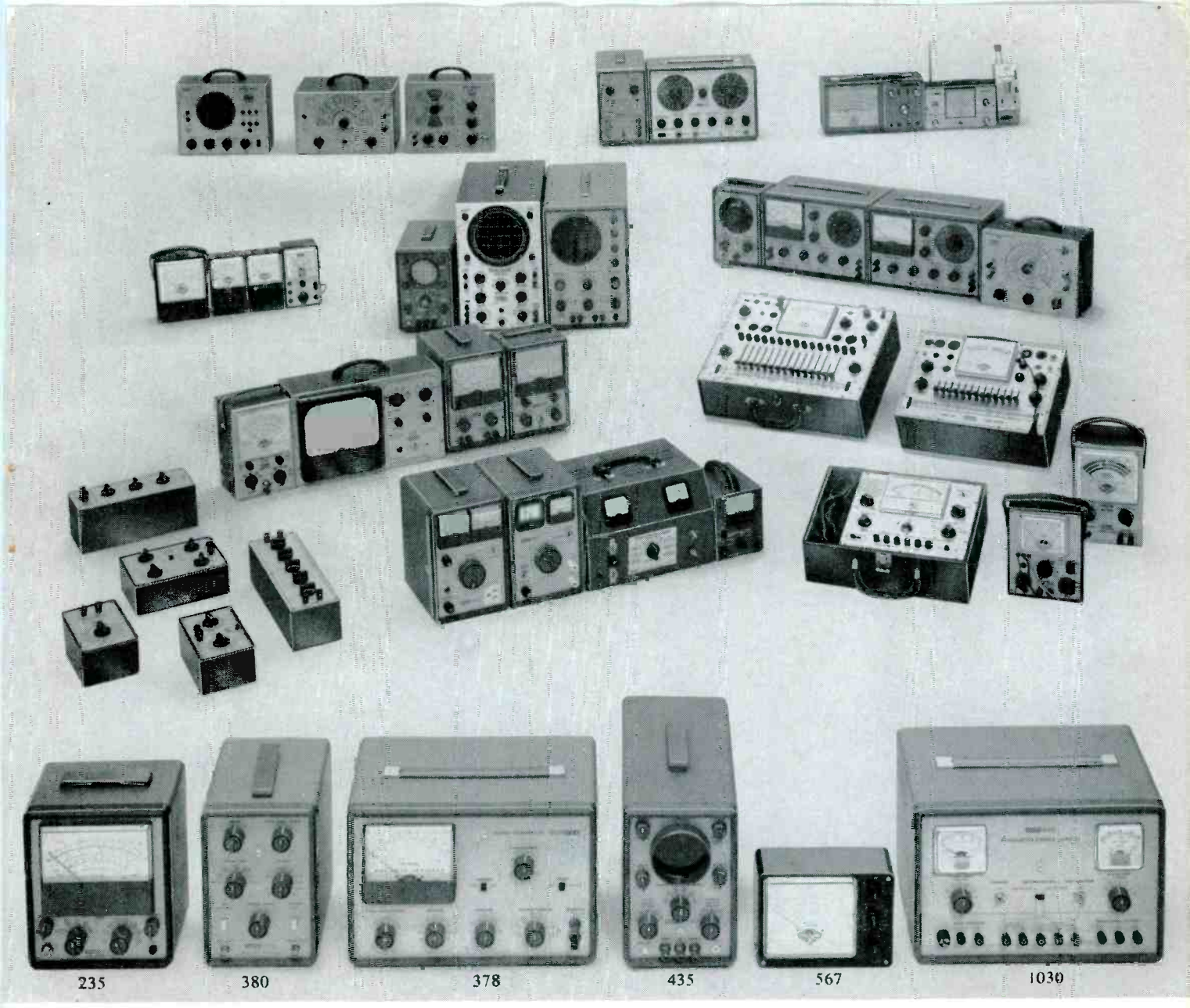
Jerrold Colorpeak antennas, like Jerrold VUfinder, Paralog Plus and Pathfinder antennas, assemble faster than any other antenna made today. All parts snap into place—anywhere—on the ground or on the roof. For hook-up ease, Colorpeak lead connections are made close to the mast.

For more details on the Jerrold Colorpeak antenna, see your Jerrold distributor.

JERROLD®

Focusing on one thing—better reception.

. . . for more details circle 101 on postcard



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The reason EICO's line is the industry's most comprehensive (100 to choose from!) is because each instrument serves a specific group of professional needs. You name the requirement–from a resistance box to a VTVM, from a signal tracer to a scope, from a tube tester to a color TV generator, etc., you can depend on EICO to give you the best professional value. Compare these latest (foreground) professional instruments at your neighborhood electronics distributor. You judge who knows your needs best – and serves your needs with the best values!

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EICO Electronic Instrument Co., Inc. 131-01 39th Avenue, Flushing, N. Y. 11352

ET-5

Please send further data on New EICO instruments below:

- ☐ **#235 Professional VTVM.** Measures to 0.01V for transistor servicing. Large 6" meter. 8DC ranges 0.5V to 1500V. 7 AC P-P ranges to 4200V. 7 AC RMS ranges to 1500V. 7 ohms ranges to 100MΩ. Response 30Hz to 3MHz ± 1 db. **Kit $49.95 Wired $64.95**
- ☐ **#380 Solid-State NTSC Color Generator.** The first serviceman-priced. True NTSC Generator. Extremely compact weighs only 4 lbs. **$169.00 Wired Only.**
- ☐ **#1030 Regulated Power Supply.** 0-150V @ 2ma, 0-400V up to 150ma, all to ⅓ of 1% Ripple 3mV. 6.3V & 12.6V, @ 3A. **Kit $59.95 Wired $99.95**
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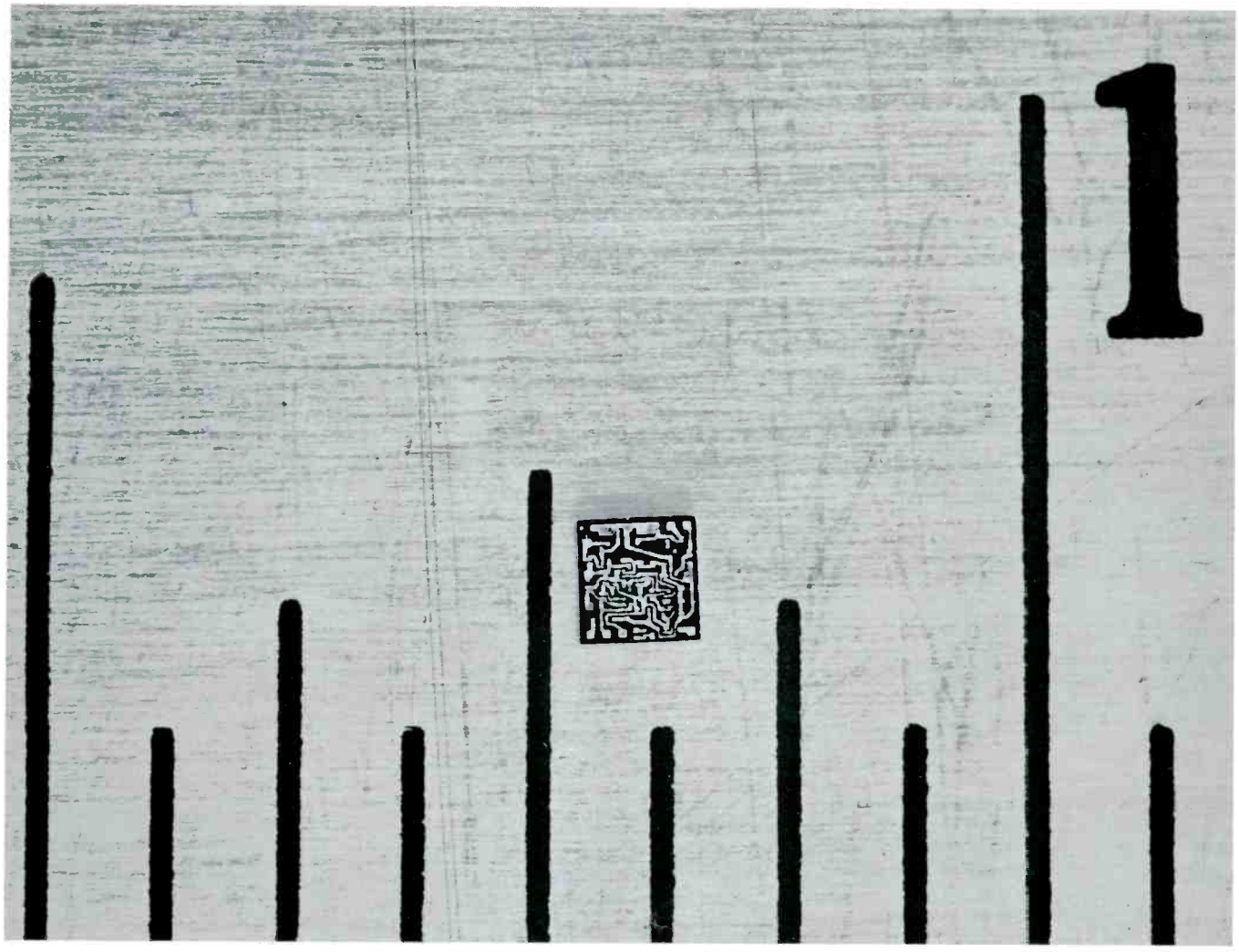
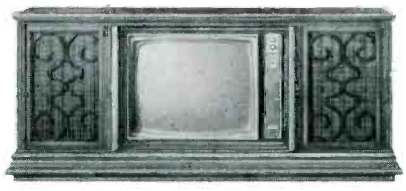


At 1/20th of an inch square it's the biggest thing in electronics



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RCA Victor was first to use integrated circuits in home entertainment products. Why? Because the integrated circuit is the most reliable circuit ever made for a consumer product. It's made in a room continuously cleansed of microscopic particles • Computer-controlled tests assure that it functions properly • Each is firmly mounted and connected to leads by ultrasonic bonding to enhance reliability (and that's what helps you sell). See your RCA Victor distributor today.

RCA The Most Trusted Name in Electronics

APRIL 1967

VOL. 85, NO. 4

ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

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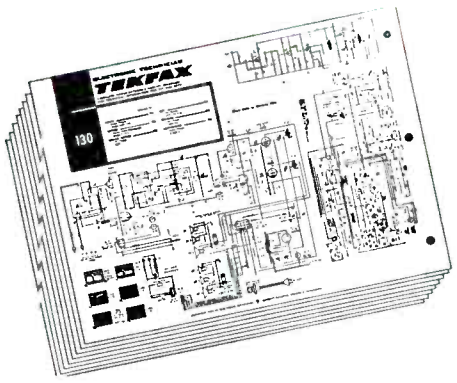
Cover

ET's editor-technicians are busy these days checking out the latest color TV circuitry and exploring new troubleshooting techniques to help you make repairs and adjustments rapidly and more accurately.

FEATURES

DEPARTMENTS

TEKFAX — 16 PAGES OF THE LATEST SCHEMATICS



Group 176 — April • 1967

ADMIRAL: TV Chassis G5, 2G5, 3G5, 5G5, 7G5, 9G5

GENERAL ELECTRIC: TV Chassis DD

MAGNAVOX: TV Chassis T923 Series

OLYMPIC: Color TV Chassis CTC 19/21 Series

PHILCO-FORD: TV Chassis 17NT45

TRUETONE: TV Model 2DC1605

ZENITH: TV Chassis 14N27

LETTERS TO THE EDITOR

Needs Info

I need an instruction manual and schematic for a Pyramid capacitor/resistor analyzer, type CRA-1. Can any reader help?

MAX OWENSBY
Northridge, Calif.

From NEA

I have noted three letters to the editor concerning interest in national service-dealer associations. More important, however, were the comments made by NEA state leaders regarding the first published inquiry (Oct. ET Letters to the Editor) at the November 12/13 board of directors meeting held here in Indianapolis. This certainly attests to the good readership your magazine has.

As I scanned the December letters, however, I had to come to the conclusion, despite what we consider to be dynamic programs (apprenticeship training under a U.S. Labor Dept. promotional prime contract; the trade's first national certified electronic technician program for TV technicians and a public relations program to help improve the less-than-desirable present image), that we appear to be doing a lousy job of keeping this professional trade informed regarding what the national associations are doing and what the trade itself hopes to do to bring about better conditions. Certainly, between now and our February 11/12 board meeting in Cincinnati, some effort will be expended to try and do a better job to solve the problem which ET unveils.

Also, let me take this moment to let you know that I am no longer president of NEA. At our August convention new officers were elected. The new NEA president is Mr. John Betz, 211 W. 18th St., Waterloo, Iowa.

We have been subscribers to ET for several years and find it very enjoyable. Thanks for your time and interest.

DICK GLASS
Director of Training, NEA
5302 W. 10th St.
Indianapolis, Ind. 46224

• *ET has received very few letters from readers who were not aware of the existence of the two national service-dealer/technician trade organizations. We do receive hundreds of inquiries regarding the addresses of the two national organizations which we answer directly. The addresses were published at this time in an effort to reduce somewhat our heavy letter-answering load. — Ed.*

ED Meter

Please help me locate a schematic and parts list for an Electronic Designs Model 100 VTVM.

FELIX BARAZANA
H. Veracruz, Ver.
Mexico

• *Can any reader help? — Ed.*

Got the Info

Thanks for printing my letter in the November 1966 issue of ET. I received letters from two national service-dealer and technicians' associations. Your magazine is the best in the field.

MARVIN E. POOLEY
Mitchell, S.D.

Technician Shortage

I operate a TV sales and service business here. For the past five years it has been almost impossible to secure a competent bench technician. At present, I have been without a bench technician since September, 1966. I have advertised in all the local papers and the NEW YORK TIMES without success. I am curious as to whether this is a nationwide condition. I am also open to suggestions as to how to secure competent help.

VINCENT P. DELZIO
Daltone T.V. Service
361A Mamaroneck Ave.
White Plains, N.Y.

•*The shortage of qualified technicians appears to be generally nationwide — with some areas more critical than others. This state of affairs has come about over a long period of time for various reasons — primarily because of flaws in our educational system. Some technicians have avoided the problem by carrying out a continuing program of apprentice in-shop training. Some service-dealers are now "stealing" qualified technicians from other areas by offering higher salaries and other benefits like many large manufacturers are doing to obtain skilled engineers.—Ed.*

Saja Tape Recorder

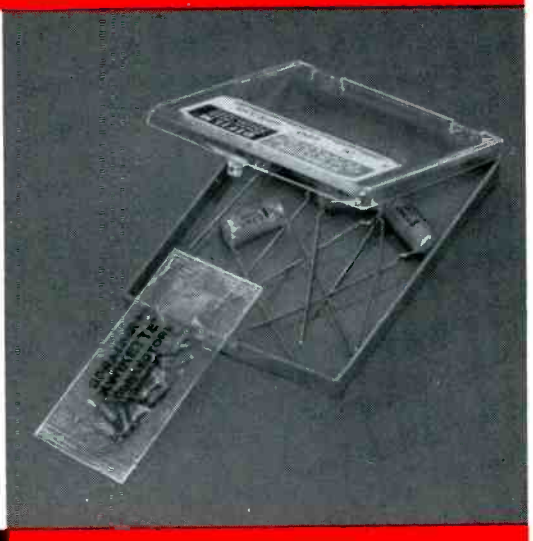
I am looking for service data and source of parts for Saja export tape recorders. Can any reader help me?

GLENN SEATON
Cleveland, Ohio

KWIKETTE* Soldering Aids available these NEW ways...

Packet of 10 for 29¢

Package of 100 for $2.79



With *all* Sprague pre-packaged wire-lead service-type capacitors *at no extra cost to you!*

NOW...YOU CAN SAVE TIME, TROUBLE, AND $$$$ ON MORE SOLDERING JOBS

This is it: the revolutionary KWIKETTE that speeds component replacement . . . and practically lets you do "in-circuit" parts testing. This unique soldering aid is *not* just another wire spring connector. It features a Copperweld wire inner core, an intermediate layer of flux, and an outer jacket of solder . . . *all you need is heat!*

You can now buy KWIKETTES from your Sprague distributor in packages of 10 and 100. You'll also find them included with *all* Sprague pre-packaged wire-lead service-type capacitors . . . *at no extra cost to you.*

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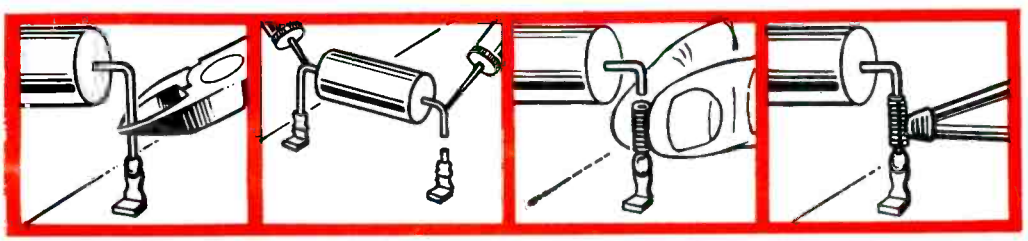

SNIP LEAD... TEST... SLIP ON KWIKETTE... APPLY HEAT!

If you haven't tried KWIKETTES yet, do it now. They're the biggest boon to the service technician since the soldering gun!

DON'T FORGET TO ASK YOUR CUSTOMERS "WHAT ELSE NEEDS FIXING?"

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THE MARK OF RELIABILITY

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LETTERS TO THE EDITOR

German Radio

Can anyone give me information about a German transistor radio, Schaub-Lorenz? Where can I get parts for this radio? If it is an import, perhaps the company has a service center in this country. Have received ELECTRONIC TECHNICIAN for one year and the TEKFAX have already saved me more than the cost of a subscription to the magazine.

WILLIAM KELLER
Phoenixville, Pa.

Wants More Stereo and CB

Have been reading ET for four years and I think it is a very good magazine. Let's have more articles on Hi Fi stereo and CB radio.

KEN SCHULTENBURG, SR.
Niagara Falls, N.Y.

• *We have more articles planned on both subjects.—Ed.*

EMC Tube Tester

Have been a subscriber and reader of your excellent magazine for a number of years and have gained untold knowledge from the many fine articles. If any reader has a schematic for an EMC tube tester, model 206, I would appreciate knowing if I can obtain a copy. Have written the manufacturer and was advised that the schematic is no longer available.

ROBERT L. WILEY
Lula, Ga.

Cash On The Line

Enclosed is my check for $10 to renew my subscription to your fine, informative magazine for the next 3 years. I would especially like to congratulate you on your fine choice of TEKFAX in the past six issues. I had several of these new sets in for repair before any other form of technical information was available.

R. H. OSWALD
Manitowoc, Wis.

One Man Shop

You have had some fine articles on larger TV shop operations — how about a piece about the one-man TV shop? I operate on a low budget, fewer service calls — miles apart and have to fix everything from lamp cords to color TVs. Some advice on how to work more efficiently would be very much appreciated.

R. GREENE
Topsfield, Mass.

• *See the report of a one-man marine electronics operation in the January 1967 issue. The TV-radio service-dealer operations we have reported on thus far have been modest operations — not large operations. In many areas the one-man TV-radio shop is fast disappearing. Although there are ways of working more efficient, the one-man operation is limited in efficiency. A lot of one-man operations are merging into two, three or more single operations and our information is they are making more money, working less hours — eating and living better. We suppose, in some thinly populated areas, however, the one-man shop will be with us for a long time.—Ed.*

Hickok Tube Tester

We have schematics and parts lists in our files as follows: 1 page schematic (has resistor and capacitor values specified). 2 pages parts list (for model 550 which is the same as 450 except with addition of a VOM). Reproductions available at 50¢ a page.

SCOTT INSTRUMENT LAB
2222 Broadway
San Diego, Calif. 92102

Needs Schematic and Alignment Data

I need a schematic and alignment data for a Commercial Trades Institute Chicago, Ill. model TV321. Also need a pulley for Tonemaster model TM-200-BKG serial U7898. Also need schematic and parts list.

D. A. STESZEWSKI
South Bend, Ind.

Kept Well Informed

I'd like to take this opportunity to express my compliments on your fine magazine. ET has kept me well informed of the constantly changing developments in the field and your color articles are just the greatest.

EDWARD WEBER
New York

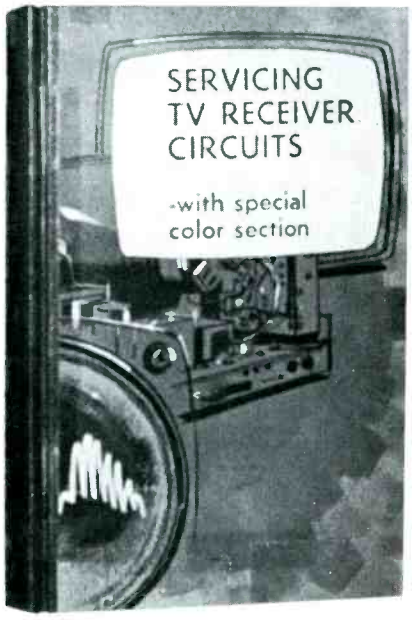
Dwell Tachometer

If John Holloman of Kensington, Md. has been unable to obtain a circuit diagram of the Accurate Instruments Co. dwell-tachometer, model AT162, I can furnish him with a factory schematic.

MATTHEW GAREY
Long Beach, Calif.

continued on page 98

Take BOTH These Brand-



- *224 pages*
- *Special Color Section*
- *34 FACT-FILLED Chapters*
- *Permanent, Hardboard Volume*

PARTIAL LIST OF CONTENTS

SERVICING TV RECEIVER CIRCUITS — with Special Color Section, contains 224 pages — 34 BIG Chapters of the type of practical servicing data every TV service technician should have . . . expert troubleshooting techniques and solutions to the most complex circuit problems. Contains step-by-step approaches to locating and correcting defects in every section of the receiver — from tuner to picture tube, from power supply to audio output. Contains complete analyses of TV circuit troubles and solutions for sweep and sync problems, AGC malfunctions, RF and IF faults, sound and audio trouble, power supply defects, etc.

Color Television Basics
Basic Color TV Circuitry
Understanding Chroma Circuitry
Details of Color Sync Circuitry
Details of Color Demodulation
Blanking and Gating in Color Sets
Color TV High-Voltage Circuits
Color TV Servicing Equipment
Chroma Circuit Servicing I
Chroma Circuit Servicing II
Color Sync and Demodulator Servicing
Obtaining Proper Scope Waveforms
Automatic Degaussing Circuitry
General Color Servicing Tips
Servicing the Horizontal Section
Servicing the Vertical Section
Adjusting Color Convergence
Using Logic to Diagnose Troubles
Developing a Methodical Approach
Troubleshooting Sync Circuits
Vertical Sweep Servicing Tips
Troubleshooting Noise Circuits
Troubleshooting AFC Circuits
Troubleshooting Synchroguide Circuits
Troubleshooting Multivibrators
Troubleshooting Horizontal Sweep
Selecting Yoke Replacements
Solving HV Flyback Problems
Troubleshooting B+ Circuits
Servicing Sound and Audio Circuits
Eliminating Unwanted Oscillations
Understanding Transistor Circuits I
Understanding Transistor Circuits II
Servicing Transistor TV Circuits

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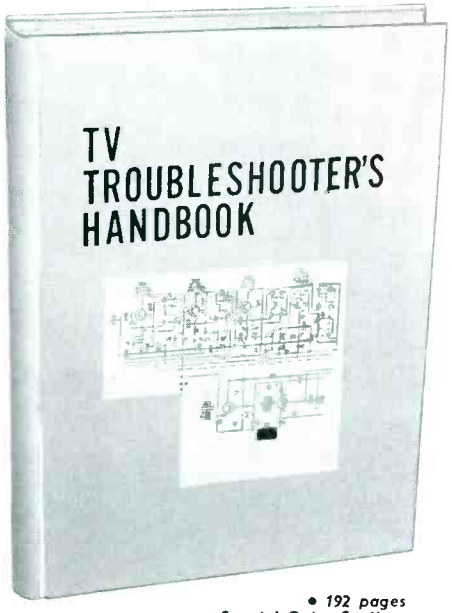


- *192 pages*
- *Special Color Sections*
- *Permanent, Hardboard Volume*
- *Over 350 solutions to "tough dog" problems*
- *Over 125 schematic diagrams & illustrations*

Partial List of Contents

TV TROUBLESHOOTER'S HANDBOOK contains over 350 proven servicing items describing "tough dog" problems and their solutions. For ease of use, these helpful trouble cures are arranged by manufacturer & model number. And, a special section concentrates on color set servicing.

These tried and tested trouble-shooting aids constitute a vital reference source of servicing techniques and will help make your own work easier and more effective. Circuit faults and solutions are included for these manufacturers:

B&W SETS
RCA VICTOR
GEN. ELECTRIC
PHILCO
SYLVANIA
WESTINGHOUSE
MAGNAVOX
MOTOROLA
ZENITH
ADMIRAL
EMERSON
CURTIS-MATHES
HALLI-CRAFTERS
CORONADO
TRUETONE
SYMPHONIC
SILVERTONE
EMERSON-DUMONT
GAMBLE SKOGMO

COLOR SETS
RCA VICTOR
SYLVANIA
GEN. ELECTRIC
ZENITH
PHILCO
MAGNAVOX
MOTOROLA
OLYMPIC
SETCHELL-CARLSON
WESTINGHOUSE
ADMIRAL

An Extraordinary

Accept BOTH these

May we send you these two unique time-savers as part of an unusual offer of a Trial Membership in Electronic Technician's Book Club?

Servicing TV Receiver Circuits

Now you can have, at your fingertips, this carefully-planned, comprehensive handbook which contains the TV service data *most needed* for troubleshooting both monochrome and color receivers.

Selected by the Editorial Staff of "Electronic Technician," this brand-new volume contains just the kind of practical, down-to-earth information you can use in your everyday service work. The material—written by nearly a dozen of the leading experts in the field—is based on articles which originally appeared in "Electronic Technician." Edited and arranged to provide a quick and easy reference, emphasis has been placed on the *practical* information you can use in home or at the service bench.

Detailed, Practical Help

This detailed compilation of practical help is the answer to the need for an organized gathering of proven troubles and cures that will help you locate and correct the most elusive TV circuit faults. This practical information will help you solve your daily servicing problems . . . will save you hours of time and effort. These accurate and clear servicing descriptions are supplemented by scores of easy-to-follow schematic diagrams and illustrations.

While no one book is a cure-all for TV troubles, *Servicing TV Receiver Circuits* comes about as close as you can get. Every chapter follows the time-proven methods of experienced troubleshooters—analyzing circuit performance and applying logical and efficient test procedures. Numerous example troubles are cited to help you solve "tough-dog" problems.

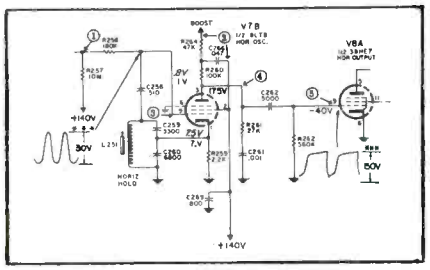
Special Color Section

More than half the content is devoted to color, and includes the practical background theory needed to troubleshoot and repair today's complex color TV receivers. A full 10 Chapters are devoted to step-by-step color TV servicing techniques, complete with test procedures, waveform photos, and trouble-correction techniques. While experience is the best teacher, an occasional re-reading of a Chapter or two when you're faced with a "tough-dog" set will make this book invaluable to you in servicing TV receivers.

New Books For Only $1.79

Offer...introducing the benefits of Electronic Technician's Book Club

invaluable NEW Servicing Handbooks for only $1.79 . . . with trial Club Membership



Literally scores of easy-to-use schematic diagrams are contained in both these new books. (Example shown greatly reduced in size)

TV Troubleshooter's Handbook

Here are helpful techniques which are a complete digest of late-model TV receiver troubles and cures, compiled strictly on the basis of their usefulness to you!

This practical compilation of servicing help contains data on new and unusual circuits and descriptions of how they work, field and factory changes, recurring defects, etc.

These accurate and clear servicing descriptions are supplemented by over 175 easy-to-follow schematic diagrams and illustrations. For ease of use, all troubles have been logically organized by manufacturer and model number.

A Special Section on color TV describes recurring defects and cures, and includes service hints for troubleshooting chroma circuits, short cuts for making convergence adjustments, descriptions of new circuits, etc.

Assembled for the first time in book form, *Servicing TV Receiver Circuits* and *TV Troubleshooter's Handbook* are handsome, hardbound books, indicative of the many other fine offerings made to Members . . . important books to read and keep . . . volumes with your specialized interests in mind.

How You Profit From Club Membership

This is just a sample of the help and generous savings the Club offers you. For here is a Club devoted exclusively to seeking out only those titles of interest to you as an electronic technician (no hobby or "fringe" books are offered). Membership in the Club offers you several advantages:

1. Charter Bonus: *Servicing TV Receiver Circuits* and *TV Troubleshooter's Handbook* carry publisher's retail price of $13.90. But they can be yours for only $1.79 with your Trial Membership.

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EDITOR'S MEMO

'Formula Kick'

Some people are always looking for sure things, absolute solutions to problems — formulas, or panaceas, that fit every situation that may arise in the world.

And there are some other people who never worry about problems. They are too busy finding solutions. In fact, they deal primarily with solutions that have no problems. Like the politician, for example, who thinks he can mold a higher order of human moral fiber by passing a special law.

The old bull-whip is often the politician's idea of a formula to the orderly process of human evolution. His formula may be a solution to *some* existing problem, but it certainly doesn't fit *this* problem. Almost every grammar-school child today knows that you can't legislate human morals.

Nor do we believe that the primary ills of our industry can be eliminated by licensing laws. We believe the self-cleaning, self-governing, self-certifying process supported by some of the service-dealer associations in this country will do the job faster and more effectively.

This solution is not a formula. It is a basic theory that has guided mankind up the ladder of progress since the day when the first two cave-men ceased to be rugged individualists, pooled their two clubs, and chased edible meat together.

It is a tested process which grows with the needs of the hour—it can be quickly revised, improved and amended to meet the inevitable changes that are now taking place and will continue to take place in a fast-changing world.

It is a method that will receive the maximum support of the largest possible number of those concerned — because it is *their solution* to their problem — a problem which they are more aware of and more sincerely concerned with than anyone else. What do the politicians know about our problems? What do they care about them?

We cannot afford to have our energies diverted up muddy jungle streams by twentieth-century snake doctors and pseudo-metaphysicians who have axes to grind.

Coming technological changes will soon need all our energies. We have no time to waste on panceas. Let's get no time to waste on panaceas. Let's get off the "formula kick."

Will the coming age of solid state TV catch you half ready?

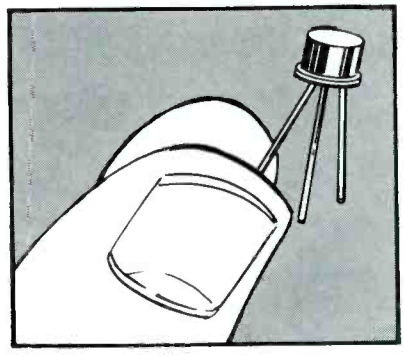
Not if you take advantage of our new "Professional Technician Program." Read on and see how Motorola's "PTP" can help.

Home entertainment products are changing—fast. There's more transistorization . . . and more advanced solid state technology each year. This means great opportunity for service organizations that keep abreast, because, well-informed technicians will be in even greater demand than they are now.

Motorola can help your service department be well prepared.

We have recently increased our staff of field technical personnel. It is their job to help provide you with Technical information for your men and to give some of the training your men will need to cope with this rapidly changing industry.

Each of our technicians has had extensive, practical consumer experience. They know their business—from your side of the fence. The training will be done *right in your place of business.* It will provide a valuable adjunct to the large-scale training meetings held by Motorola Regional Service Managers & Motorola Distributors. Two hours will be spent in formal training. The remainder of the day will be spent working with your men *on your work* to give information—and to help find ways to make more profitable and productive use of service time.



Get full information on availability of this training for your shop. Just call your Motorola Distributor.

MOTOROLA®

. . . for more details circle 125 on postcard

TECHNICAL DIGEST

ADMIRAL

TV Model TKE-3011—Audio Output Tube Replacement

The new educational TV receiver TKE3011 will use a 6BY11 audio output tube to obtain the specified 3w (EIA standard) audio output. At present the tube is only available from Admiral distributors.

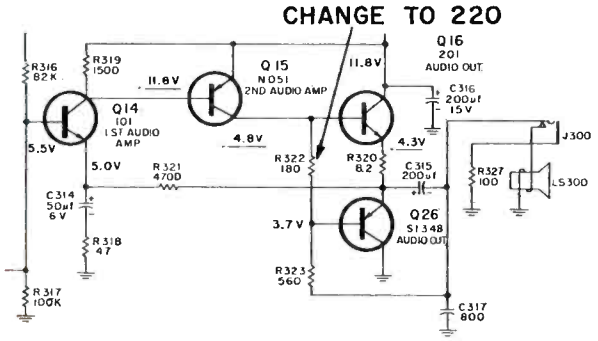
Emergency replacements can be made with the 6BF11 tube used in current entertainment type sets. The output will be sharply reduced, to about 1w, which could be unsatisfactory for classroom use.

If you are called on to service any of these educational TV sets, be sure you have this tube on hand.

GENERAL ELECTRIC

TB Chassis—Audio Distortion

Audio distortion, resembling a "raspy" speaker, has been reported from some areas. This has been traced to crossover distortion occurring in Q15 and Q16 because of component tolerance buildup.



The correction is to replace R322 180Ω±10% with a 220Ω±10% ½w resistor. If a 10% tolerance resistor is not readily available, select the proper value using an accurate ohmmeter.

Do not increase the value of R322 over 240Ω or the ratings of the output transistors will be exceeded.

OLYMPIC

TV Chassis NCP, NDP—Horizontal Oscillator Modification

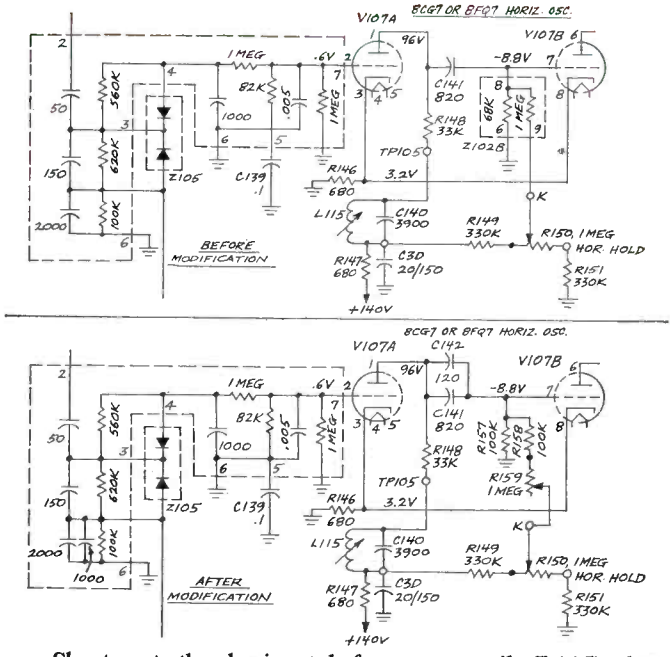
The NCP and NDP chassis employ an 8FQ7 tube as a horizontal oscillator which has a wide range of dynamic operation.

When a replacement of this tube is required, the new tube may throw the horizontal frequency out of control range. This may also happen if the tube or components in the circuit age.

Compensation in the horizontal oscillator circuit was required in the past. Varying the value of R149 and R151 resistors, was good for the immediate tube change, but not a permanent cure.

Modification has been made on the horizontal circuit to employ an additional control, not available before. The control allows setting of the horizontal hold control to its mid-position under all conditions encountered with various 8FQ7 tubes, when the horizontal sweep circuit is adjusted as follows:

Allow a two minute warm-up, tune in a station.



Short out the horizontal frequency coil (L115), by jumping TP-105 tie point to the —140v terminal.

Connect a clip lead from TP-104 to ground, to disable the horizontal sync input.

Adjust the horizontal hold control to mid-position, adjust the new control until the picture is near locked-in.

Remove jumper from L115 and adjust L115 until picture is in sync. Remove clip lead from TP-104 and ground allowing station sync signal to reach the horizontal circuits.

In production this control will be labeled "H. BAL." (horizontal balance), and will be located directly above and on the same plate as the horizontal hold control.

The control and its associated circuit can be added in the field, by installation of modification kit PP35557, which has installation instructions enclosed.

The kit is available at $2.50 list, and consists of the following parts:

1 Potentiometer	1M ½w ±30%
2 Resistors	100K ½w
1 Capacitor	120pf N1500
1 Capacitor	1000pf 1kv ±20%
1 Terminal strip, double lug, stand-off	

PHILCO-FORD

High Fidelity Console Models N-P-Q Line—Noisy Loudness Controls

If static or noisy audio is heard through the speaker system on the mentioned models, when the metal control knob is touched, juggled, or rotated, use a compression spring over the control shaft between the knob and control bushing to provide an improved ground between the knob and control shaft.

To reduce or minimize the condition proceed as follows:

1. Remove metal loudness control knob.
2. Place spring over shaft.
3. Replace loudness conrtol knob.

Suggested spring Part #28-14692-1 or equivalent.

RCA Transistors Rectifiers Integrated Circuits

For EXPERIMENTERS HOBBYISTS HAMS and TECHNICIANS

LOOK FOR THIS DISPLAY AT YOUR RCA DISTRIBUTOR

Here displayed on the RCA Solid-State Center is the RCA SK-Series Transistors, Rectifiers, and Integrated Circuits; the new RCA 3N128 MOS Field-Effect Transistor; RCA's 40214 Silicon Stud Rectifier; and three RCA Experimenter's Kits. This new Solid-State Center, in addition to its host of devices, also includes technical literature to support the devices right on the rack. It's the "one-stop" answer to the solid-state needs of experimenter, hobbyist, ham, or the replacement requirements of the service technician.

All devices and kits are packaged in easily identifiable see-through packs for your convenience. Included with each device is broad performance data or specific ratings and characteristics where applicable.

RCA Solid-State Center Includes:

- RCA Experimenter's Kits. Three kits enable you to build a light dimmer or any one of 14 different circuits for dozens of applications around the house.
- RCA SK-Series "Top-of-the-Line" Devices: 17 Transistors, 2 Rectifiers, and 2 Integrated Circuits, for experimenter or replacement use.
- RCA Technical Manuals. Four manuals include: RCA Experimenter's Manual, RCA Transistor Manual, RCA Linear Integrated Circuits Fundamentals Manual, and RCA Tunnel Diode Manual.
- RCA Solid-State Replacement Guide. Lists all RCA SK-Series "Top-of-the-Line" Transistors, Rectifiers, and Integrated Circuits and the more than 7,300 types which they replace.

Keep RCA Experimenter's Kits and the RCA SK-Series in mind when you're shopping for solid-state devices. Look for the RCA Solid-State Center. Now at your RCA Distributor. Do it today!

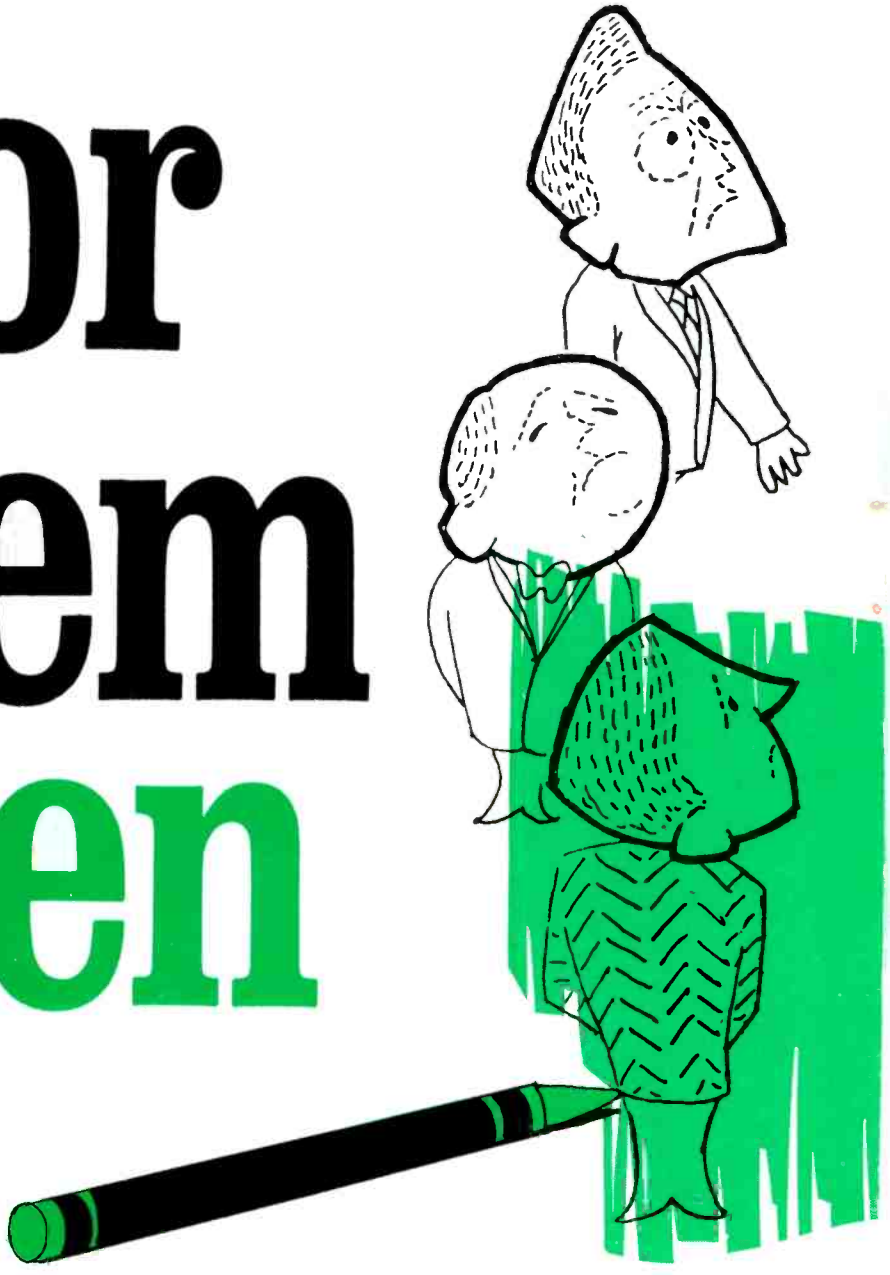
RCA Electronic Components and Devices, Harrison, N.J

RCA®

The Most Trusted Name in Electronics

. . . for more details circle 133 on postcard

Color them green



Channel Master's Crossfire Antenna Series has

...More dealers prefer Channel Master to any other brand (2 to 1 by survey of leading trade magazine).

...More have been sold (and are still being sold) than any other antenna in the history of television. And dealer acceptance is still growing.

...More dealers bought Crossfire antennas in January and February than in any previous first two month period.

No wonder other antenna manufacturers try so hard to re-work their own designs along the famous Channel Master Crossfire lines.

But it just can't be done.

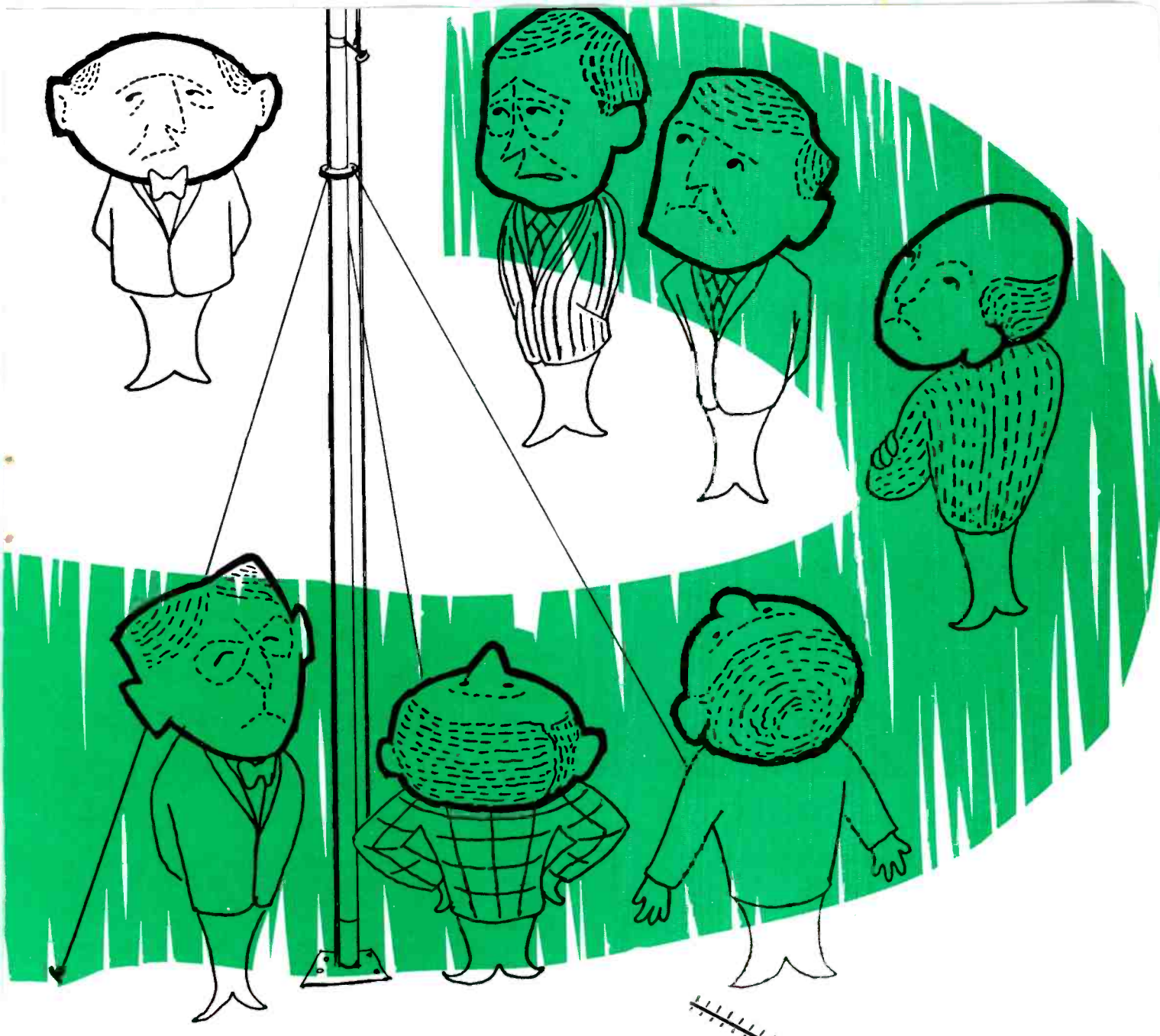
Legally, the Crossfire series is protected by five U.S. patents or patents pending.

And, in terms of mechanical and electronic design, the Crossfire series maintains a standard that has never been equalled.

Take mechanical design, for instance. Crossfire antennas have weathered six tough winters, verifying structural superiority originally proven in wind tunnel tests at the University of Miami hurricane test labs. Channel Master dealers ...who have just recorded the biggest first-two-months Crossfire sales in history...can tell you many of those antennas went up to replace less rugged makes that couldn't take the winter storms.

Most, of course, were teamed up with new set sales to meet the critical demands of color reception. Because, when it comes to electronics, Channel Master Crossfire Series antennas set the industry pace for clean, crisp color as well as outstanding black and white and FM Stereo.

In seven VHF models of Color Crossfires, electronic leadership takes the form of Proportional Energy Absorption

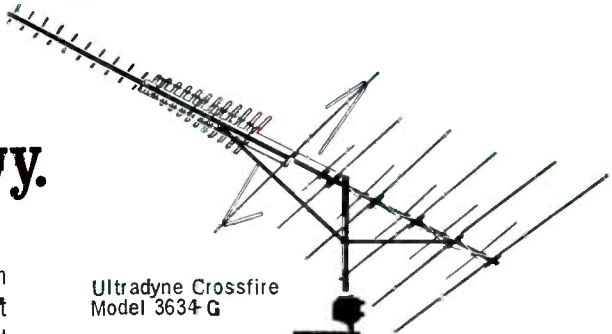


our competition green with envy.

and gain-boosting Tri-Band Directors. Then there are the 82-channel Ultradyne Crossfires...6 of them...with the most advanced, self-coupling, UHF section ever developed, plus all the Color Crossfire features. Finally, the Coloray group provides television's first electronic ghost-killing service in an 82-channel model and two VHF/FM models. All are finished with Channel Master's famous golden E.P.C....the coating that has been adopted by the military because of its weather protection.

Channel Master dealers know green is the color of envious competition. But they also know green is the color that lines their cash drawers when they meet the critical demands of Color head on with Channel Master Crossfire Antennas. Only Channel Master gives dealers full profit...then protects that profit from mail order and discounter inroads.

Color your cash drawer green. Call your Channel Master Distributor.



Ultradyne Crossfire
Model 3634-G

The House of COLOR

CHANNEL MASTER®

ELLENVILLE, N.Y.

. . . for more details circle 109 on postcard

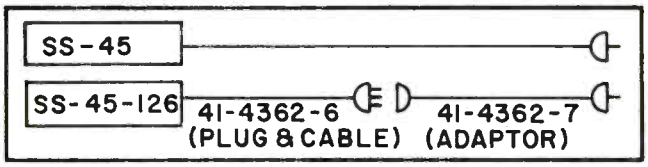
TECHNICAL DIGEST

PHILCO-FORD

SS-45 and SS-45, Code 126 Extension Speakers—Converting 3-Prong Plug to Common Phono Plug

The SS-45 extension speaker was early-production used with "P" line high fidelity merchandise. The connector on the end of the extension cable uses a regular single prong phono plug.

The SS-45 Code 126 extension speaker is later-production used with high power output "Q" line high fidelity merchandise. The connector on the end of the extension cable is a special 3-prong plug to match the associated



extension speaker socket on "Q" line 300w models which has sufficient power output to damage the smaller speaker assembly, SS-36.

When used with "P" line and lower power "Q" line models.

SS-45 is already equipped with proper single prong plug.

SS-45, Code 126 has an adaptor plug #41-4362-7 packed in shipping carton with speaker assembly (Converts 3-prong to common phono plug).

When used with high power "Q" line models (Q-1799, 1795 and 1793).

SS-45 needs a 3-prong plug instead of a single prong plug the assembly comes equipped with. There is no adapter available, so to use the early production SS45 you must do the following:

Install a 3-prong plug (#54-4878) on end of the extension cable, or, replace extension cable and plug assembly with #41-4362-6.

GENERAL ELECTRIC

Tape Recorder Model TP1100B—Bias Oscillator Transistor and Record Lamp Failure

When there is an absence of bias and erase voltage and the record lamp does not light, the following condition may exist:

The bias and erase oscillator transistor Q9 (EA1135) developed a collector-to-emitter short, causing full power supply voltage of 21.5v to appear across the record lamp. The record lamp will glow very brightly for a short period before the filament opens.

When this trouble occurs, replace bias/erase oscillator transistor Q9 and record lamp.

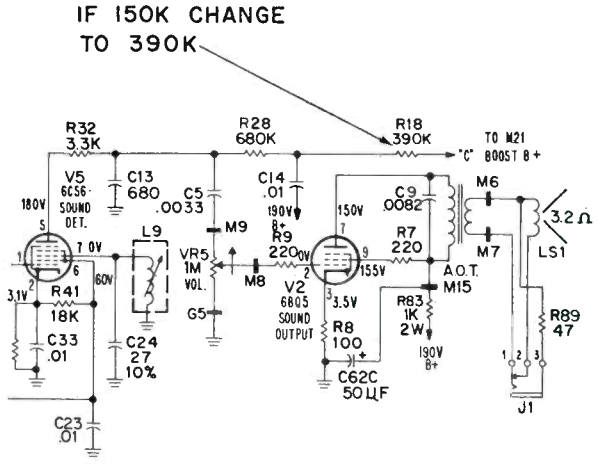
If one junction of Q9 should open preventing Q9 from conducting, the symptom would be as stated here, however, it would not be necessary to replace the record lamp bulb.

PHILCO-FORD

TV Chassis 17JT41, 17LT43, 17NT45—Run Change Information

17NT45 Run #2 Panel and 17JT41, 17LT43 Run #7 Panel.

TECHNICAL DIGEST



To improve hum rejection in the audio output stage, resistor R18 in the audio detector plate has been changed from 150K to 390K.

17NT45 Run #2 panel will be identified by a red dot on the panel.

17JT41 and 17LT43 run #7 panels will be identified by a violet dot on the panel.

How To Tighten Grille Cloth

From time to time we have had requests for information on how to repair the grille cloth that sags on one corner possibly because of moisture or temperature conditions in the home. The following is a suggested procedure which can be used to tighten this sagging cloth.

A. For plastic grille cloth or combination plastic and cotton grille cloth.

1. At a distance of approximately 10in., pass a heat lamp (250w) back and forth across the affected area of the cloth until it tightens.

CAUTION: Do not allow the heat to concentrate in one area too long as the material will scorch.

B. For cotton grille cloth.

1. Mix in a container 1 part water and 1 part Isopropyl
2. Place mixture in an atomizer.
3. Dampen affected area with atomizer.

(If an atomizer is not available, the cloth may be dampened by flicking the mixture on the cloth with a small brush).

4. Use a heat lamp to dry the cloth.

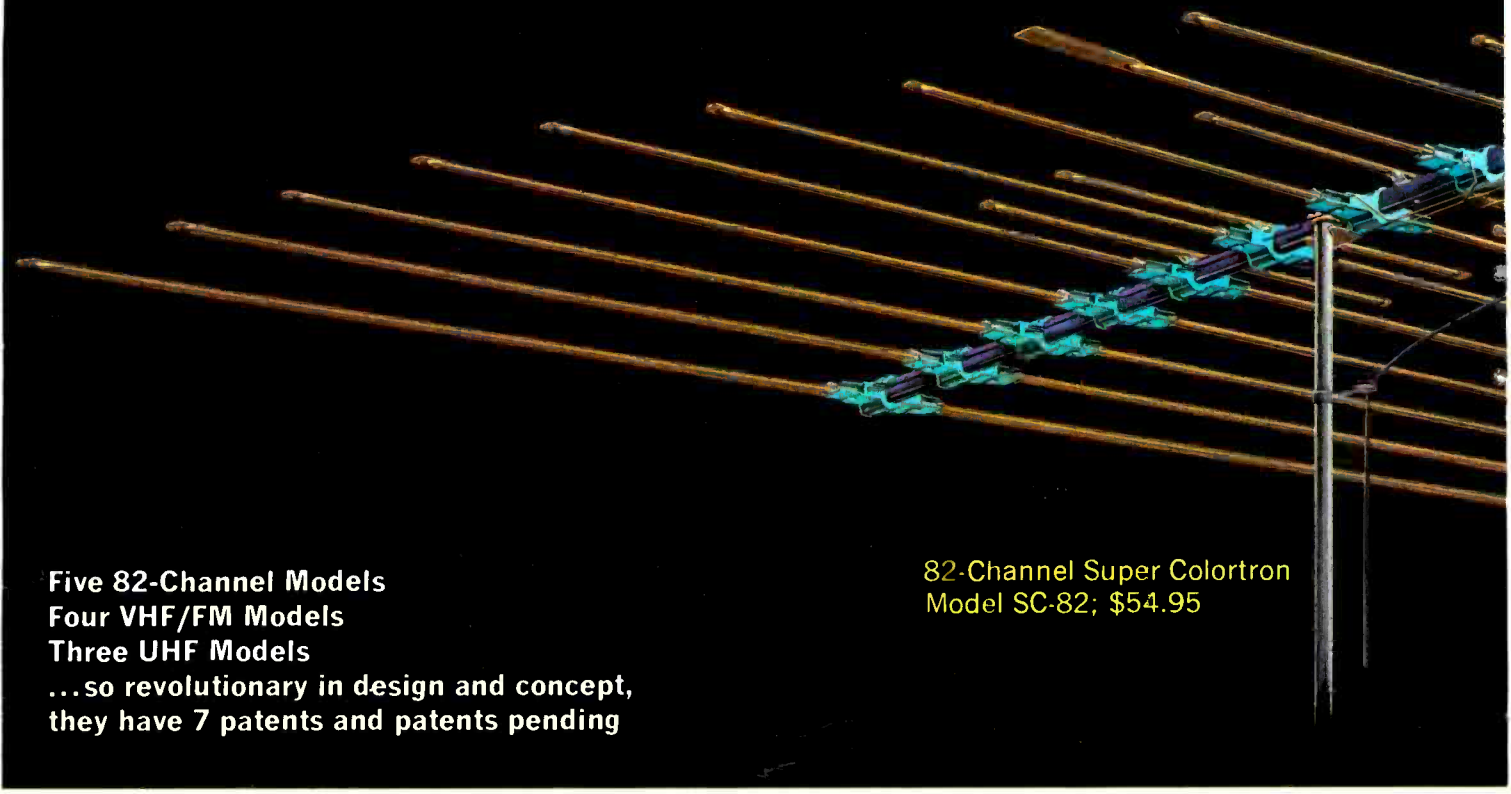
(Use the same procedure as outlined for plastic grille cloths). If sagging is still present after drying, repeat the dampening and drying process.

Courtesy service training department, Magnavox.

Old Schematics

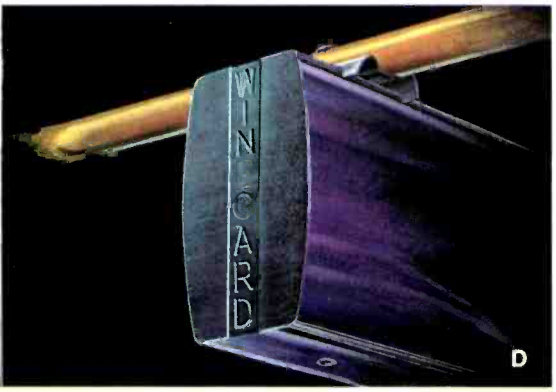
Supreme Publications offers to send promptly by mail most radio schematics for $1 each which go back to the 1930's. Try them: Supreme Publications, 1760 Balsam Rd., Highland Park, Ill.

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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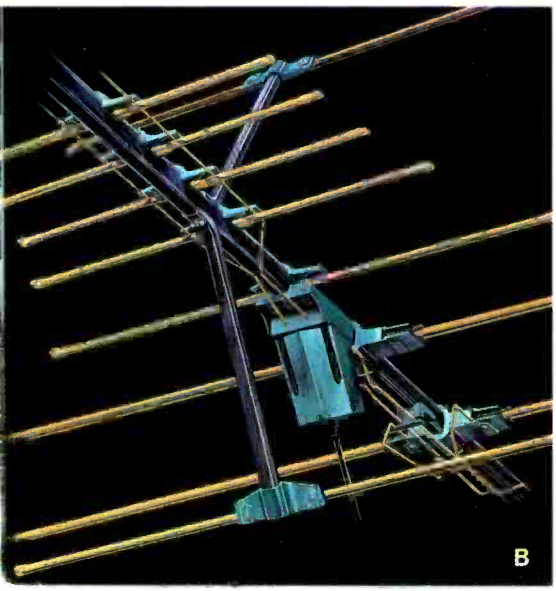

B

The World's First Total Design Antennas

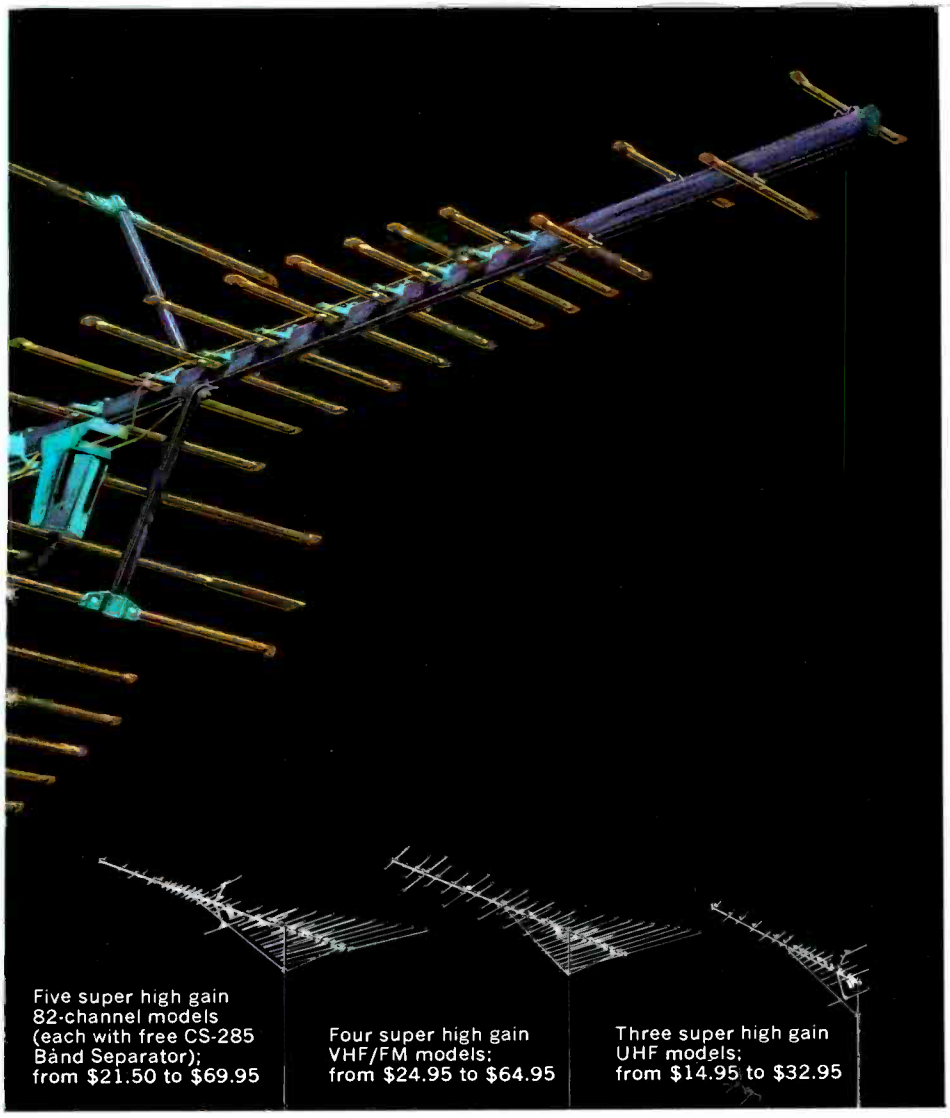
New antennas come and go. But there's never been an antenna like the amazing Winegard Super Colortron. 12 models in all—totally designed with more exclusive electronic, construction and performance features than all other antennas combined. It's taken us a while to create and develop and perfect the 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.

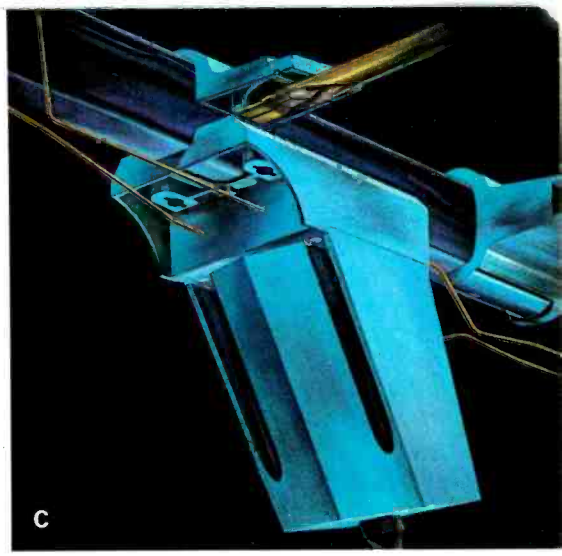
Total Design Electro-Lens Director System: Exclusive patented Electro-Lens system (U.S. Patent 2,700,105; Canada 511,984) absorbs entire signal and focuses it directly onto the driven elements to give Super Colortrons pinpoint directivity.

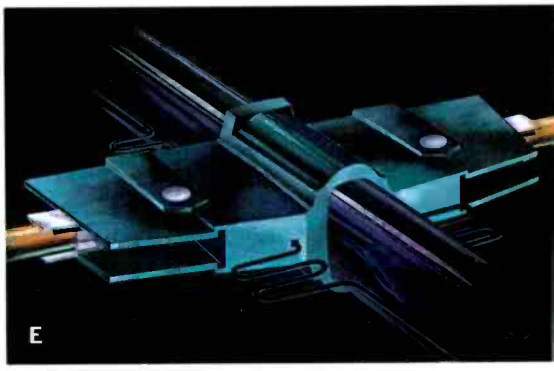


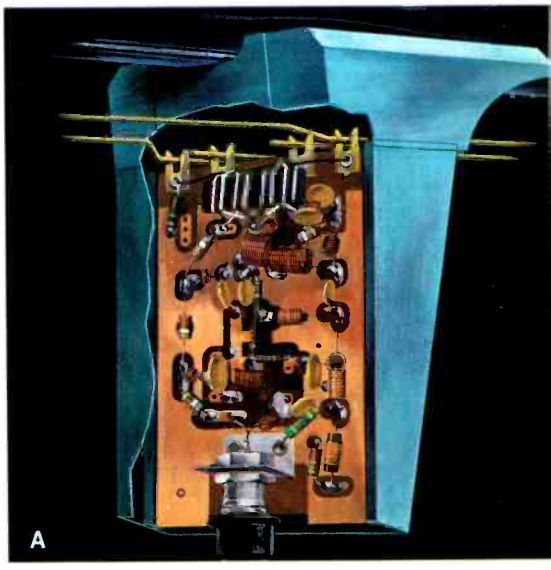
Five super high gain 82-channel models (each with free CS-285 Band Separator); from $21.50 to $69.95

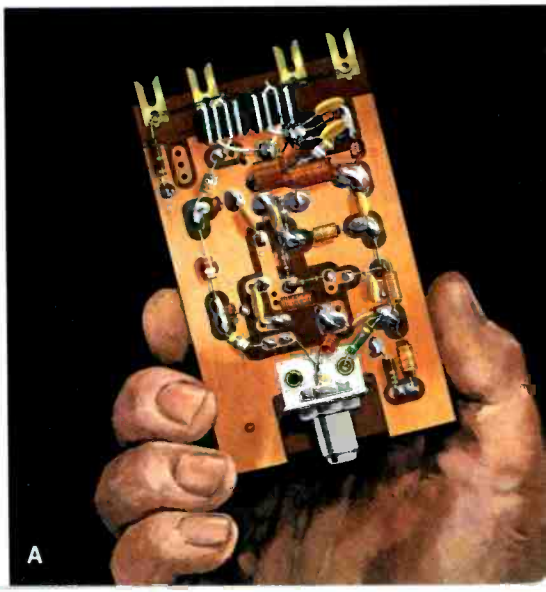
Four super high gain VHF/FM models; from $24.95 to $64.95

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









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.

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

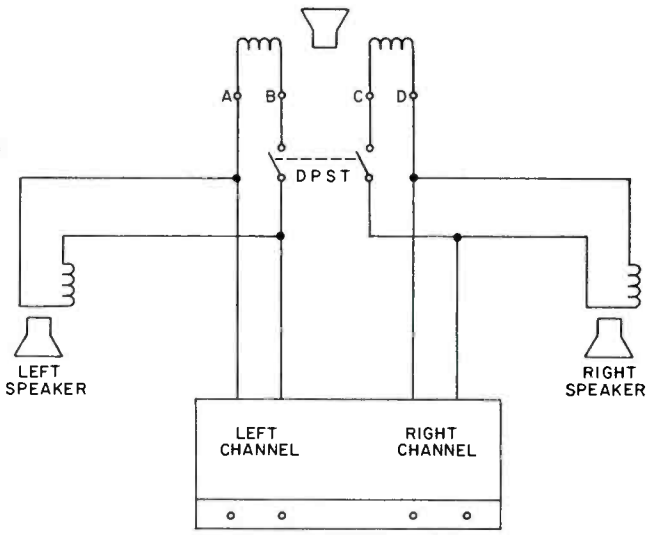
WINEGARD COMPANY, 3000 KIRKWOOD STREET, BURLINGTON, IOWA 52601

Dual VC Speaker Solves Stereo Extension Problem

■ How many times have you been asked by a stereo customer to install an extension speaker to his den or outdoor patio? Most customers want this to be an inexpensive project and do not want two speakers nor care for the stereo sound effect.

If you tap off one speaker of the stereo, you may unbalance the output, and you do not have the total audio reproduced from the extension speaker.

This problem can be solved with a dual voice coil speaker that is designed for multi-impedance matching of transistor auto radios. The Quam Nichols Co., for example, makes a 5- x 7-in. speaker, model 57A2MT,



or equivalent that mounts nicely in an 8-in. speaker baffle. These speakers have a dual VC of 20Ω impedance for each coil.

One of the voice coils is connected to the right channel stereo speaker and the other one to the left channel output. This hook-up will not cause any cross talk or distortion.

These speakers will match very well the 8 to 16Ω transformer output type amplifiers. They also work equally well with direct feed transistor amplifiers having a 20 to 40Ω impedance output.

The only precaution is to have proper phasing of the two coils. To do this, listen to the audio output while you reverse the leads of terminals A and B or C and D until maximum output is obtained.

This set-up produces good quality audio output and cuts the cost in half for the installation. ■

Stockroom on wheels!

Your stockroom is as big as a catalog and as near as a Greyhound bus, when you specify Greyhound Package Express

Greyhound Package Express puts a warehouse at your fingertips. Gives you easy access to more different kinds of items than your shelf space could possibly accommodate. No matter what your customer wants—if it's in a catalog, you can get it for him fast by GPX. Your profits are boosted by a wider choice of merchandise...while your capital investment is kept to a minimum. GPX shipments travel on regular Greyhound buses, running on fast, frequent passenger schedules. Very often, you get what your customers need in a matter of hours. Specify GPX for round-the-clock service. 7 days a week, 24 hours a day. Weekends and holidays, too! Choice of C.O.D., Collect, Prepaid, or GPX Charge Account. For complete information about service, rates and routes, call Greyhound, or write: Greyhound Package Express, Dept. 53-D, 10 South Riverside Plaza, Chicago, Illinois 60606.

It's there in hours and costs you less

For Example	Buses Daily	Running Time	20 lbs.	30 lbs.	40 lbs.*
BOSTON—NEW YORK	28	4 hrs. 15 mins.	$2.20	$2.60	$2.90
LOS ANGELES—SAN FRANCISCO	22	9 hrs. 15 mins.	2.10	2.45	2.80
PITTSBURGH—CLEVELAND	12	2 hrs. 45 mins.	2.00	2.25	2.65
INDIANAPOLIS—CHICAGO	10	4 hrs.	2.10	2.45	2.85

*Other low rates up to 100 lbs. Lot shipments, too.

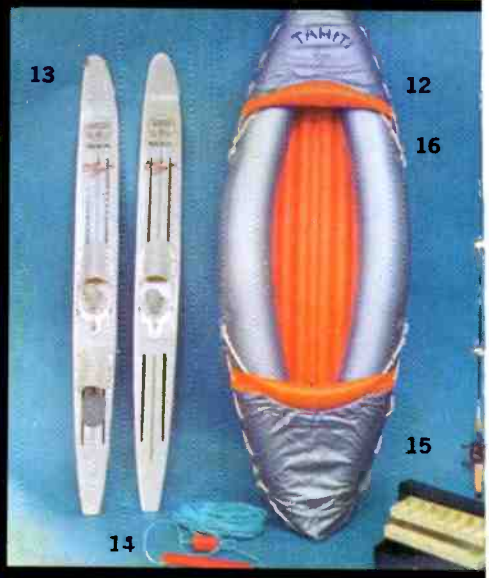
GPX
GREYHOUND PACKAGE EXPRESS

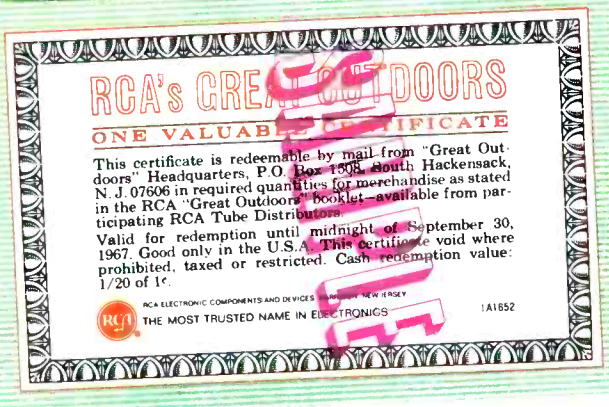
One of a series of messages depicting another growing service of The Greyhound Corporation.

. . . for more details circle 117 on postcard

RCA brings you a marvelous array of prizes for

THE GREAT OUTDOORS





Choose from a great selection of prizes available to you with RCA's GREAT OUTDOORS prize certificates. These valuable prize certificates are **free with your purchase of RCA entertainment receiving tubes** from your participating RCA Tube Distributor at the rate of one certificate for every ten RCA receiving tubes purchased. (Optional with RCA Tube Distributors.)

1. 30-42 Skil Portable Electric Saw. 76 Cert.
2. 30-45 Black and Decker Drill Kit. 46 Cert.
3. 30-90 Thor 4½" Bench Grinder. 55 Cert.
4. 30-85 Skil ¼" Variable-Speed Drill. 53 Cert.
5. 30-20 Wen Sabre Saw. 53 Cert.
6. 32-324 Atlantic "Comparto" Golf Bag. 62 Cert.
7. 32-89 Spalding "Jerry Barber" Golf Woods. 56 Cert.
8. 32-91 Spalding "Jerry Barber" Golf Irons. 94 Cert.
   32-356 Set of 3 Bobby Nichols "Grand Slam" Golf Woods. 107 Cert. Not illustrated.
   32-357 Set of 5 Bobby Nichols "Grand Slam" Golf Irons. 119 Cert. Not illustrated.
9. 32-319 Wilson "Flag-Hi" Golf Balls. 25 Cert.
10. 32-344 Wilson "Tom Gola" Basketball. 18 Cert.
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19. 20-589 Hickok Dacron-Cotton Golf Slacks. Pleated. 33 Cert.
20. 31-30 Central 20" Lawn Spreader. 32 Cert.
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22. 31-51 Village Blacksmith Precision Lopping Shears. 9 Cert.
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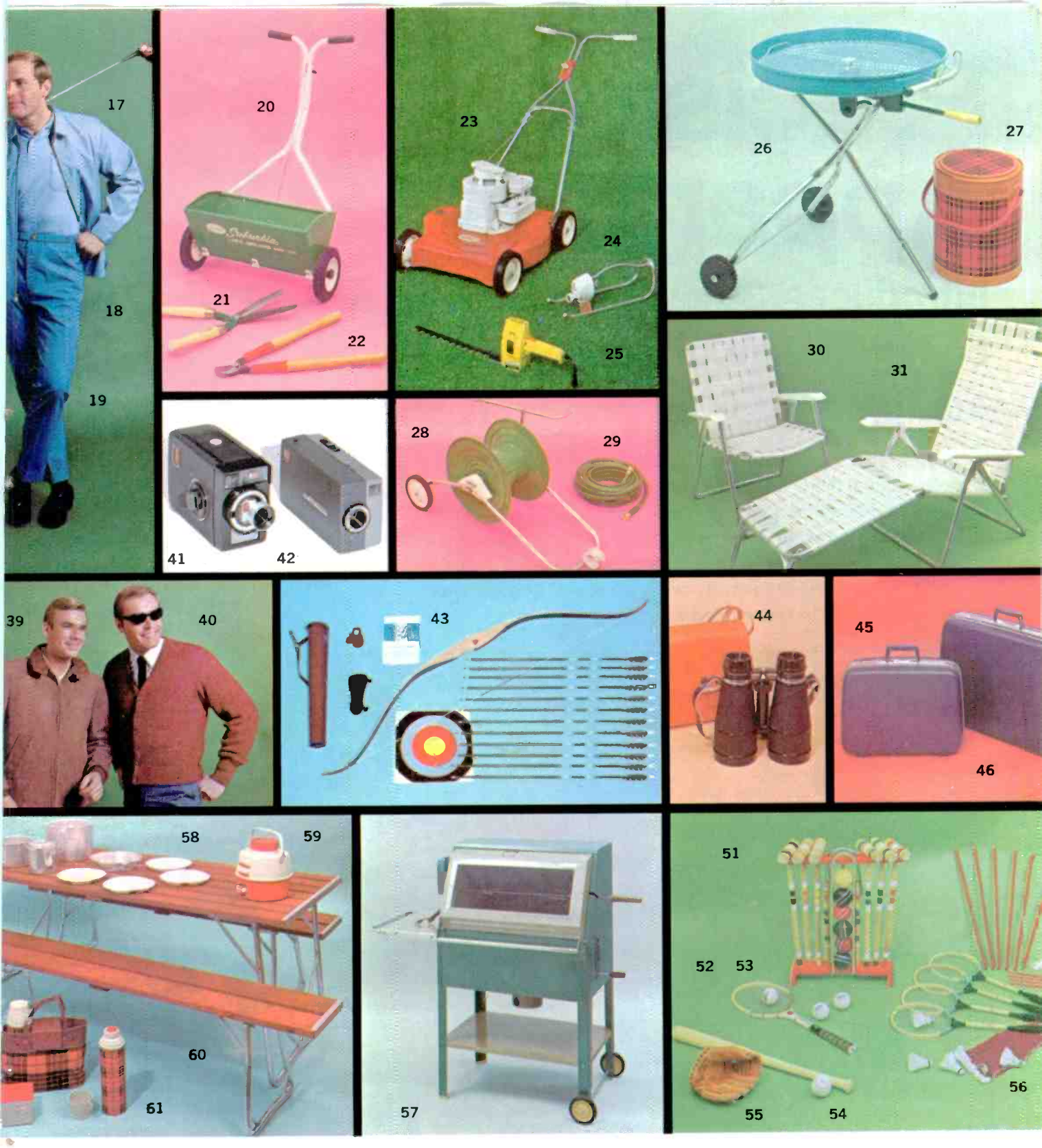
31. 46-119 Shott Aluminum and Web Chaise. 40 Cert.



32. 46-141 Bunting Aluminum Ball-Glide Chair. 95 Cert.
46-142 Bunting Aluminum Spring Base Chair. 95 Cert. Not illustrated.
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ELECTRONIC TECHNICIAN

APRIL 1967

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

TEKLAB REPORT

Understand this unique small-screen color receiver — it's different

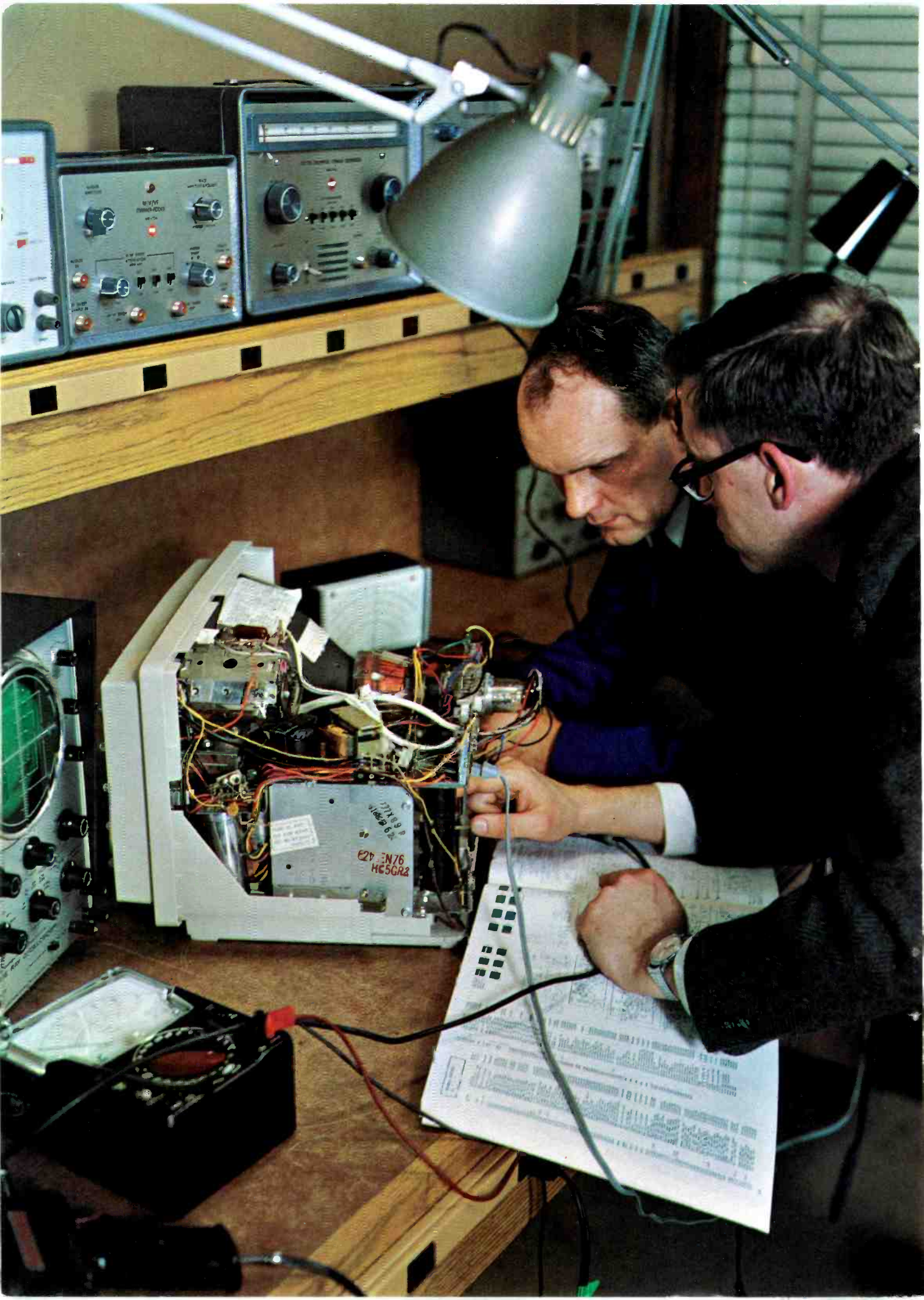
Part Two of a Series

■ Last month we covered some important details of this unusual color receiver — including the horizontal in-line three gun CRT and the relatively simple methods used for obtaining purity and convergence.

We will now explore the color demodulation circuits, the color difference amplifiers and review some chroma circuit trouble symptoms that may be encountered and their causes.

Color Demodulation Circuits

The 3.58MHz sideband information and reference burst signal are taken from the composite video, at the amplifier cathode circuit by a chroma take-off transformer. The 3.5MHz signal across the primary is coupled to the grid of a conventional bandpass amplifier by the slug-tuned secondary of the chroma take-off transformer. The output of the bandpass amplifier is transformer coupled to the burst gate cathode by a double-tuned chroma amp transformer. The secondary of this transformer is connected in shunt with the chroma gain control, providing a take-off point for chroma



'Porta-Color'

information. During retrace, a pulse from the horizontal output transformer is shaped and coupled to the burst gate tube grid, to gate the tube on and thus extract the burst or reference signal.

A 3.58MHz series resonant trap is connected between grid and ground — the burst-gate part of the tube — thus, with respect to 3.58MHz, the gate tube is functioning as a grounded-grid amplifier with its plate circuit tuned by the primary of the crystal filter transformer for maximum output at 3.58MHz. The burst signal, which is mainly capacitively coupled to the bifilar wound secondary of the crystal filter transformer by a 39pf capacitor, excites the high Q resonant crystal circuit into a sinewave oscillation that results in a 3.58MHz wavetrain.

If the 3.58MHz crystal is defective or the crystal filter transformer is not properly adjusted, the 3.5MHz oscillator will be out of sync, as shown in Fig. 1.

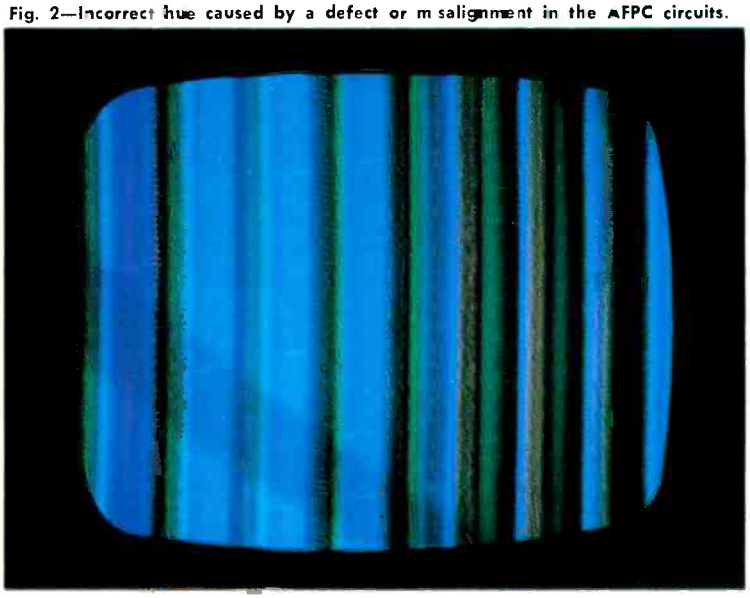
The reference amp part of the tube also limits the 3.5MHz wavetrain signal to produce a sinewave of almost constant amplitude in the primary winding of the chroma demodulator transformer.

The tint control, transformer and a 12pf capacitor tune the chroma demodulator transformer primary. If the transformer is improperly adjusted, the hue or color phase will be incorrect (as shown in the bar pattern of Fig. 2).

A 90deg shift from reference burst appears in the primary of the chroma demodulator transformer. The 3.58MHz carrier in the transformer primary shifted 90deg from burst, is inductively coupled to both secondary windings of the transformer. They in turn supply subcarrier information to the synchronous detector diodes. The R-Y

Fig. 1—Defective 3.58MHz crystal throws oscillator out of frequency as indicated by color-bar-pattern.

Fig. 2—Incorrect hue caused by a defect or misalignment in the AFPC circuits.



Technical editor Joe Zauhar and associate editor Philip Dahlen look over the G-E Porta-Color receiver's insides in a corner of ET's TEKLAB.

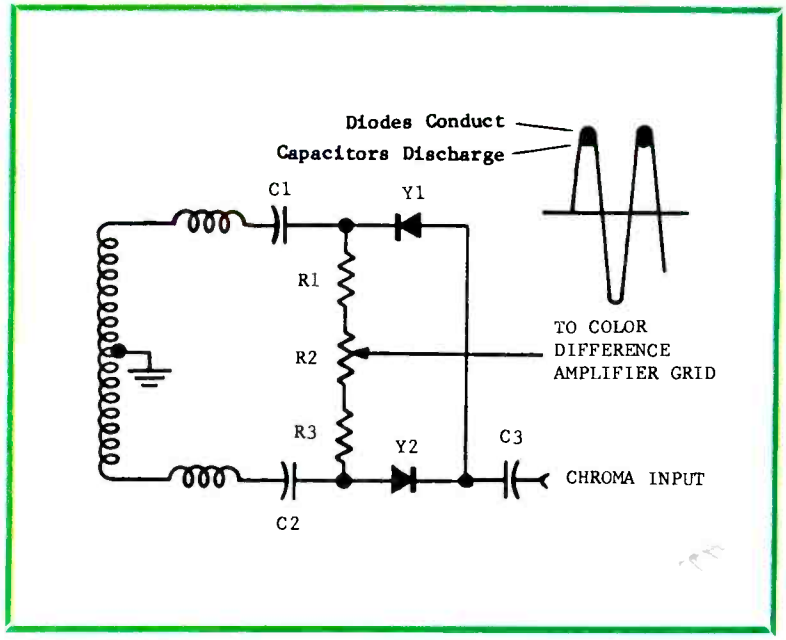


Fig. 3—Simplified circuit of balanced-diode synchronous detectors.

secondary of the chroma demodulator is tightly coupled to the primary, therefore the subcarrier phase for this winding follows that of the primary, while the B-Y secondary is loosely coupled and is separately tuned to produce the necessary phase shift between the two subcarriers. The two subcarriers, essentially in quadrature, are coupled to the synchronous detector diodes.

The synchronous detectors are balanced diode types (see Fig. 3). Each of the two detectors has a balancing potentiometer to produce zero dc volts from the output of the detectors so that the presence or absence of the carrier has no effect at the grids of the color difference amplifiers. Although the limiting action of the reference amplifier produces a sinewave carrier with a fairly constant amplitude, some variations in amplitude might exist. Balancing out the carrier at the output of the synchronous detectors provides gray scale stability by maintaining a given potential at the grid of the color difference amplifiers whether or not the subcarrier is present. As shown in Fig. 4, diode Y502 opened and caused a blue screen.

The reference signal from the secondary winding is fed to the series connected diodes through C1 and C2, while the chrominance signal from the cathode circuit of the burst gate is connected in parallel with the anode and cathode of Y1 and Y2, respectively. Each diode is functioning as a peak detector. In the absence of chroma information, capacitors C1 and C2 are charged to the peak value of the reference signal and with the diodes cut off, both capacitors discharge in series across series resistors R1, R2 and R3. Further diode conduction then occurs only at the peaks of the reference signals.

Diode Y1 conducts when a negative signal is present at its cathode from the secondary of the transformer. At the same instant, a postive signal is presented at the other end of the transformer secondary and diode Y2 conducts in the opposite direction to diode Y1. This conduction of equal but opposite currents produces zero output at the center of the balancing potentiometer, R2.

When the diodes are conducting, the chrominance signal is detected by each diode. Diode Y1 develops a postive voltage which is proportional to the sum of the chroma and in phase reference signal. Diode

Y2 develops a negative voltage which is proportional to the sum of the chroma and the 180deg out of phase reference signal.

Color Difference Amplifiers

The three triodes used for the color difference amplifiers are contained in a 6AC10 compactron. Besides performing the function of amplifying the demodulated chroma information, the color difference amplifiers are part of the biasing network in the CRT control grid circuits. The plate of each amplifier is connected to the junction of two series connected resistors which are in turn placed between B+ and the respective CRT control grid. Since the cathode of each amplifier is returned to ground through small value resistors, each amplifier becomes one leg of a bleeder network (see Fig. 5). This provides a level of bias for the control grids of each of the three CRT guns which may be made to change by conduction of the color difference amplifiers. In a quiescent state the picture tube grid bias remains constant. The chroma output from the color difference amplifiers is coupled to the picture tube control grids by the RC networks in the color difference amplifiers' plate circuit.

The detected chroma information from the R-Y synchronous detector is dc coupled to the R-Y color difference amplifier grid, and in like manner, the B-Y chroma information is coupled to the B-Y amplifier. The G-Y signal is derived by matrixing in the common cathode circuit and appears in the G-Y amplifier plate circuit. The G-Y amplifier operates as a grounded grid amplifier with a capacitor serving as ac grid return to ground.

The final article in this series will cover the horizontal oscillator and phase detector circuits, horizontal deflection and HV, plus other important circuits of this receiver. ■

Fig. 4—Blue screen caused by open synchronous detector diode, Y502.

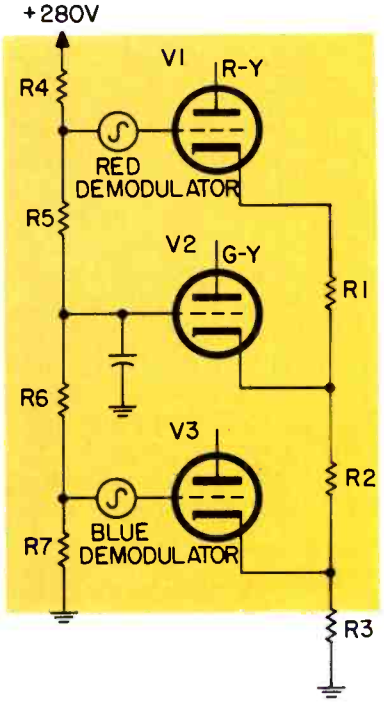


Fig. 5—Simplified schematic of color difference amplifiers.

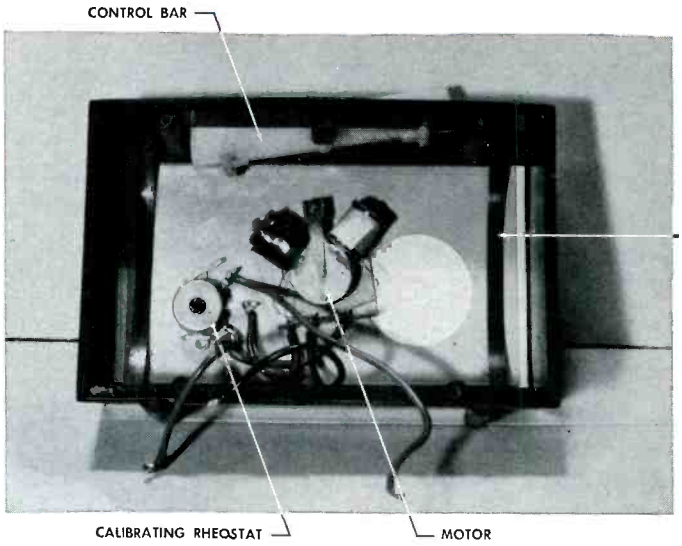


Fig. 2—Meter case of a manual control box. The meter is held to the front case with two retainer springs. Calibrating rheostat is also shown.

Repairing Antenna

Lightning, winter winds and ice place heavy strain on antenna rotators and open the way for repairs and new business

■ Repairing antenna rotators is easy — if you know how they are designed and operate and you have the mechanical ability. And, in addition to the added income you will receive from rotator maintenance, there's a lot of potential cash waiting in new rotator sales and new fringe area antenna installations.

We normally come into contact with three types of antenna rotators. 1) A manual unit in which the operator must hold the direction lever down until the desired antenna orientation is obtained; 2) The automatic rotator in which the desired direction can be selected and the motor will follow and stop at this point; 3) A transistorized or semi-automatic rotator which is synchronized and has a greater degree of accuracy. Transistors and two separate motors are used in these rotators.

Rotator Operation

It will prove extremely helpful to understand how these rotators function.

The manual rotator has the least number of parts and is simple to operate. When the direction switch is pushed down to one side, 117vac is applied to the primary of the rotator's power transformer. At the same time, other contacts on the

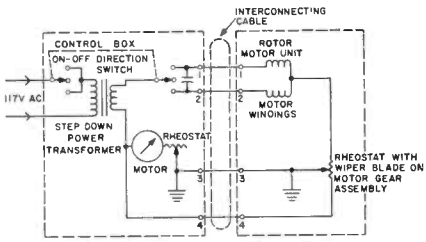


Fig. 1—Wiring diagram of Cornell-Dubilier manual rotator.

direction switch make contact with one leg of the motor winding. Press down on the right side and the motor will turn clockwise. Press down on the left and the motor will turn counter-clockwise. The direction switch simply transfers the voltage to one motor winding and then to the other winding—reversing the field and direction of rotation (see Fig. 1).

Correct direction of the rotator motor is indicated with a wirewound rheostat, which turns with the rotator shaft. A wire connects to this rheostat and also to the indicating meter inside the control box. A correct meter reading can be ob-

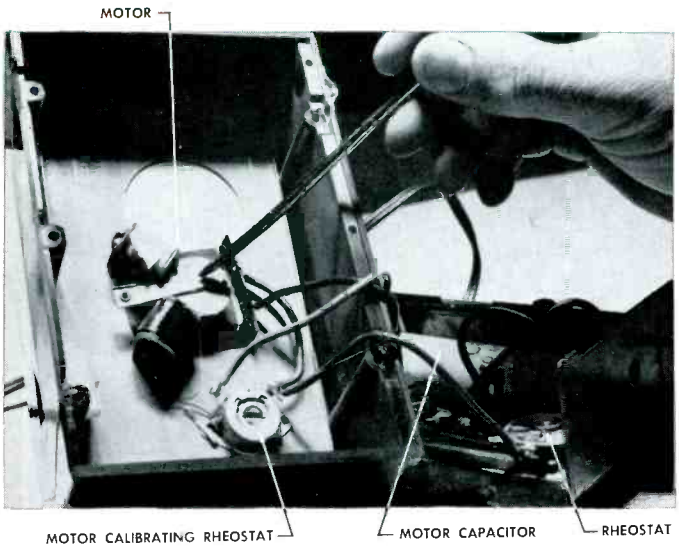


Fig. 4—Various components located inside an Alliance T12 control box.

Fig. 6—Automatic control box which burned while resting out of sync.

Rotators

tained by adjusting a small rheostat in the control box (see Fig. 2).

An automatic rotator stops at a pre-set point on the dial. The operator turns the direction knob and leaves it set at a specific direction. Then the rotator motor will turn, stopping at this point on

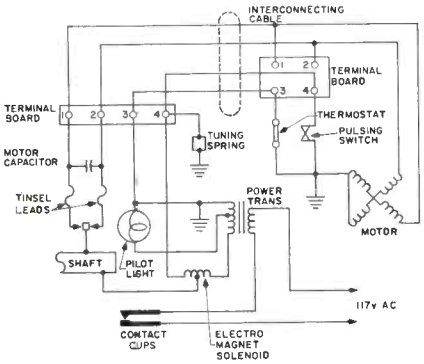


Fig. 3—Schematic of Alliance automatic rotator U-83.

the direction dial. The automatic rotator is constructed the same as a manual rotator but has a pulsing solenoid, pulsing switch, transistor control or with two separate motors. The wiring diagram of a typical automatic rotator is shown in Fig. 3.

The direction indicator knob is turned to the desired location and left there. When the ac switch is turned to the ON position, the primary and secondary voltages are applied to the correct motor windings. A pulsing switch in the motor unit will trip the pulsing solenoid in the control box pulling the ratchet assembly around to the desired location against a stop indent and the off/on switch will shut the unit off.

Manual Rotator Construction

This rotator consists of a control box, antenna motor and interconnecting wires. There are five basic components to any manual rotator control box.

1. Motor-direction indicator
2. Power step-down transformer
3. Direction switch
4. Motor capacitor
5. Rheostat

All front panel meters will indicate the direction the antenna is turning or the point where it has stopped. The power transformer is a step-down type, delivering about 29 to 35acv under no-load. While in operation, the operating voltage is around 30v.

To reverse the motor, a direction switch is tied to one end of the secondary winding of the power transformer, switching to each separate motor winding. The motor will turn in either direction but the direction switch must be held in position so that contacts will be made. If the direction switch is not engaged, the rotator motor will stop. A motor capacitor is switched into the two motor windings at the instant of changing direction.

In the control box shown in Fig. 4, a rheostat is shorted to ground with a moving contact switch-indicating antenna direction.

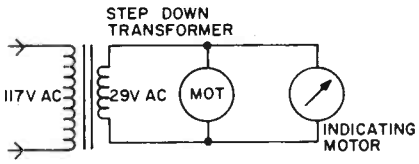


Fig. 5—Diagram of Channel Master model 9520 rotator showing parallel wiring.

In the unit diagramed in Fig. 5, the meter location is paralleled by the motor and step-down transformer. If the meter fails in any way, the rotator will still turn.

This unit has a five conductor cable instead of the regular four wire cable. Three wires are used for the motor circuit. Two wires

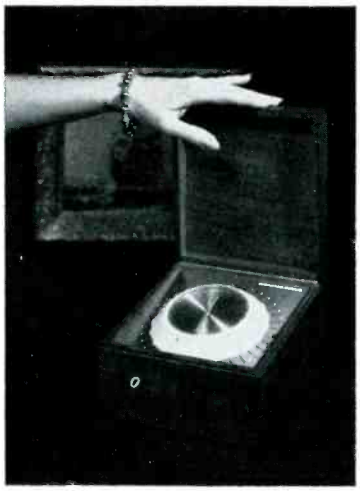


Fig. 7—Channel Master model 9516A automatic rotator.

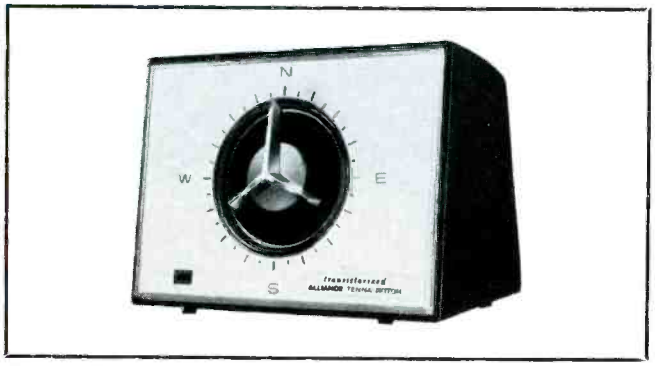


Fig. 8—Alliance model C-225 transistorized antenna rotator.

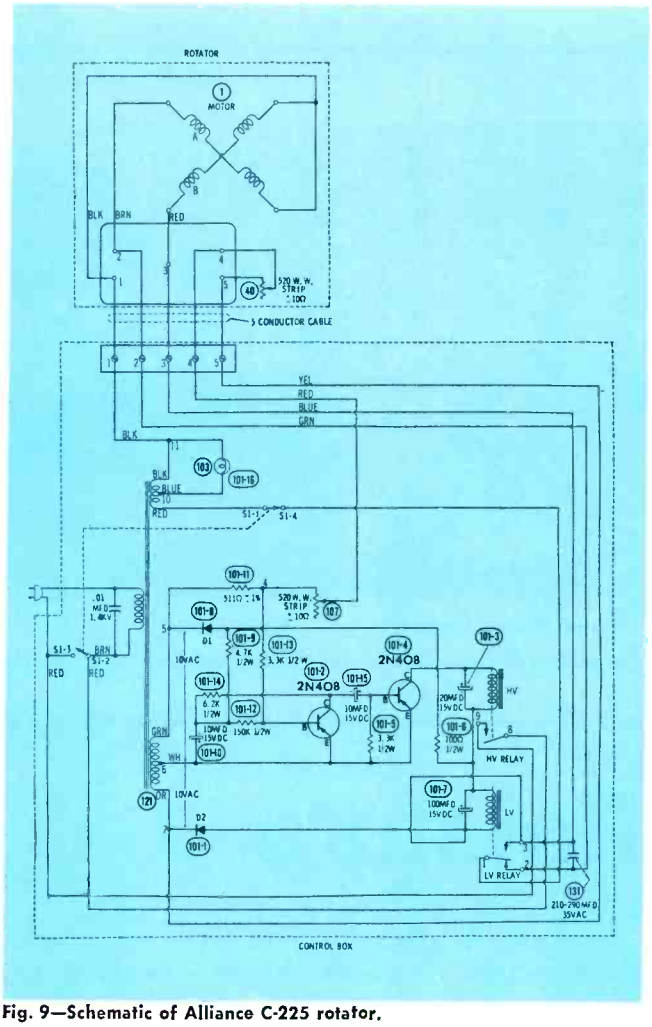


Fig. 9—Schematic of Alliance C-225 rotator.

are used for the rheostat which is part of the meter circuit. One extra wire makes it possible for the meter rheostat to be operated on a separate circuit. Since the two circuits are independent, smoother meter operation and greater meter direction accuracy is said to be possible.

Automatic Control Box

The automatic control box consists of six basic parts.

1. Rotating-knob indicator assembly
2. Pulsing-relay contacts
3. Pulsing solenoid
4. Step-down power transformer
5. Motor capacitor
6. One or two pilot lamps

To start an automatic rotator, the indicator switching assembly is rotated and left set on the desired direction. The switching assembly has start and stop contacts with switching contacts for reversed direction. When the starting contact is made, the rotator motor will turn—sending a voltage pulse to the pulsing relay in the control box. The pulsing solenoid relay pulls the indicator switching assembly around in steps to the stopped location. Now the rotator will shut off.

Excessive damage can result if the automatic pulsing relay jumps out of sync, or step, with the antenna motor. This condition is noted when the indicator lights remain on. Actually, the indicator switching assembly stops but is out of step with the antenna motor. If left in this position, the power transformer and switching point will become hot and burn. The automatic rotator should never be allowed to remain operating when the indicating lights are on (see Fig. 6). Simply flip the tripping lever located underneath the control box until the two units are synchronized.

Generally, the antenna motor will get out of step with the pulsing relay when the operator pushes the lever for one direction and then suddenly reverses direction. To get most automatic rotators back in step, it is best to turn the indicator knob to north, or the end of rotation. New let the indicator hand stop and trigger the trip lever of the relay until the lights go out. Reverse the direction of the rotator to the other end of rotation and both motor and control box should be in sync.

To synchronize the automatic rotator shown in Fig. 7, which has two separate motors, turn the control box knob to north position. Select the closest clockwise or counter-clockwise direction to north. When the dial has revolved and finally halts in the indicated top position, the automatic rotator is synchronized. Now reverse the direction and check the control box indication with that of the antenna on the roof.

Most step-down power transformer and motor capacitors are the same as those used in the manual models. One or two dial lights are used on automatic rotators and will

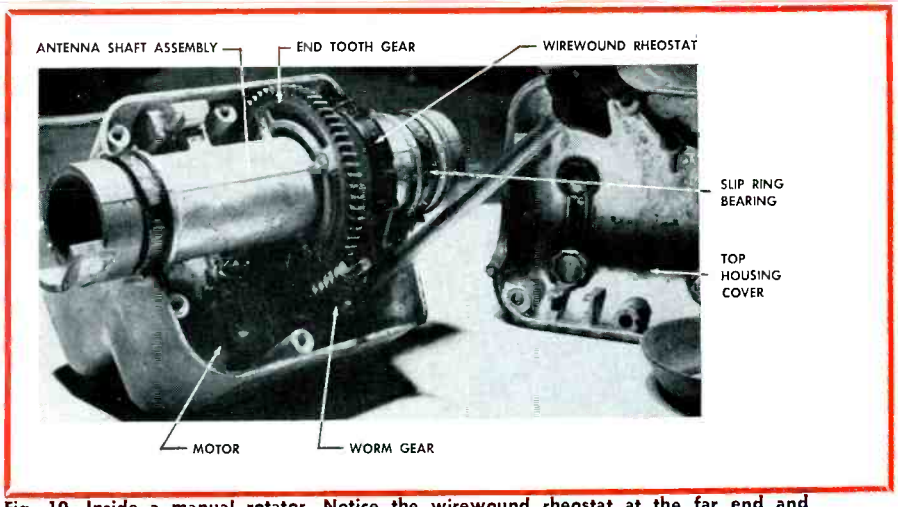


Fig. 10—Inside a manual rotator. Notice the wirewound rheostat at the far end and also the worm gear that drives the antenna shaft assembly.

Fig. 11—Remove all sticky grease with a brush and cleaning fluid and lubricate slip-rings and bearings with petrolatum.

go out when the motor stops.

The automatic transistorized unit shown in Fig. 8 has a bridge circuit and a phase selective solid-state switching circuit which is said to provide exact antenna positioning. The circuit is shown in Fig. 9.

Rotator Motor Assembly

The manual motor housing consists of a small, low voltage ac motor, end, or worm gear, reduction gear and metal housing assembly. Speed reduction of the small motor is accomplished with end and worm gear assembly. A rheostat wiping blade is bolted to the main antenna shaft assembly indicating direction of the antenna.

In all motor models a braking or stop-slide action is accomplished. The automatic models use a contact switching assembly to trigger the pulsing solenoid in the control box. A tripping cam on the motor shaft assembly strikes the pulsing contact switch twice on each rotation of the small motor. Each time the contact switch is tripped, the pulsing solenoid pulls the control direction assembly around one notch.

Checking Manual Control Box and Motor Housing

To quickly determine why a rotator will not turn, substitute a new control box or check with a continuity checker. The ohmmeter or any lamp-type continuity tester will indicate grounds, open interconnecting cables or poor connections. When suspecting a defective control box, substitute a new one. Always check the control box and continuity of the interconnecting cable before removing the rotator motor from the mast.

If a new control box is not handy, go directly to the motor capacitor located in the control box. Shunt a rotator capacitor across the leads of the original one. A defective capacitor will cause slow, sluggish rotation or no rotation. Dried out motor capacitors result in most control box failures.

On the rotator shown in Fig. 1, the ac step-down power transformer potential is 35acv, without the rotator motor connected. Check the ac voltage reading on terminals 3 and 4. The ac voltage may vary from 29 to 35acv on most manual and automatic rotators. Under working loads, the potential drops about 5v.

Check, clean and spray all switching terminal contacts. Bad switching controls will first show up as an intermittent dial light or no antenna rotation. Burned switching contacts will cause the rotator to be erratic or become intermittent in operation. Signs of excessive arcing of switching points will flash across the TV screen while the rotator is in motion. This condition can also arise on automatic rotators when the main contacts in the detent body assembly are improperly adjusted.

If the direction meter does not indicate, check for a bad meter, open motor rheostat, broken cable wire or open rheostat in the control box. Most manual meters will have a resistance of around 70Ω. Generally, when the rheostat in the motor housing opens, the meter will not read and, of course, the motor will not turn. This only applies to rotators with meter, rheostat and power transformer operating in series. The small rheostat in the manual control box will vary in resistance from 100 to 150Ω. See Chart I for manual rotator troubles.

All wires should show continuity on a manual rotator. The fourth wire on the automatic pulsing motor will show open unless the pulsing switch is making contact.

Generally, the removal of four bolts will allow the motor assembly to come apart (see Fig. 10). In the motor housing used with the control box shown in Fig. 4, a rheostat wiping blade turns with the antenna shaft assembly. One leg of the rheostat goes via the interconnecting cables of terminal four to terminal four on the manual control box. This conductor goes to the indicating meter which shows antenna direction. If the rheostat becomes worn and opens, the motor will stop and no meter indication will be noted. When dirt or grease

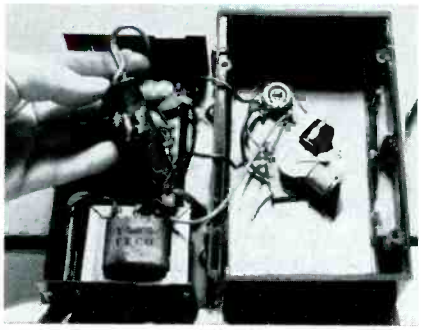


Fig. 12—Motor capacitor with a hole blown in it when the control box was hit by lightning.

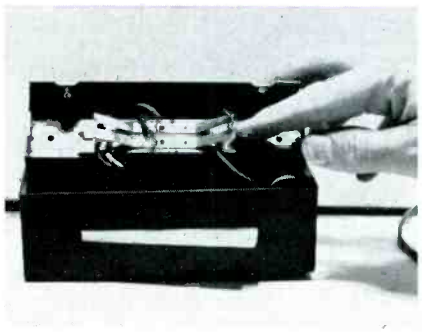


Fig. 13—Another control box hit by lightning shows burned marks on the ac contact switch blades.

CHART I

FOR MANUAL ROTATORS

Rotator fails to operate when control lever is pushed.	Check and shunt the capacitor. Check primary switch, directional switch and interconnecting cable. Substitute a new control box to see if the trouble is in motor or control box.
	Check motor to see if it has a broken gear.
Meter indicator will not move.	Check the resistance of meter, and meter rheostat for open. Check contact spring for good contact of rheostat in motor unit. Check meter return wire.
Rotator operates slowly or sluggishly.	Change the capacitor. Check hookup of interconnecting cable. Check length of cable.

FOR AUTOMATIC ROTATORS

Rotator fails to operate when turned to desired direction.	If motor is not turning, check tripping lever. Check capacitor. Check input contacts to make sure they are closed. Check cables. Check contact switch in rotator unit for proper operation.
Light fails to come on.	Out of sync. Trigger trip level until in sync. Input controls not adjusted properly.
Rotator operates slowly or sluggishly.	Change the capacitor. Check the cable. Check length of cable.
Light fails to come on.	Bad lamp. Bad socket. Bad connection to transformer.
Solenoid buzzes.	Check armature setting on bracket. Check pawl clearance.
Rotator does not go full 360deg.	Stripped gears. Teeth out of end gear. Cable wrapped too tightly around rotator and mast.

accumulates on the rheostat or wiping blade, an erratic reading will appear on the indicating meter.

Broken teeth from end gears or dry bearings can prevent the rotator from turning. It is also possible that the rotator will only turn a few degrees and then stop. Under excessive wind storms and using large antenna bays, a few teeth are frequently whipped from the end gear assembly. Dry slip ring bearings will cause the rotator to bind and drag. Use a paint brush dipped in gasoline or special cleaning fluids (not carbon tetrachloride), and clean the bearings. Apply petroleum jelly or proper consistency grease on the slip rings and bearings (see Fig. 11).

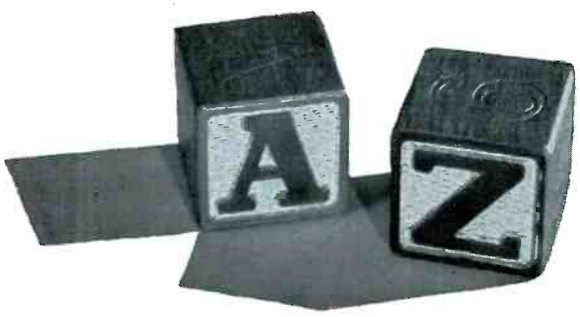
Trouble Cases

In the unit shown in Fig. 4, the rotator would not turn or show an indication on the meter. The motor capacitor was shunted and a continuity check made. An open was noted on terminal four from the motor housing. The rotator cable was checked and showed continuity. An open rheostat in the meter circuit of the motor housing was found to be worn and several wires were corroded. The trouble was a bent wiper blade not making contact with the rheostat winding.

Another rotator would not move the antenna, only the control box would hum. Substituting a new control box did not solve the problem and the motor housing was removed from the roof. A grounded field winding of the small ac motor would only let the motor hum. A new ac motor restored the rotator. Lightning damage suffered by another control box is shown in Fig. 12 and 13.

One rotator would rock back and forth or oscillate. By substituting a new control box, the trouble was located. After digging into the defective control box, a 2N408 transistor was found to have emitter-to-collector leakage.

Valuable information on maintaining antenna rotators is available in rotator manufacturers' service manuals. Most rotator components are available at wholesale parts distributors or from the rotator manufacturer. ■



Semiconductors from A to Z

Understand basic integrated circuits before they become widely used in home entertainment equipment

■ This series of articles has included descriptions of regular transistors, FET's, MOS' and tunnel diodes. Another device that is becoming increasingly important in semiconductor radios, TV sets and special eqiupment is the integrated circuit. This device must also be understood by the technician if he is to remain efficient in his field as technology advances.

Silicon chips, smaller than a dime (Fig. 1) can now be "grown" with an assortment of electronic components. Although some integrated circuits are currently being made with plug-in bases, they are so reliable that many are wired directly into larger circuits. One manufacturer indicates that when some of their integrated circuits are operated between 25 and 30°C (around room temperature) in an oscillator circuit, they experience a failure rate equal to 0.001 percent per 1000 hours. This is equivalent to running 263,000 integrated circuits for a year without experiencing a single failure. A TV manufacturer indicates that the integrated circuit used in their sets is the least likely component to fail.

One integrated circuit (Fig. 2), sold as part No. CA3005 by an

Fig. 1—Approximately 135 usable circuits have been formed on a silicon wafer not much larger than a dime. The relative size of a complete integrated circuit unit is shown on the face of a dime. Courtesy of Motorola.

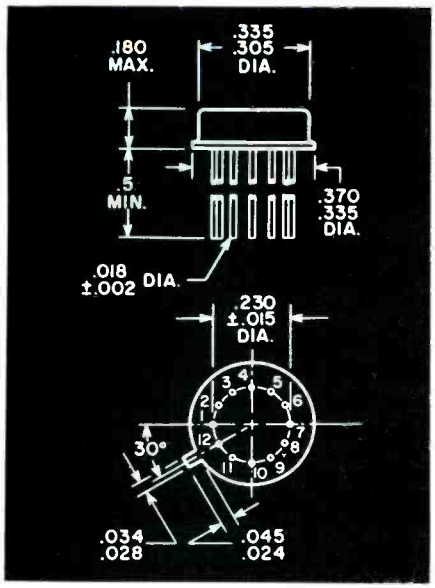


Fig. 2—The dimensions of an integrated circuit sold by an electronics supply company for $2.80. Courtesy of RCA.

electronics supply company for $2.80, is commonly used as an RF amplifier. According to the manufacturer, this amplifier has an RF, IF, and video frequency capability, with a frequency response ranging from dc to 100MHz. It has a balanced differential amplifier circuit having a controlled constant-current source, and it can be used as a cascode amplifier.

The function of this integrated circuit can be more readily explained by first comparing a variable-current-source amplifier with a constant-current-source amplifier and then comparing an unbalanced differential amplifier circuit with a balanced differential amplifier circuit.

A Variable-Current-Source Amplifier

The variable-current-source amplifier circuit (Fig. 3) is similar to the transistor circuit shown in Fig. 2, page 64, of the SEMICONDUCTORS FROM A TO Z article in the October, 1966, issue of ELECTRONIC TECHNICIAN. The only difference is that the collector resistor (R_C) and emitter resistor (R_E) are combined as a single load resistor (R_L) in the emitter portion of the circuit (Fig. 3). The transistor in this circuit has the same characteristic curve as that shown in Fig. 3 of the forementioned article.

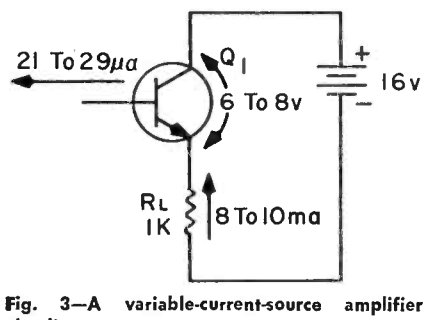


Fig. 3—A variable-current-source amplifier circuit.

If the transistor could conduct sufficient current to cause the voltage drop across the load resistor to equal the voltage source, there would be no collector-to-emitter voltage. The maximum collector current (I_C) would be the amount of current then passing through the load resistance. (When $C_{CE} = 0$, $I_C = \frac{V_{CC}}{R_L}$.) Since the circuit contains a 1K load resistance and a 16v source, 16ma of current is required for these conditions.

If the base of the transistor could cut off the collector current completely, no voltage drop would exist across the load resistor and the collector-to-emitter voltage would equal the voltage source. (When $I_C = 0$, $V_{CE} = V_{CC} = 16$v.)

Using the points determined in the two preceding paragraphs, the circuit's load line can be drawn on the transistor's characteristic curve (Fig. 4). From this load line we see that when the base current (I_B) fluctuates between 21 and 29μa, the transistor's collector-to-emitter voltage (V_{CE}) fluctuates between 6 and 8v, and the current flowing through the load resistor (R_L) fluctuates between 8 and 10 ma. (*The characteristic curve indicates that this is a fluctuation in collector current rather than a fluctuation in emmiter current. The actual emitter current, as explained in the September,* 1966, *article* SEMICONDUCTORS FROM A TO Z, *varies from* 8ma + 21μa *to* 10ma + 29μa — *the collector current plus the base current — or from* 8.021 *to* 10.029ma.) For all practical purposes, there is no need for this degree of accuracy, and we can merely refer to the collector current as the current flowing through the load resistor R_L in Fig. 3. We see that a variable amount of current is able to flow from the voltage source (V_{CC}), and that is the reason the circuit has been referred to as a variable-current-source amplifier.

A Constant-Current-Source Amplifier

A second transistor (Q_2) is used to regulate the current in the constant current source amplifier circuit (Fig. 5). Resistors R_1 and R_2 are used as a voltage divider to provide this transistor with 25μa of base current (I_B). From the transistor's characteristic curve (Fig. 6), we see that the transistor's collector current (I_C) is almost solely dependent on the transistor's base current (I_B) and nearly independent of variations in its collector-to-emitter voltage (V_{CE}). When this particular transistor experiences a constant 25μa base current, and the collector-to-emitter voltage is varied from 8 to 10v, the collector current varies only from 9.0 to 9.5ma—remaining nearly constant.

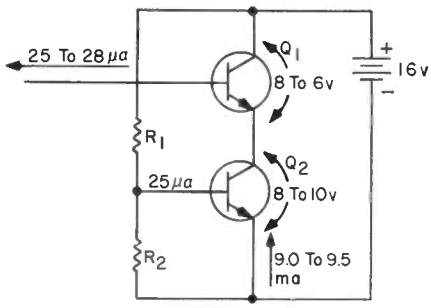


Fig. 5—A constant-current-source amplifier circuit.

The other transistor (Q_1) in this circuit (Fig. 5) is used to vary the collector-to-emitter voltage of the nearly constant current transistor (Q_2). Since the circuit contains a 16v source of voltage (V_{CC}), the collector-to-emitter voltage in transistor Q_1 must vary from 6 to 8v to cause the collector-to-emitter voltage in transistor Q_2 to vary from 10 to 8v (16v −6v = 10v, 16v −8v = 8v.) When the collector-to-emitter voltage of transistor Q_1 is 6v, the collector-to-emitter voltage of transistor Q_2 is 10v, and transistor Q_2 conducts 9.5ma of current. Since

transistor Q_1 is connected in series with transistor Q_2, 9.5ma of current must pass through it as well. When the collector-to-emitter voltage of transistor Q_1 is 8v, the collector-to-emitter voltage of transistor Q_2 is 8v, and transistors Q_1 and Q_2 conduct 9.0ma of current. Lines have been drawn on the characteristic curve (Fig. 7) of transistor Q_1 to indicate that when it's collector-to-emitter voltage (V_{CE}) varies between 6 and 8v, the collector current (I_C) varies between 9.5 and 9.0ma. By drawing a line through the two points representing these voltage-current combinations, the effective load line can be drawn for the circuit (Fig. 5) containing transistor Q_1. From the effective load line we see that the base current (I_B) must vary between 25 and 28.5μa to cause the transistor's emitter voltage to vary between 6 and 8v. In this circuit (Fig. 5), a 3.5μa variation in base current results in a 2v change in collector-to-emitter voltage, while in the circuit discussed earlier (Fig. 3), the same transistor required an 8μa variation in base current to produce the 2v change in collector-to-emitter voltage.

If the effective load line (Fig. 7) for the nearly constant current circuit (Fig. 5) could be extended to both coordinates, we would see that

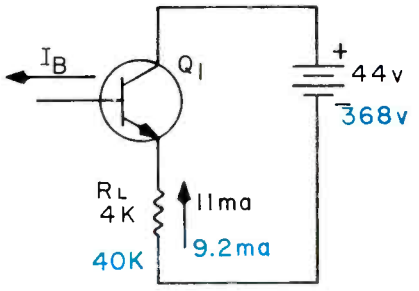


Fig. 8—An equivalent to the constant-current-source amplifier circuit.

it would indicate a maximum current of 11ma and a maximum potential of 44v. The conditions experienced by transistor Q_1 are nearly the same as those it would experience in a circuit (Fig. 8) containing a 44v source and a 4K load resistor. The effective load line, obviously, cannot extend over this range of conditions. In this circuit (Fig. 5), the collector-to-emitter voltage of transistor Q_1 cannot be greater than

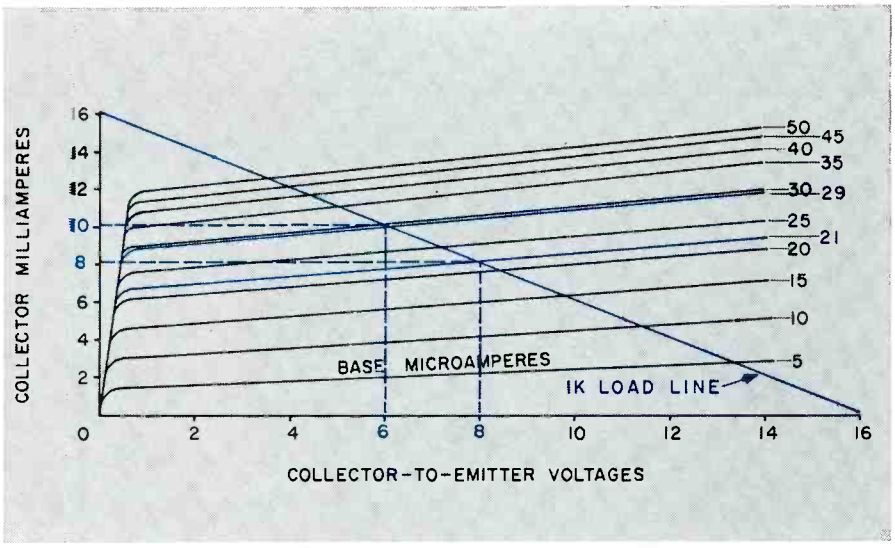


Fig. 4—The load line of the variable-current-source amplifier circuit.

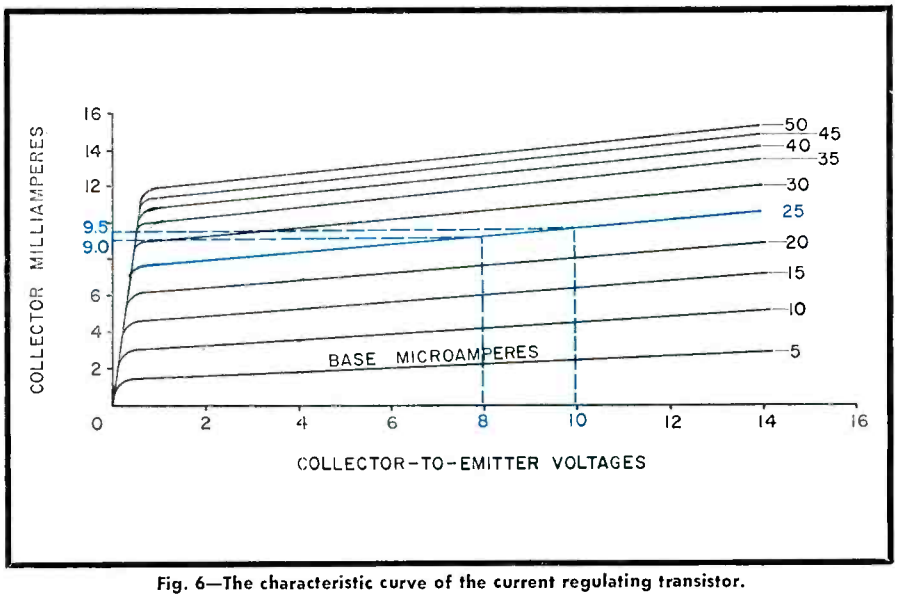


Fig. 6—The characteristic curve of the current regulating transistor.

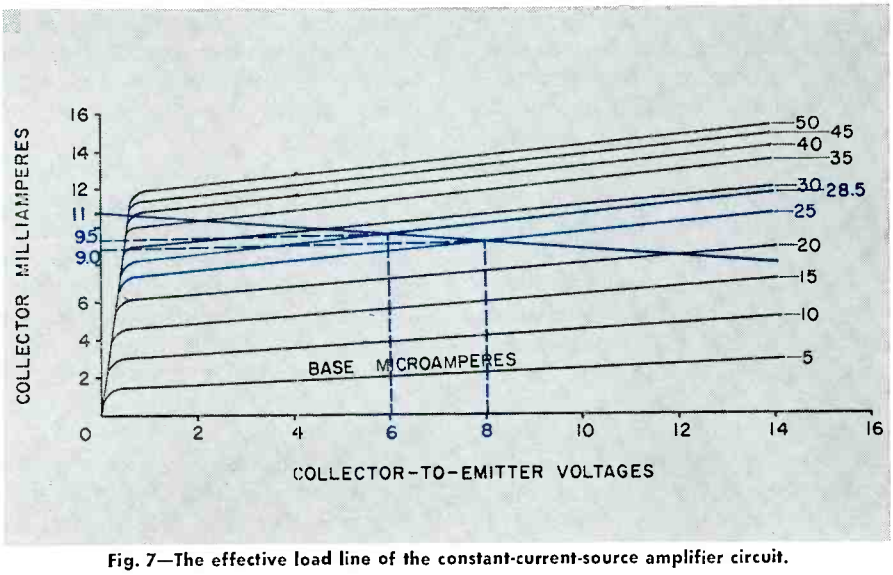


Fig. 7—The effective load line of the constant-current-source amplifier circuit.

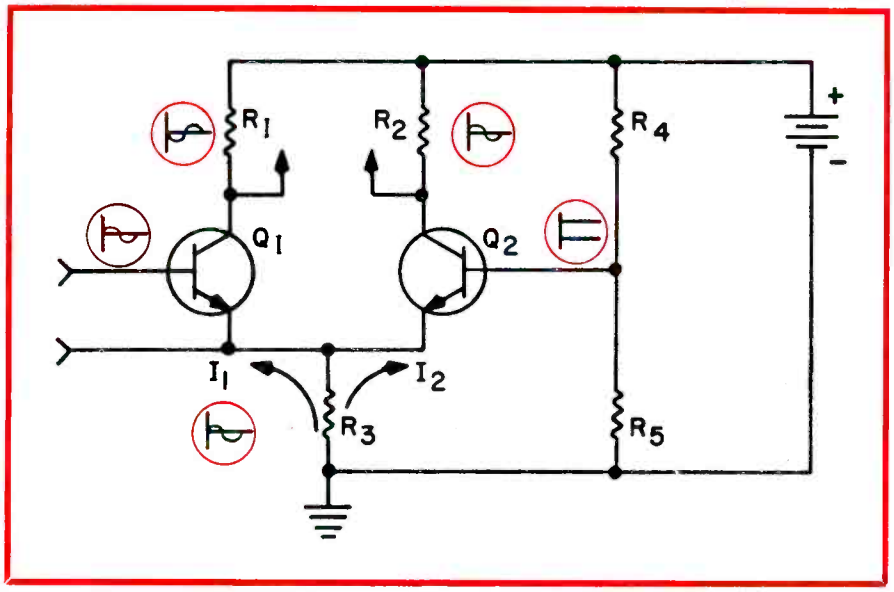


Fig. 9—An unbalanced differential amplifier circuit.

the actual 16v source. As the collector-to-emitter voltage in transistor Q_1 exceeds 15v, the collector-to-emitter voltage in transistor Q_2 becomes less than 1v, and there is a sharp decrease in the amount of current passing through the transistor and circuit.

Suppose we were able to substitute another transistor, for the current regulating transistor Q_2 in the circuit (Fig. 5), that was able to regulate the current 10 times as effectively as before. When the collector-to-emitter voltage in this transistor changes from 8 to 10v, the collector current changes from 9.00 to 9.05ma. Under these new conditions transistor Q_1 conducts 9.05ma when the collector-to-emitter potential is 6v, and it conducts 9.00ma when the collector-to-emitter potential is 8v. If these new points were plotted on the transistor's characteristic curve, we would see that the maximum current conducted in the circuit would be 9.2ma and that there would be an effective potential of 368v. These conditions experienced by transistor Q_1 are nearly the same as those it would experience in a circuit (Fig. 8) containing a 368v supply and a 40K load resistor. The transistor would probably require less than a ½ μa signal to produce a change of 2v.

An Unbalanced Differential Amplifier

A high percentage of the linear integrated circuits currently available make use of differential amplification. The two transistors (Q_1 and Q_2) in a simplified differential amplifier circuit (Fig 9) have separate collector resistors (R_1 and R_2) but a common emitter resistor (R_3). When the base of the first transistor (Q_1) is made more positive with respect to its emitter, the transistor is more forward biased — the collector current will increase and the collector-to-emitter voltage is reduced. As more current flows through the emitter resistor (R_3), the emitters of both transistors become more positive with respect to ground.

The base of the second transistor (Q_2) is biased by two resistors (R_4 and R_5) in a voltage divider. Since the base current is only a small portion of the current passing through the voltage divider, the base remains at a nearly constant voltage with respect to ground.

As the first transistor (Q_1) conducts more current and the emitters of both transistors become more positive with respect to ground, the emitter of the second transistor (Q_2) also becomes more positive with respect to the base — the base remaining at a nearly constant voltage above ground.

Since the base of the second transistor is less positive with respect to the emitter, the transistor (Q_2) is less forward biased and conducts less current.

When the base of the first transistor (Q_1) is made less positive with respect to the emitter, the transistor is less forward biased, and its collector current decreases as its collector-to-emitter voltage increases. As less current flows through the emitter resistor (R_3), the emitters of both transistors become less positive with respect to ground. While being less positive with respect to ground, the emitter of the second transistor is also less positive with respect to the base — which still remains at a nearly constant potential with respect to ground. Since its base has become more positive with respect to its emitter, the second transistor is now more forward biased and conducts more current.

When the emitter current in the first transistor increases, the emitter current in the second transistor decreases. Since the voltage drop in the common emitter resistor is the sum of the voltage drops caused by the two transistors [$V_{emitter} = (I_1 + I_2)\ R_3$ or $I_1R_3 + I_2R_3$], the amplitude of the emitter signal is reduced by the two opposing changes in current.

As the first transistor's collector current (I_1) increases, the second transistor's collector current (I_2) decreases, and when the first transistor conducts less current, the second transistor conducts more current. As a result of this situation, the voltage drop across one collector resistor (I_1R_1) increases as the voltage drop across the other collector resistor (I_2R_2) decreases and vice-versa. Since the signal present on one collector resistor is present in inverted form on the other collector resistor, the signal applied to the base of the first transistor results in a push-pull signal at the circuit's output.

There is no way of biasing the two transistors in this circuit so that the change in current across one collector resistor is equal to the change in current across the other

collector resistor. It is the change in emitter voltage that produces the signal in the second transistor. If the signal current of one transistor is equal to the alternate signal current of the other transistor, no signal voltage can be developed across the emitter resistor (When $\Delta I_1 = -\Delta I_2$, $\Delta V_{emitter} = \Delta I_1 R_3 + \Delta I_2 R_3 = \Delta I_1 R_3 - \Delta I_1 R_3 = 0$).

We can more easily compare the currents flowing through the two transistors (Q_1 and Q_2) by applying values to the differential amplifier circuit (Fig. 10). By changing the forward bias of the first transistor (Q_1), the voltage drop across its collector resistor (R_1) varies from about 1 to 4v, and the voltage drop across the common emitter resistor (R_3) varies from 8 to 10v. The voltage drop across the first transistor (V_1) must, therefore, vary from 7 to 2v [16v — (1v + 8v) = 7v, and 16v — (4v × 10v) = 2v].

The change in the voltage drop across the common emitter resistor changes the bias of the second transistor (Q_2), and as a result of this change, the voltage drop across its collector resistor (R_2) varies from 4 to 1v. The voltage drop across the second transistor must, therefore, vary from 4 to 5v [16v — (4v + 8v) = 4v, and 16v — (1v + 10v) = 5v].

Since the voltage drop across the 1K common emitter resistor (R_3) varies from 8 to 10v, the current (I_3) flowing through this resistor must vary from 8 to 10 ma $\left[\frac{8v}{1000\Omega} = 0.008a = 8ma, \text{ and } \frac{10v}{1000\Omega} = 0.010a = 10ma\right]$. Since this resistance (R_3) is in series with both transistors (Q_1 and Q_2), the current passing through the resistor must equal the total of the currents passing through the two transistors ($I_3 = I_1 + I_2$).

If the same amount of current could alternately flow through both transistors, and each transistor had collector resistors (R_1 and R_2) of equal value, the voltage drops across the two resistors would be equal at alternate intervals of time. (If I_1 could equal I_2 and $R_1 = R_2$, then I_1R_1 would equal I_2R_2).

When the forward bias of the first transistor (Q_1) results in a 7v collector-to-emitter potential, the transistor conducts sufficient current to produce an 8v drop across the common emitter resistor (R_3). Under these conditions, 8ma of current passes through this resistor and is the total current passing through the two transistors.

When the two collector resistors (R_1 and R_2) are of equal value, the voltage drop across one is four times that across the other, and 1/5th of the total current passes through one resistor while the remaining 4/5ths of the total current passes through the other resistor. The first transistor must, therefore, be biased to conduct 1.6ma while the second transistor must be biased to conduct 6.40ma (1/5 × 8.00ma = 1.60ma, and 4/5 × 8.00ma = 6.40ma).

When the forward bias of the first transistor conducts sufficient current to produce a 10v drop across the common emitter resistor. Under these conditions, the common emitter resistor conducts 10ma. Since there is four times as much voltage drop, this time, across the first collector resistor than there is across the second collector resistor, 4/5ths of the current (8.00ma) must now flow through the first transistor and only 1/5th of the current (2.00ma) through the second transistor (4/5 × 10.00ma = 8.00ma, and 1/5 × 10.00ma = 2.00ma).

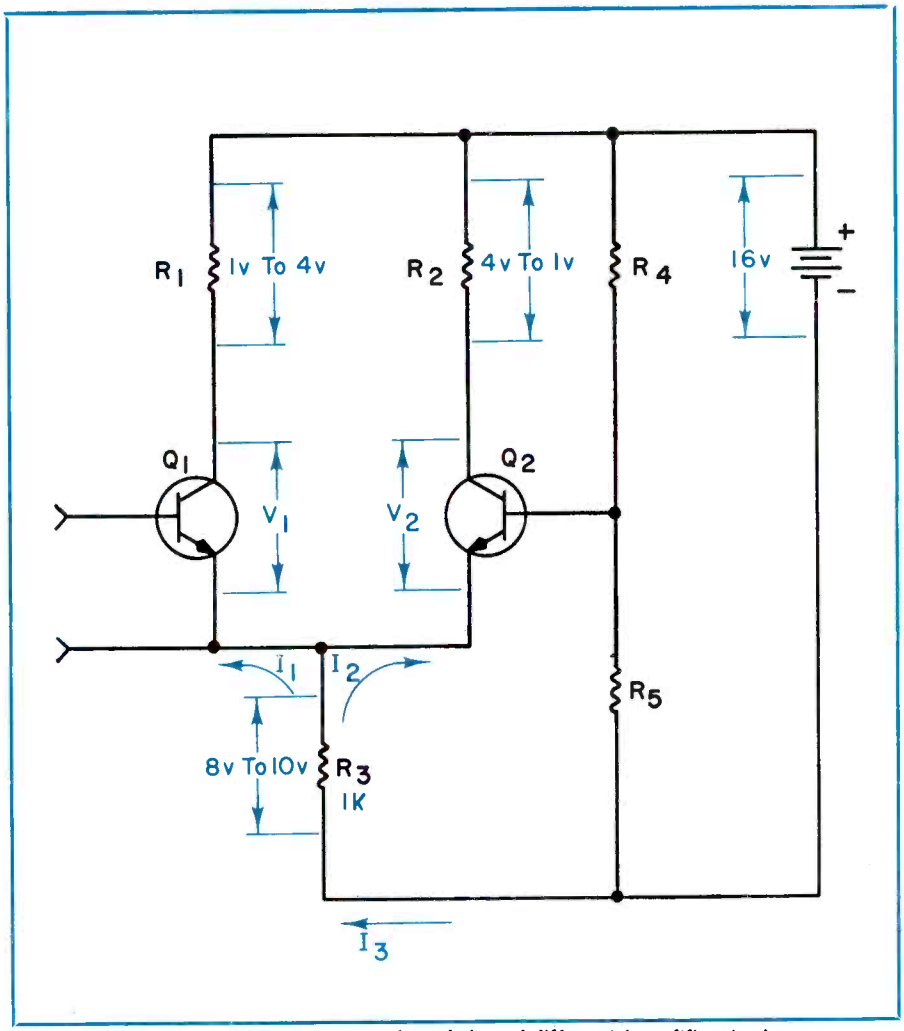


Fig. 10—Voltages present in the unbalanced differential amplifier circuit.

1v	4v		
1.60ma	6.40ma	8.00ma	8v
2.00ma	8.00ma	10.00ma	10v

From these calculations we see that the current flowing through the first transistor fluctuates from

continued on page 101

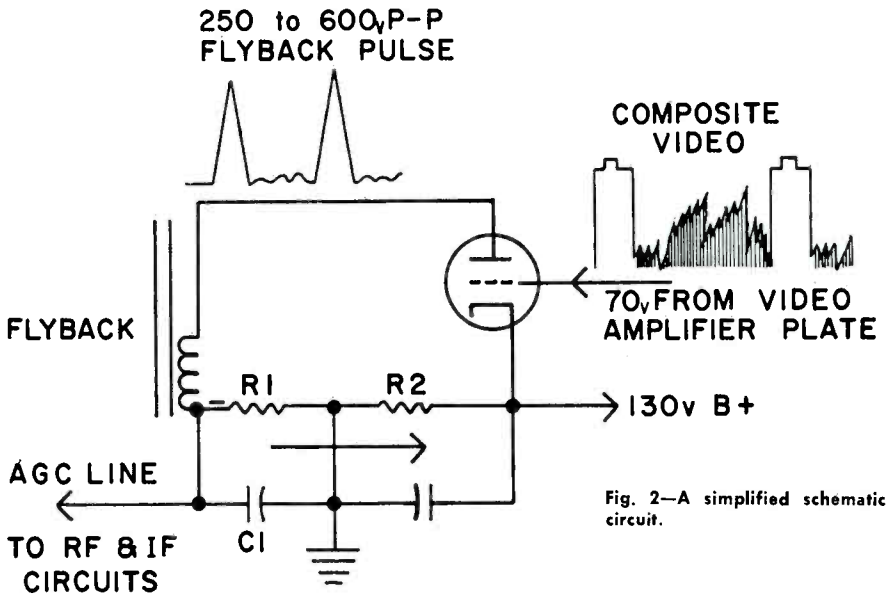


Fig. 2—A simplified schematic of a basic keyed AGC circuit.

UNDERSTANDING MODERN

You cannot troubleshoot and properly repair present-day keyed AGC circuits unless

Part 1 of a Series

■ Every well trained and experienced technician already knows that TV receiver AGC systems, on both B/W and color sets, are designed to develop a dc voltage that varies with the *strength* of the video signals being received. And this voltage is used to maintain the signal strength of the RF and video IF stages at a constant level — to prevent picture and sound fluctuations.

We also know that the simple AGC systems used in older TV sets had many inadequacies. For one thing, the time constant of the circuits were slow and reacted "sluggishly" to signal variations. And noise pulses of various kinds, plus "ghosts" caused by passing airplanes, created unstable signals.

"Keyed," or "gated" AGC circuits provide many improvements over earlier systems. The keyed system is referenced to a portion of the signal, the horizontal sync pulse tips, which does not vary as a function of video information. Thus, it is a more accurate reference. The dc AGC voltage varies with the amplitude of the received horizontal sync pulse. In other words, more AGC voltage is developed on black scenes and less AGC voltage is developed on lighter scenes.

Because *time* is your most valuable asset, you can make more money when you repair more sets within a given time. Since most of your time is used in troubleshooting — in isolating defective components — your primary need is to reduce troubleshooting time.

To save time in troubleshooting AGC systems, you'll need to know every detail about how these circuits operate. You will also need to develop new, more efficient techniques to speed servicing and repair. Before we explore practical AGC circuits, however, it may prove helpful to remind ourselves, briefly, of the basic principles of keyed AGC.

Basic Principles

Look at the simplified block diagram in Fig. 1. Note that a stage, known as the "AGC keyer," is used. In some sets this stage may be a combination AGC, sync clipper, or separator and noise suppressor. And, in modern solid-state circuits, still another stage, the AGC amplifier, is frequently a common addition.

Older AGC systems took the AGC control voltage from the video detector but in modern systems, the control, or bias voltage, is taken from the "keyer." A composite signal from the video amplifier is, in effect, "mixed" with a pulse which is taken from a winding on the horizontal output transformer, to produce the AGC voltage. It is important to remember, however, that the system functions only on the upper, or highest amplitude portion, of the horizontal sync pulses.

It is sometimes helpful to think of the typical AGC keyer in general terms — a system that uses two fast-acting "switches" which always function simultaneously (when the receiver is properly synced). The plate/cathode circuit of the keyer tube serves as one switch and the grid/plate circuit serves as the other switch. The first switch is actuated by positive-going horizontal pulses taken from the flyback transformer

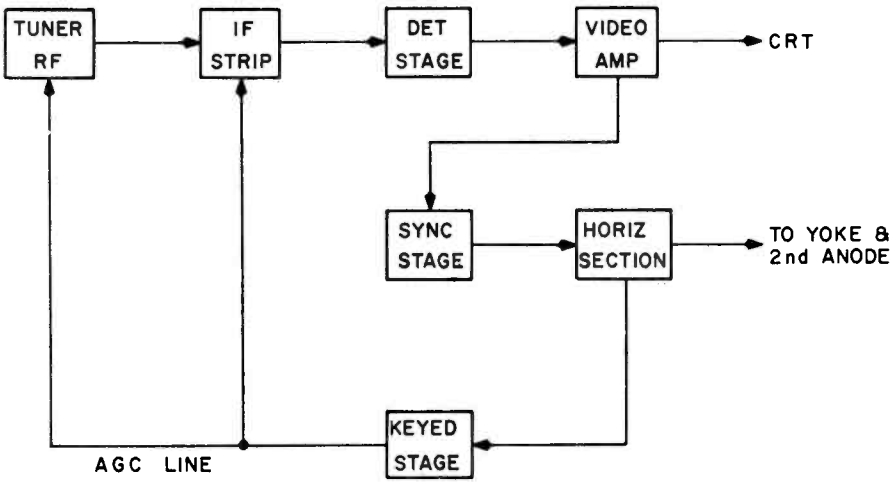


Fig. 1—Simplified block diagram of a TV, showing AGC keyer.

AGC CIRCUITS

you have a thorough knowledge of their functions

and the second switch is actuated by positive-going horizontal sync pulses from the composite video signal. Let's look at a simplified circuit and see how the two simultaneously-operating "switches" function.

Take a look at the simplified schematic shown in Fig. 2. Note that a sharp positive-going horizontal pulse, having an amplitude that may vary in different keyer designs from 250v and upward, is taken from a winding on the flyback transformer and applied across the plate/cathode circuit of the keyer tube. This section of the tube acts like a diode rectifier and the tube will conduct on each horizontal pulse. R1 and R2 act as the diode load. Note that no B+ voltage is applied to the keyer tube plate.

The current waveform through resistors R1 and R2 is a series of sharp spikes at a frequency of 15.75kHz — the horizontal sweep rate. Note, also, that the resistors are grounded at their connecting points. The arrow shows the direction of current flow through the resistors. Observe, too, that the ungrounded end of R1 is *more negative* than the grounded end. This plate/cathode network is the first "switch" in the keyer.

The grid of the keyer tube is connected directly to the video amplifier plate. Under no-signal conditions this particular keyer tube's grid is approximately 70v, the same as the supply voltage to the video amplifier tube's plate. Because the keyer tube cathode is connected to the 130v supply, the tube's grid is then —60v with respect to the cathode. The keyer tube, under these conditions, is cut off and cannot conduct.

When a positive-going composite video signal having a horizontal pulse amplitude of approximately 60v is on the plate of the video amplifier, the —60v bias on the keyer grid is balanced out and the tube conducts. This action takes place only in the blacker-than-black signal region — at the tips of the horizontal sync pulses. This is the tube's second "switch."

At the instant the keyer tube conducts, it develops a negative voltage across R1. This can occur, of course, only if both "switches" are closed simultaneously — when the keyer plate is made positive by the flyback pulse and the positive voltage on the grid is increased by the horizontal sync pulse.

Strong received signals will make the keyer grid more positive — creating higher negative pulses across R1. C1 filters the ac from the negative pulses and they are then fed to the AGC bus. The actual design of keyed AGC circuits vary, but all serve the same purpose. Now, let's take a look at some actual circuits and see how they operate.

Typical AGC Circuits

We'll begin with an older chassis and work up to the more modern circuits — including solid-state systems.

The keyed AGC circuit shown in Fig. 3, using a 6AU6 tube, is employed in a Westinghouse V2417 chassis. The tube's screen grid is connected to a 270v B+ source. The cathode has about 155v, obtained through the action of resistors R300, 302 and the AGC level control, R301. The level control is set to provide this voltage. The control grid is dc coupled to the plate circuit of the video amplifier which makes it 100v positive. The 100v on the control grid and 165v on the cathode, places the grid at —65v with respect to the cathode. The tube, of course, is cut off under these conditions.

When the tube's plate receives a capacitively-coupled 600v P-P positive-going pulse from the flyback at the same time that the grid receives a 100v P-P positive-going composite video signal, the keyer tube conducts. When the tube conducts, the pulse-coupling capacitor becomes charged as shown in Fig. 3. When the tube cuts off, the capacitor discharges through resistors R205 and R208 to ground — producing a negative voltage drop. This potential is about —45v but is reduced to a lower voltage which varies between 1 to 5v through drops which take place in R203, 204, 205 and 208. Current flowing from the capacitor through R205 and R208 to ground, opposes current produced by the 270v

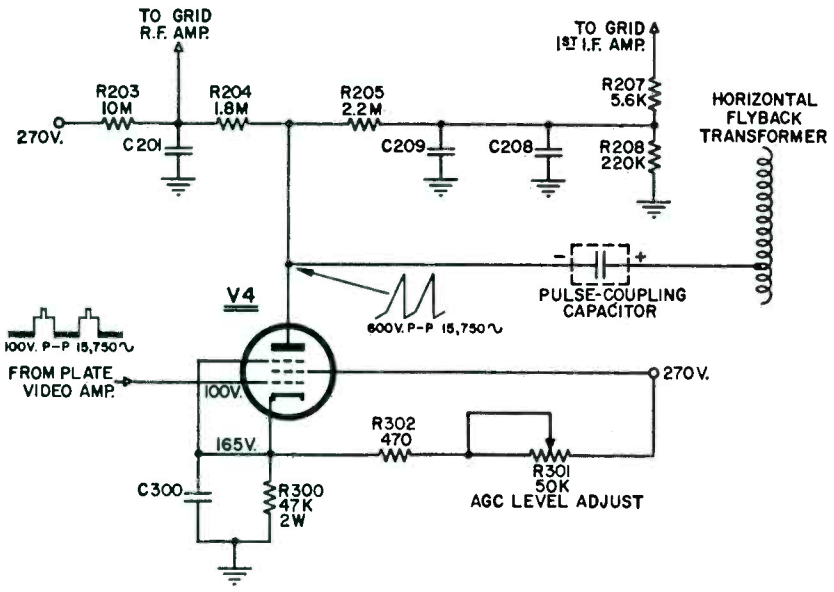


Fig. 3—Keyed AGC circuit in Westinghouse V2417 chassis.

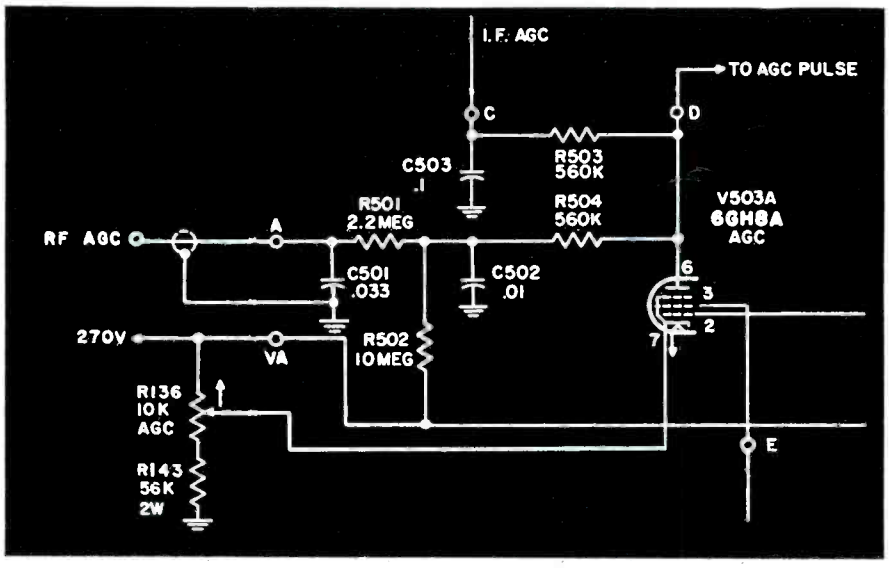


Fig. 4—Keyed AGC system used in the Magnavox T904 color chassis.

across the resistors and the resultant voltage drop across these resistors is the low dc AGC voltage which varies with the incoming signals.

The AGC control in this circuit is used primarily to compensate for variations in AGC circuit component tolerances and to set AGC action at the optimum point for average incoming signal levels. The resistor, R302, limits the amount of positive voltage to the tube's cathode when the control is set to minimum. Under normal conditions, the AGC control is set to provide about —65v bias between the control grid and cathode. Capacitors C201, 208 and 209 filter the 15.75kHz ac from the AGC voltage. It should be noted in practice that the pulse-coupling capacitor in this particular chassis is a 5-in.-long piece of shielded cable.

Once again, as previously indicated, AGC bias — a negative voltage — varies in proportion to the amount of current flowing from the AGC tube. And this current is likewise proportional to the incoming signal amplitude. A strong video signal at the grid of the AGC tube will cause it to conduct more heavily and the larger current will produce a larger negative voltage in the AGC bus. This increased negative voltage will *decrease* the RF and IF gain. The 1st and 2nd IF grids in this chassis are AGC controlled.

It is interesting to note that the AGC bias circuit to the tuner is designed to apply a somewhat lower voltage to the RF tube grid than that applied to the two IF tube grids. The RF bias is inactive at this lower voltage and begins to function only when the incoming signal becomes stronger. In effect, the RF AGC bias is "delayed." Now we'll look at a more modern keyed AGC circuit.

The schematic in Fig. 4 shows a keyed AGC system used in the Magnavox T904 color chassis. We'll only review the circuit operation briefly.

The pentode section of a 6GH8 tube has its control grid dc coupled to the sync amplifier plate which places a certain amount of B+ on the keyer grid. The cathode of the tube is connected through the 10K AGC control (R136) which places B+ on the cathode. Under normal conditions, the voltage on the cathode will be higher than that on the grid — biasing the tube well below cutoff. The signal on the tube's grid is a positive-going composite video signal. The tube is so biased that it conducts only on the horizontal sync signals. At the instant a sync pulse appears on the grid, a high positive pulse from a winding on the horizontal output transformer is applied to the plate through a 68pf, N150-type, coupling capacitor. The tube conducts at this instant — creating negative AGC bias proportional to the signal strength.

This review of a few keyed AGC circuit functions should give us a fair idea of how modern circuits operate. Forthcoming articles will explore a few other keyed AGC circuits, including transistorized types. Troubleshooting procedures, including the analysis of trouble symptoms, will also be detailed in forthcoming articles. ■

Telephone operators at Bethlehem Steel use CC-TV office monitoring system to route calls to sales personnel. Equipment furnished by Sylvania.

Servicing Closed-Circuit TV Equipment

Learn the 'ropes' in this area of the electronics field and increase your earning ability

Part 1 of A Series

■ A substantial number of ELECTRONIC TECHNICIAN readers have moved into the business of servicing CC-TV equipment as a diversified sideline and some have become specialists. In many cases, CC-TV is now employed within integrated setups — audio-visual communications systems. (See the article "Striking It Rich in Audio and Visual Communications," ET September 1966.) Some specialists design and install custom audio-visual systems to fit particular needs —in addition to servicing equipment already installed.

Closed-Circuit TV is widely used today in schools and colleges, industrial manufacturing plants, retail stores, security stystems, hospitals and in many other areas. And it is showing continuous growth. It can be said unequivocally that this area of the electronics field is indeed promising.

General Technical Considerations

To effectively maintain closed-circuit TV systems, technicians should have a good knowledge of theory involved. While some basic knowledge is compatible with that which every TV technician now has, much additional specialized knowledge is required for CC-TV.

You will, for example, learn that two basic camera types are in general use: the vidicon and orthicon type cameras. And, in recent years, high resolution cameras have been developed which produce pictures three times as sharp as home-type TV receivers.

You will also need to know what equipment is being used and keep up with technological developments in this area, as with home entertainment equipment, because the techniques involved in maintenance are constantly changing.

Cameras are designed for harsh environmental conditions. Those used in this area generally contain only the video pick-up tube, hori-

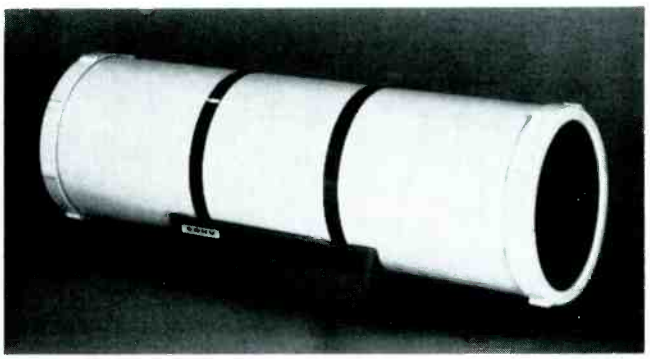


Fig. 1—Cameras designed for rough environmental conditions usually contain only the video pick-up tube, horizontal deflection circuit and preamplifier in a sealed housing.

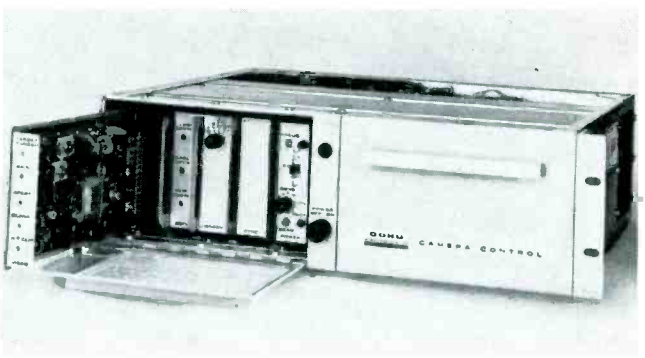


Fig. 2—Separate unit used with remote package shown in Fig. 1 is normally located in a permanent interior spot.

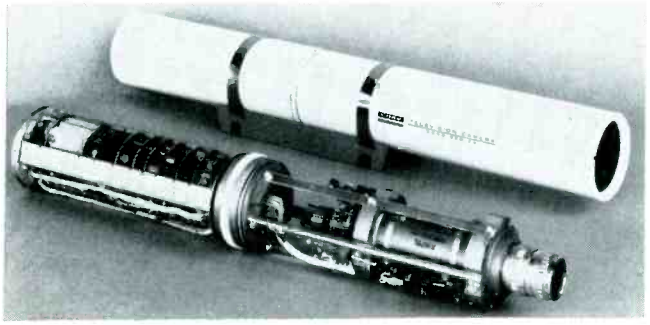


Fig. 3—Miniaturized power supply, synchronizing generator, vertical deflection and amplifier circuits in a sealed housing which is used on an environmental-resistant camera head.

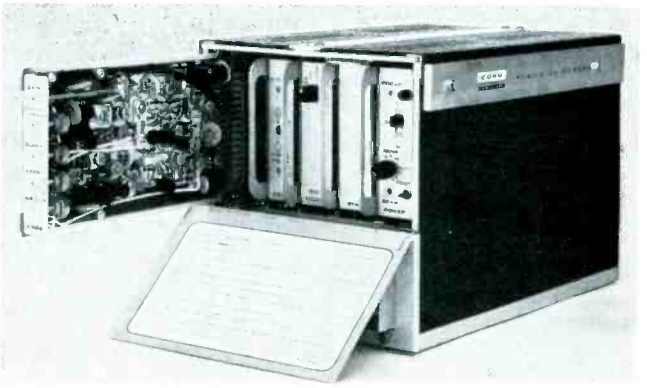


Fig. 4—Single unit "self-contained" camera for interior use.

zontal deflection circuit and preamplifier — all in a sealed housing (see Fig. 1). All other camera circuit assemblies, including those containing controls for alignment and other functions, are contained in a separate unit which is normally located in a permanent interior spot (see Fig. 2).

Where a separate camera control is not used, a miniaturized power supply, synchronizing generator, vertical deflection and amplifier circuits are in a sealed housing and attached to an environment-resistant camera head (Fig. 3). This single-unit camera, frequently referred to as a "self-contained," camera, is also constructed for interior use and is usually larger (see Fig. 4).

Most of the equipment being designed and manufactured today is solid-state and mounted on etched circuit boards. The etched boards are frequently treated with a compound to prevent trouble caused by dust, corrosion, etc. Some boards are encapsulated, or potted, in a non-conductive material to prevent trouble caused by extreme environmental conditions.

You will come into contact with a wide variety of products capable of satisfying almost any need. Some of this equipment, like that shown in Fig. 5, is completely solid-state and has plug-in modules. Available modules are designed so the service-dealer can put together a variety of custom units to satisfy most needs.

This particular equipment is designed to have a video passband of either 15 or 30MHz, having resolutions up to 1100 lines and a variety of horizontal scan rates and other features. Integrated circuitry, of course, is already making its way into modern CC-TV cameras. Now let's get a little closer to some important basic considerations regarding this equipment.

The Vidicon Tube

About 90 percent of the equipment used in the areas previously mentioned are built around the vidicon tube. And this tube requires considerable care.

A cross-sectional view of a vidicon tube's structure is shown in Fig. 6. It is probably the weakest and most costly link in the CC-TV equipment chain.

Some installations require orthicon type equipment because of its greater sensitivity and ability to operate at lower light levels. It should be understood, however, that each type of equipment has its own advantages and disadvantages.

The standard-type vidicon tube is about 1in. in diameter and 6in. long. The tube base has an electron gun which functions the same as a gun in a B/W TV. The gun's beam is usually deflected electromagnetically with a yoke similar to that used on a TV receiver — although some equipment uses electrostatic deflection.

A photoconductive layer, called the "target," is deposited on the vidicon's faceplate. When this target is lighted the vidicon conducts. The target layer is an insulator when the vidicon is in darkness. An exaggerated drawing of the target is shown in Fig. 7.

Since a fast moving beam is used to sweep the target surface, scan failure can cause the target to be burned in the same way as sweep failure can cause the phosphor or burn on the inside face-plate of a TV CRT.

Fig. 5—One-piece and two-piece CC-TV camera systems by General Precision's GPL Division feature solid-state circuitry and plug-in modular construction.

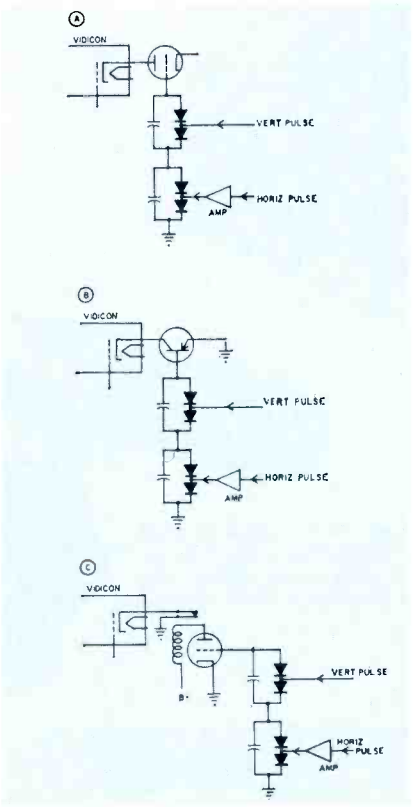


Fig. 8—Three circuits used to protect the vidicon tube. (A)—System which uses rectified positive pulses to keep triode tube "gated" on. (B)—Positive dc keeps transistor gated on. (C)—Relay is kept energized by positive voltage which keeps triode conducting.

All vidicon cameras have a protective circuit to prevent damage to the costly vidicon if the horizontal or vertical sweep fails. The protective circuit cuts off the vidicon beam when a scan failure occurs. Three systems used for vidicon protection are shown in Fig. 8.

Vidicon maintenance consists primarily of routine face-plate cleaning. The same type of tissue and liquid cleaner recommended for optical lenses is used. This is very important since a build-up of foreign substances on the vidicon face will reduce light transmission which in turn can shorten tube life because of the necessity of "overdriving" to maintain picture brightness.

Some important points in vidicon care are as follows:

1. Do not allow direct sunlight to fall on the target area of the vidicon.

2. Do not focus the camera on a spot or flood light.

3. Do not operate the camera with a low light level for any length of time — even if picture quality appears good. This will reduce vidicon life.

4. Do not rotate the vidicon in the deflection yoke from the position set at the factory.

5. Always cap the lens when the camera is not in use and if the lens mount is removed, make sure to cap it.

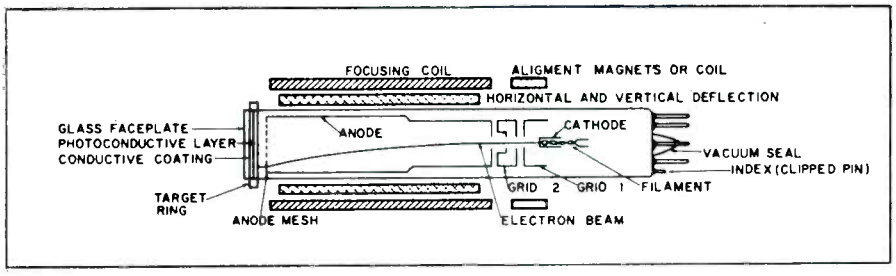


Fig. 6—Cross-sectional view of a vidicon tube's structure.

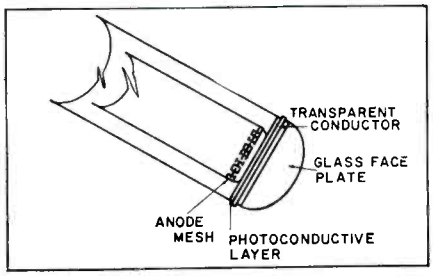


Fig. 7—Relative position of materials used to form the target on a vidicon tube.

Sweep Circuits

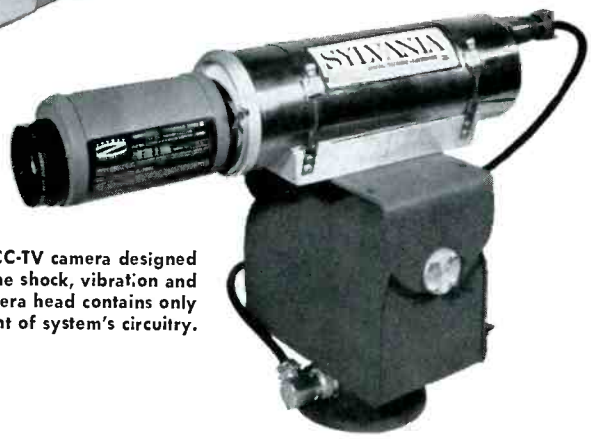
Sweep circuits used in CC-TV equipment are basically similar to those used in B/W TVs.

In cameras which are completely housed in one case, cathode follower circuits are frequently used to drive the deflection yoke. In those cameras having separate control units, sweep circuits are frequently contained in the control unit housing. In these situations, because of the cable run length, transformer coupling may be used.

Some vidicon equipment uses electrostatic deflection, similar to that used on most oscilloscopes, and a simple sweep generator is plate-coupled directly to the vidicon deflection elements.

It should be noted that the sync signals for the video output usually originate with the camera sweep circuits. Some cameras have a crystal oscillator which drives the sweep

Blonder-Tongue CC-TV camera provides 800 lines resolution.



Two-piece Sylvania CC-TV camera designed to withstand extreme shock, vibration and noise. Sealed camera head contains only 10 percent of system's circuitry.

Librarian keeps tabs on activities in public rooms and in other sections at the library.

CC-TV camera by Channel Master Corp.

Two CC-TV cameras by Diamond Electronics are solid-state.

output tube for horizontal deflection with dividers to count down to the vertical frequency so an interlaced signal is obtained.

Some camera systems use a free-running horizontal oscillator and tie the vertical oscillator to the 60Hz line frequency.

Some systems feed the sync separately through coaxial cable to synchronize the monitor. If the signal is not used to sync the monitor through the composite video, it is used for "blanking" during the sweep retrace. The blanking signal is applied directly to an active element in the camera tube to cut off the video during retrace.

Normal output for a CC-TV camera is about 1v. If the system uses a composite output signal, one with the sync signal included in the video, the sync signal will be somewhat greater than 1v.

In composite systems the sync may be added in a number of ways. In many cases the sweep outputs are coupled independently to the video amplifier. Since the horizontal sync is usually weaker, it is frequently applied one stage ahead of the vertical sync. The sync may be applied to the cathode, screen or mixed and applied to the grid of a video tube.

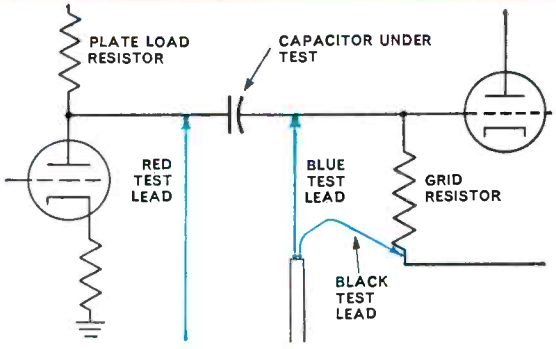
Since the CC-TV output signal is fed through a coaxial cable, the output of the video amplifier must match the impedance of the cable. This is usually 75Ω.

The CC-TV system has a number of controls similar to those on a regular TV receiver. These include width, vertical size, vertical linearity and focus. Additionally, there are blanking controls to determine the amount of blanking injected into the video signal, a beam control, to determine the beam current in the vidicon and a target control, to adjust the potential on the vidicon's photoconductive surface.

Control adjustment is sometimes critical and misadjustment can shorten a vidicon tube's life. Too much beam current, for example, will shorten the life of the vidicon. And it will somtimes cause retrace lines or picture smear.

A forthcoming article on this subject will explore some installation and maintenance problems. ■

locate defective capacitors in-circuit



3-LEAD LEAKAGE TEST: One test lead is connected to the plate side of the capacitor and the ground lead to the grid leak return on the other side of the capacitor, and the meter is zeroed. The third test lead is then connected to the grid side of the capacitor and the meter scale shows the leakage directly in megohms.

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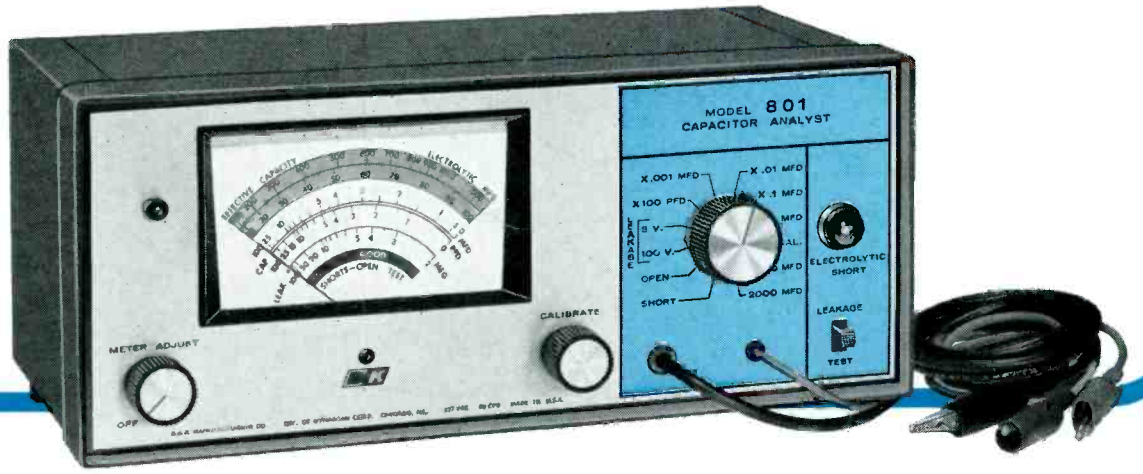

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COLORFAX

Sylvania's DO6 Color Chassis

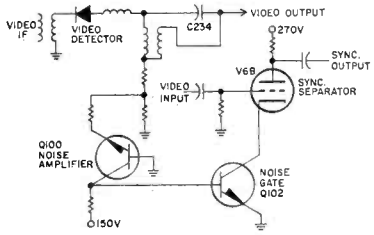
The new chassis is similar to the DO5 color chassis and has many features of the DO2 shown here. It employs a power transformer, shunt type high voltage regulation and pincushion correction at the raster top and bottom. The pincushion correction circuit uses a passive transformer and is slug adjusted.

Chroma circuits are very similar to the DO5 chassis, "X" and "Z" demodulation is used to drive the color difference amplifiers. Matrixing in the cathode and grid circuits provide drive for the G-Y amplifier.

In the video amplifier circuit the pentode-triode (10JT8) used in the DO5 has been replaced by a 6HL7 pentode and the triode section (color killer) is now transistor Q600, an SE1002/2N3694 type.

An additional refinement has been made in the noise gate circuit. Transistor (Q102) has been added to provide greater bias amplification.

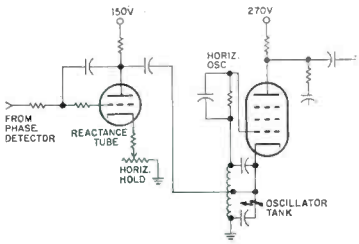
This bias is used to cut off the



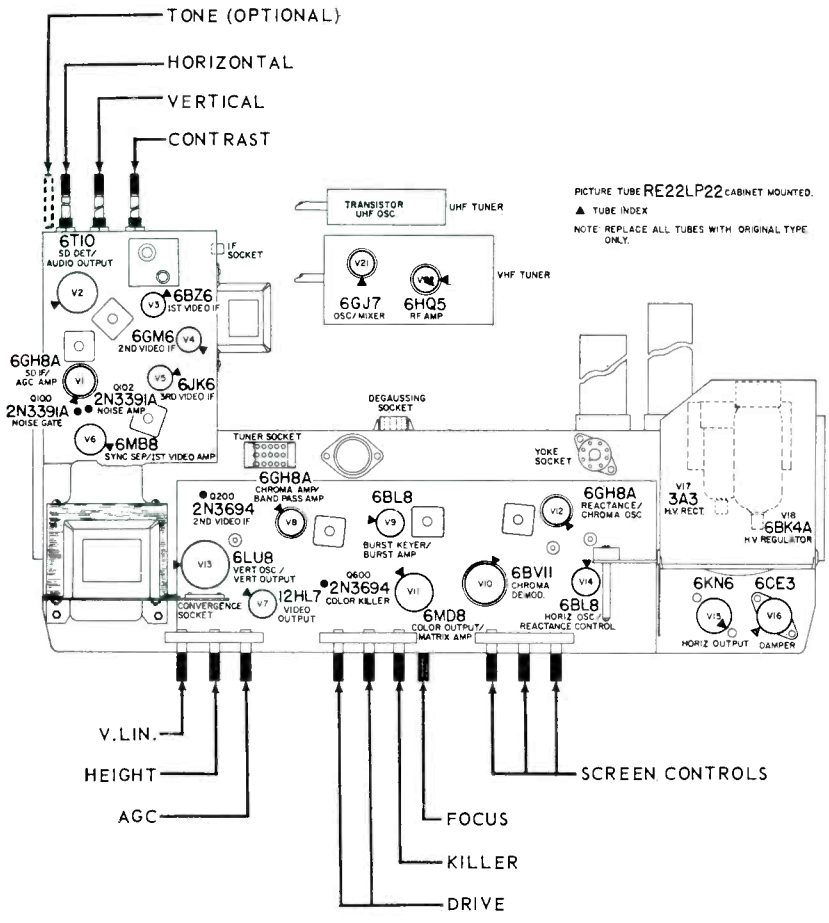
sync separator stage and prevent noise pulses from affecting the scanning oscillators. (See schematic above.)

The brightness and contrast levels are set by adjusting the contrast range control. A spike flyback pulse is rectified by SC204 to provide a negative dc source for biasing the final video amplifier. This sets the amplifier conduction level and, by dc coupling, the CRT cathode potential. This bias is further adjusted by signal level regardless of average video level variations. To prevent loss of gray scale range caused by changes in average video level, dc restoration is required.

The horizontal AFC circuit in the DO6 is similar to traditional AFC used in color subcarrier frequency control. A diode phase detector is used to compare oscillator and horizontal sync pulse frequency to provide a correction voltage. This voltage controls the reactive current conduction of a reactance tube. The reactance tube is paralleled with a portion of the oscillator tank circuit to provide oscillator control as shown below.



At the grid of the video output stage, dc restoration is accomplished by the clamping diode, SC204. This diode clamps at about the blanking level to provide fixed bias for the video output stage.



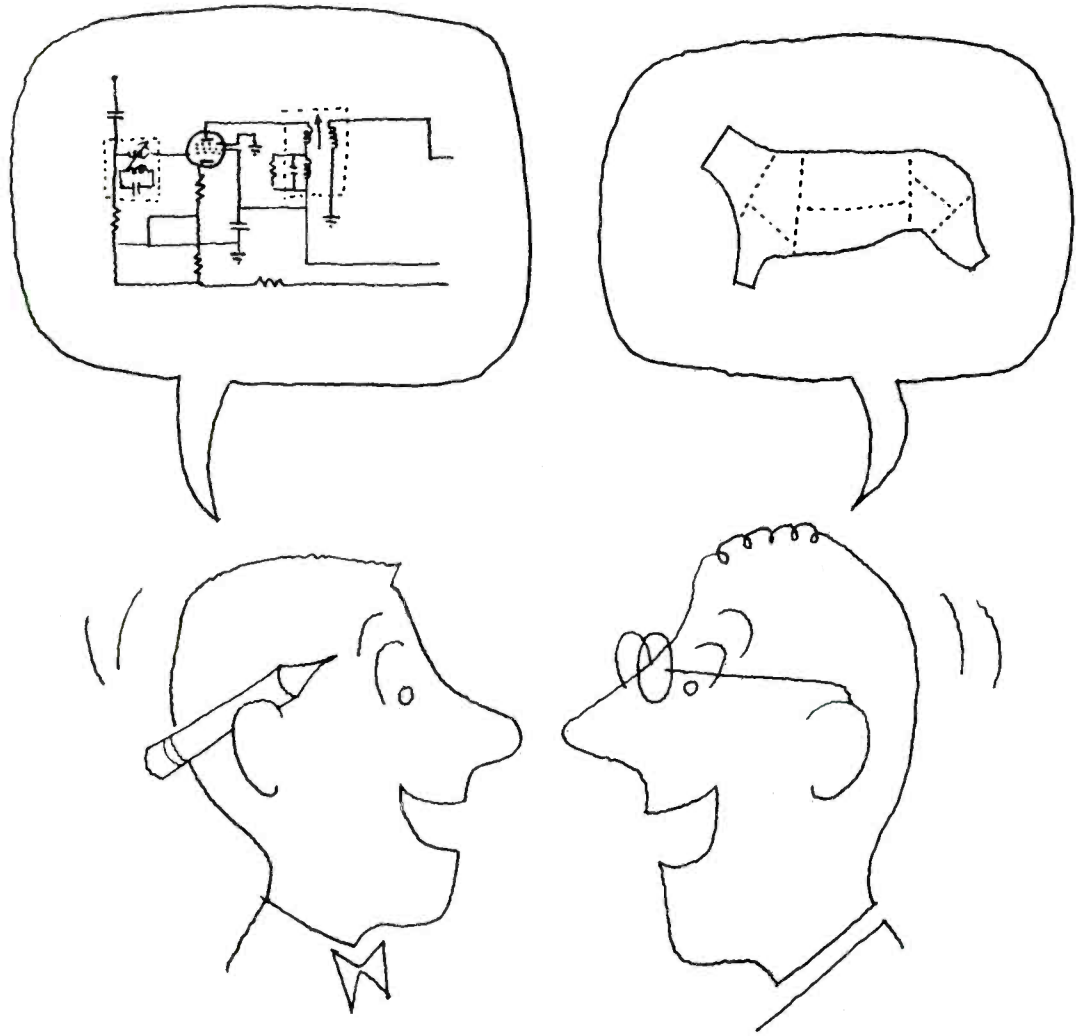
D06 CHASSIS LAYOUT

Replacing Rubber Bushings on Admiral Color TV Tuning Motor

If the motor will not disengage to permit manual tuning on power tuned Admiral color TV sets using the 91C76-1 tuning motor the condition can be caused by the following: On early production sets the bushings may become warped by oil or heat, preventing the motor from pulling far enough out to disengage. The bushings should be replaced with part No. 91C76-52. The bushings are specially treated to prevent recurrence of this condition.

Color Sync and Brightness Problems on Sylvania's DO1, DO2

Intermittent color sync problems have been found in several DO1 and DO2 chassis caused by a cold solder



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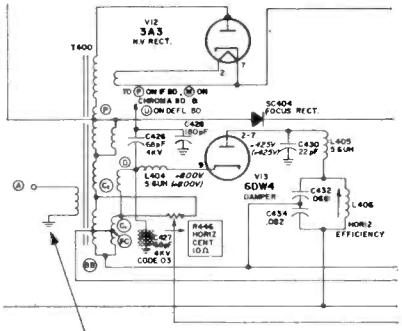
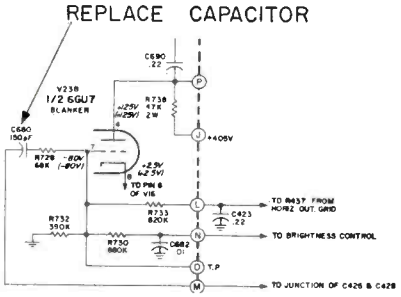
joint. This connection is found on the ground side of the flyback AFC





transformer winding. Re-heat the joint and if there's smoke, there's rosin.

An intermittent opening of C680 in the blanker tube grid circuit, V23B, will cause the brightness to change. Replacement of the 150pf capacitor with a new component will correct the trouble.

RCA Victor CTC16X Chassis HV Rectifier Substitution

Reports reveal tube type 3A3A is being substituted for type 3CA3 in the CTC16X chassis without circuit modification. The 3A3A is a greatly improved tube type designed for better reliability in the high voltage section. Therefore, the 3A3A is a recommended replacement for the 3CA3, if a 3.3Ω resistor is placed in series with the filament lead.

Some replacement tubes, will be double-branded-labeled 3A3A/3CA3. These tubes should, however, be considered as type 3A3A when used in a CTC16X chassis, requiring the addition of the filament resistor.

Installation of the resistor can be made at the rectifier socket without removing the chassis.

Relocate black filament lead from pin 2 to pin 4, connect resistor from pin 2 to pin 4.

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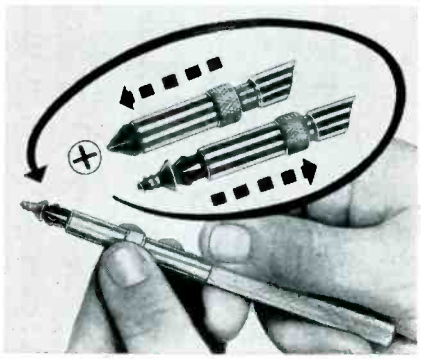
VTVM 700

A new VTVM is introduced that has a ½v transistor servicing range. Both P-P and RMS voltages are read on separate scales in 7 overlapping

ranges with a rated frequency response of 30Hz to 3MHz. Its 11M input is designed for negligible loading in dc measurements from 0.01 to 1.5kv in 8 overlapping ranges. EICO.

Phillips Screw Launcher 701

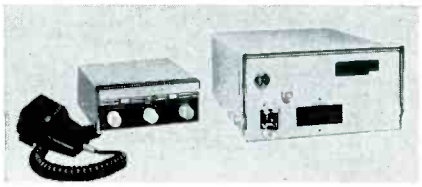
A launcher tool for starting Phillips screws is an addition to a line of screw launchers. Available in four



lengths — 3, 5, 7 and 9in. — the screw launcher is designed to grip and start cross-slot screws. Prices from $1.75 to $2.20. Vaco.

Two-Way Radio 702

A 120w, FM, two-way, mobile radio is announced that is designed to operate on six channels in the 148 to 174MHz band. The transceiver employs solid-state circuitry throughout, except in the final RF power ampli-



fier stage of the transmitter where an "instant-heat" tube is used. Specifications indicate that spurious emissions are down more than −85db and distortion is less than 4%. The transmitter-receiver unit is designed for trunk mounting and is only 15 x 9⅛ x 4½ in. The unit weighs only 15 lb. A remote control unit is provided with volume, channel selection and squelch controls. Kaar.

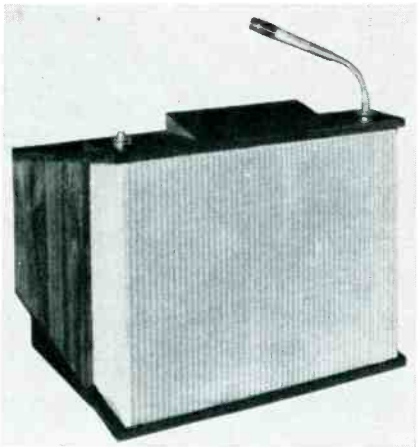
Illuminated Magnifier 703

An illuminated magnifier is announced that reportedly provides 48

sq in. free of distortion or aberation. Included in the unit are two high-intensity flood lights for uniform, concentrated illumination, and a panoramic arm. The arm consists of a vertical mounting post and base with jointed arm that extends to 19in. Techni-Tool.

PA Lecterns 704

A series of roll-about and table model lecterns are introduced for schools, hotels, conference halls, etc. They contain dual mounted speaker columns that may reportedly be individually oriented both vertically and horizontally to meet audience configuration and the physical shape of the location. The model shown weighs



70 lb, measures 19 x 26 x 21 in. and is designed to rest on any table. Temple Sound.

Dual-Channel CB Transceivers 705

A matched pair of dual-channel, unlicensed, CB walkie talkies has a 10 transistor superheterodyne circuit that

includes [illegible] RF Stage. The units operate on eight 1.5v penlight cells. List price for pair is $84.95. Channel Master.

Radio Analyzer 706

A solid-state instrument is announced for servicing and troubleshooting all types of AM and FM radios. The instrument combines "sig-

nal injection," "signal detection" and a power supply source in a single portable instrument. The generator output includes 1kHz audio and RF over the range of 240kHz to 1750kHz plus 10.7MHz FM IF, for "injection-type" service work. "Signal tracer" circuitry incorporates a light-

loading probe along with a tuneable amplifier covering 240kHz to 1.75MHz and a built-in audio amplifier and speaker. Price $149.50. Hickok.

Bench Lamp **707**

A bench lamp is designed to provide both fluorescent and incandescent light. It comes with a double-wall re-

flector hood with ventilating louvers for air cooling, and either a standard 26-in. arm or an extra long 33-in. arm. Price $28.10. Acme Lite Products.

Universal Tool **708**

A new universal terminal attaching tool can reportedly be used to attach both insulated and non-insulated ter-

minals to wire from 22 to 10 AWG. It is also designed to strip wire from 10 to 22 AWG, cut wire and cut all bolts ranging from ¼ to ⅝ in diameter. Price $5.99. Aerovox.

Color Generator **709**

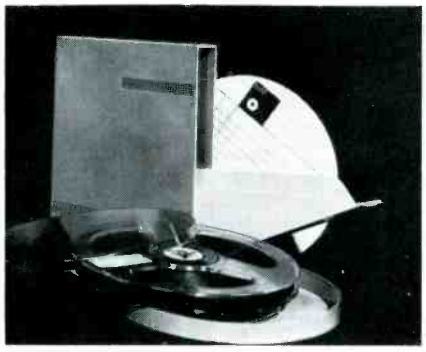
A solid state, color generator featuring a movable single dot and single vertical and horizontal line patterns is announced. Its automatic timer heating element is thermostatically controlled to maintain a minimum operating temperature of 80°F. All adjustments are located on the front panel under the hinged pattern strip,

for readily accessible fine adjustment of each channel, timer controls or dot size. Price $149.95. Sencore.

NEW PRODUCTS

Tape Package 710

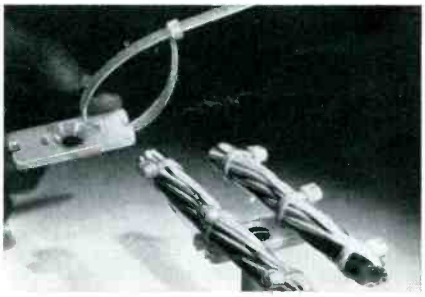
A line of magnetic tape is to be distributed in individual plastic containers. The containers are reportedly



made of high-impact molded plastic, with an inner plastic box to guard the tape against dust and dirt. Computron.

Butterfly Clamp 711

A butterfly clamp is designed to hold two cables side by side. In installations, the nylon clamp is fastened in place with two screws and



two ties are inserted in the slots in the clamp. The wire bundles are then positioned and the ties are fastened around each wire bundle. Either self locking or twist locking ties may be used. Thomas & Betts.

Cartridge-Tape Deck 712

Announced is a cartridge-tape deck for background music and special programs in commercial and business establishments. It reportedly uses a specially designed, two-hour, no rewind cartridge that provides continuous service without tape tangles,

tension loss or tape edge fatigue. The cartridge slides in from the front and all controls, including fuse change, are on the front panel so that the unit can be operated from any confined location. The unit has a rated frequency response of 50Hz to 7.5kHz. Bell.

AM/FM Tuner 713

Announced is an AM/FM Tuner that is designed to provide a background music source for any commer-

cial-sound system. The circuitry is completely transistorized and designed to handle strong input signals. Specifications indicate an FM sensitivity of 3μv with 200kHz band width and an AM sensitivity of 10μv with 8kHz band width. Bell.

Remote Control Switch 714

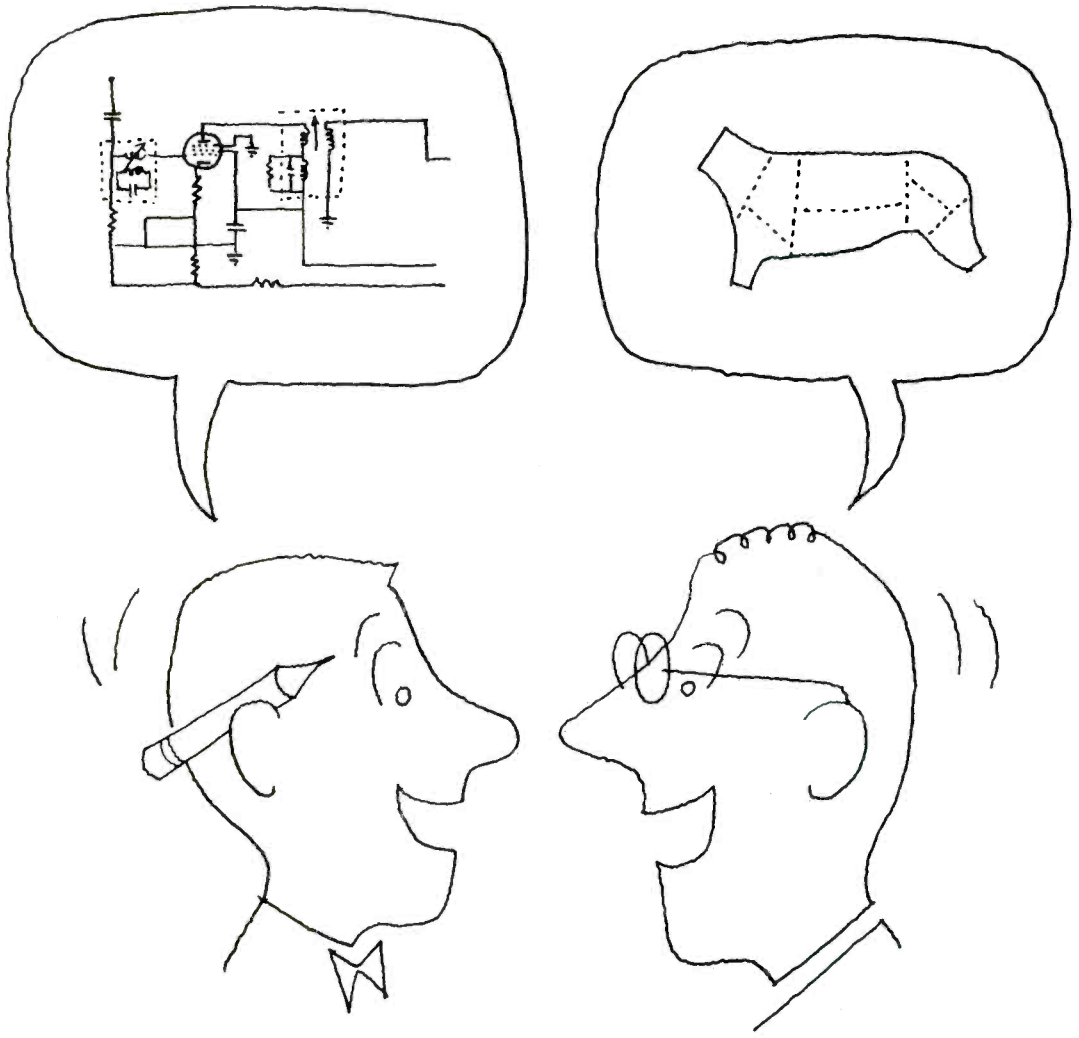
A wireless remote control switch is announced that is designed to turn electrical equipment ON and OFF with

a battery powered transmitter. The unit will reportedly operate over a range of 40ft, and specifications indicate that the relay in the receiver has a contact rating of 7.5amp. Euphonics.

Telephone-Type Handset 715

A close-talking, dynamic-microphone-type handset has been designed

for environments of high-ambient noise and reverberant acoustics. Specifications indicate that the microphone has a frequency response of 70Hz to 5kHz and that the noise discrimination averages 15db. The output impedance is 150/250Ω. Altec Lansing.



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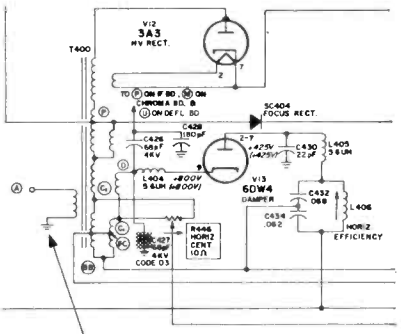
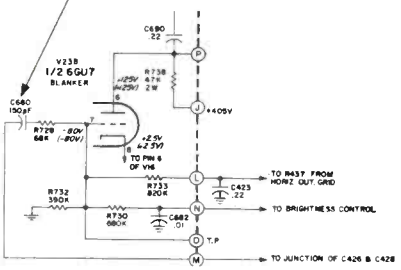
joint. This connection is found on the ground side of the flyback AFC



HEAT CONNECTION

REPLACE CAPACITOR



transformer winding. Re-heat the joint and if there's smoke, there's rosin.

An intermittent opening of C680 in the blanker tube grid circuit, V23B, will cause the brightness to change. Replacement of the 150pf capacitor with a new component will correct the trouble.

RCA Victor CTC16X Chassis HV Rectifier Substitution

Reports reveal tube type 3A3A is being substituted for type 3CA3 in the CTC16X chassis without circuit modification. The 3A3A is a greatly improved tube type designed for better reliability in the high voltage section. Therefore, the 3A3A is a recommended replacement for the 3CA3, if a 3.3Ω resistor is placed in series with the filament lead.

Some replacement tubes, will be double-branded-labeled 3A3A/3CA3. These tubes should, however, be considered as type 3A3A when used in a CTC16X chassis, requiring the addition of the filament resistor.

Installation of the resistor can be made at the rectifier socket without removing the chassis.

Relocate black filament lead from pin 2 to pin 4, connect resistor from pin 2 to pin 4.

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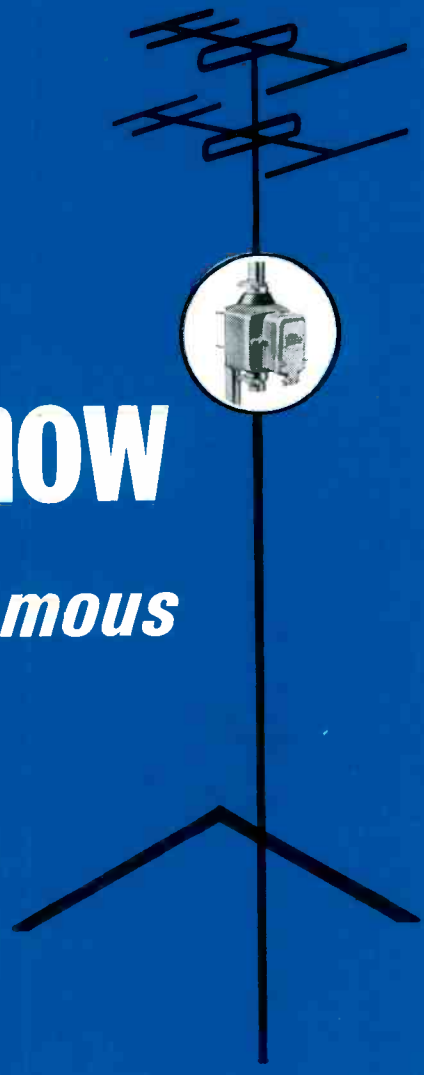

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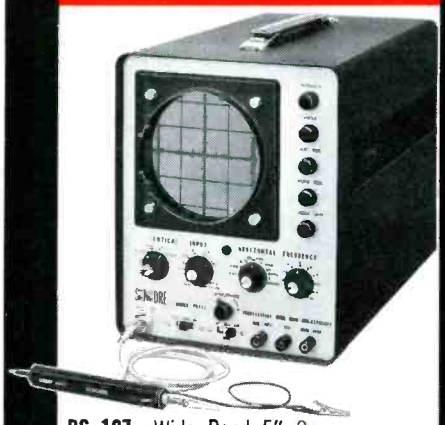
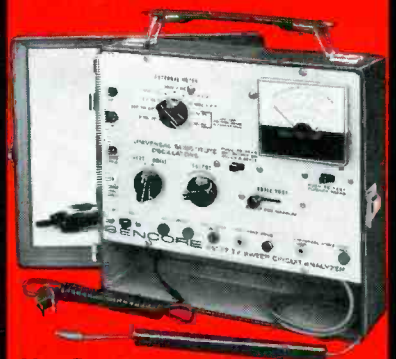
CIRCUIT ANALYZERS



PS 127—Wide Band 5" Oscilloscope with direct reading P to P volts. **$199.50**

SM 112E — Combination VTVM-VOM with automatic scale indication. **$89.95**



SS 137—Sweep Circuit Analyzer for both black & white and color TV. **$79.50**

FS 134—Field Strength Meter covers all VHF and UHF channels plus FM. **$199.50**

PICTURE TUBE TESTERS & REJ.

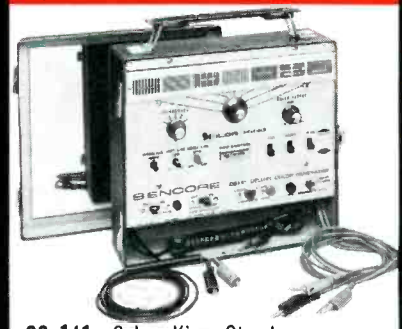
CR 143—CRT Champion Deluxe CRT checker and rejuvenator. A must for accurate color CRT testing. **$99.50**

CR 13—CRT Cadet: CRT checker and rejuvenator. Easy to set-up; fast to use. **$79.95**

COLOR GENERATORS

CG 10 — Lo Boy Standard Color Bar Generator — battery operated. **$89.95**

CG 12 — Lo Boy Standard Color Bar Generator — AC operated and 4.5 mc tuning crystal. **$109.95**



CG 141—Color King Standard Color Bar Generator with exclusive TEMP CONTROL for absolute stability. **$149.95**

CA 122B—Deluxe Color Circuit Analyzer for black & white and color. **$187.50**

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MX 129—Deluxe Multiplex Generator for fast repair of FM Stereo receivers. **$169.50**

MX 11—Channelizer FM Stereo Multiplex Generator simplifies stereo servicing. **$99.50**

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RC 144—Handy 36 Resistor-Capacitor substitution unit—lower than the cost of the parts. **$14.95**

RC 145—Handy 53 Resistor, Capacitor and Electrolytic substitution with full protection. **$34.95**

RC 146—Handy 75. Resistors, Capacitors, Electrolytics, Power Resistors, and Universal Silicon and Selenium Rectifiers at your fingertips. **$44.95**

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TC 131—Semi-Automatic Tube Tester for you or your customer. Easy to operate—sensitive. **$99.50**

TC 132—New Mighty Mite V speedy and sensitive in home or shop tube tester. **$74.50**

FC 123—Filament Checker. A must for series string filament testing. **$3.95**

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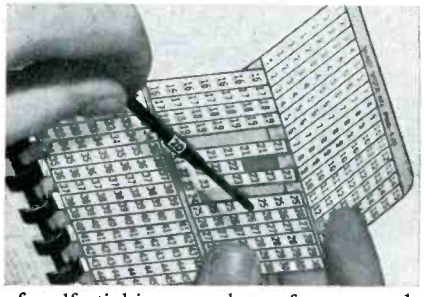
NEW PRODUCTS

Wire Marking Kit 716

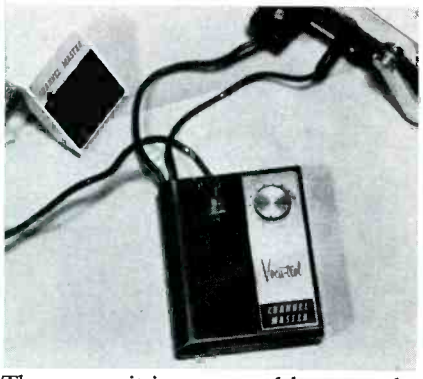
A pocket-size book of wire markers for on-the-job use is announced. It features 10 flip-strip dispenser cards



of self-sticking markers for around-the-wire identification. The kit reportedly contains up to 450 wire markers and matching terminal markers. Price $2.50. Brady.

Voice-Actuated Switch 717

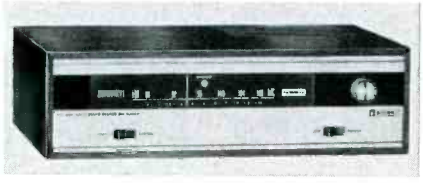
A voice-actuated switch is announced that is designed to convert four current tape recorder models to sound-switched machines, creating a broad line of voice-actuated recorders.



The new unit is connected between the recorder's remote microphone input and the normal microphone. A variable sensitivity adjustment is provided to pre-set the sound-activation level. A three second delay circuit prevents shut-off during normal pauses such as occur in dictation. List price $12.95. Channel Master.

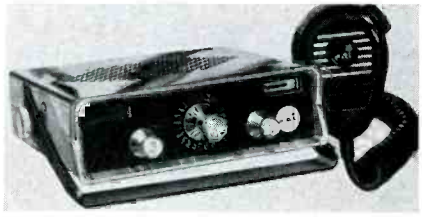
FM Stereo Tuner 718

Announced is a solid-state, FM/stereo FM tuner with a reported sensitivity of 1.5mv for 20db quieting. Specifications indicate that it has an image rejection of over 90db, a 55db signal-to-noise ratio, less than 1 percent distortion and a frequency response of 50Hz to 15kHz ±1.5db. Price without cabinet $89.95. Allied.



CB Transceiver 719

A new 23-channel, solid-state CB transceiver is introduced that measures 5¾ x 6¼ x 1⅞ in. Crystals are reportedly supplied for all 23 channels,



and the transceiver comes complete with microphone, illuminated S meter, illuminated channel selector and modulation indicator. Courier.

For more information on these
NEW PRODUCTS
See pages 103 & 104
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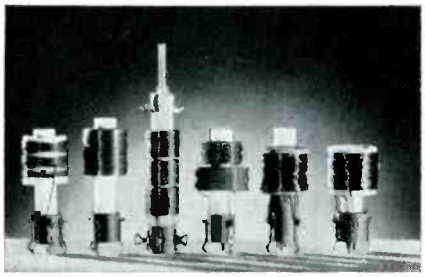
NEW PRODUCTS

Color TV Coils 720

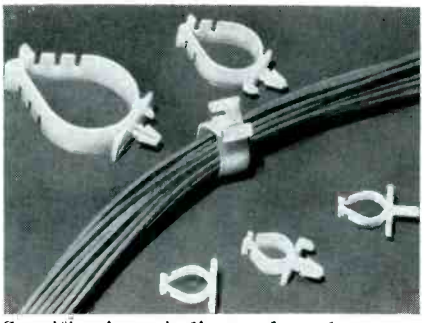
Exact-replacement, sweep-circuit coils for color-TV sets are introduced. The focus, convergence and sweep-



circuit coils reportedly are directly interchangeable with the original coils in color-TV sets made by five manufacturers. J. W. Miller.

Routing Clamps 721

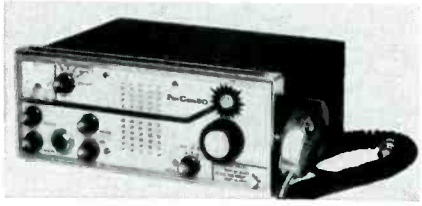
Announced are routing clamps for temporarily routing wires or clamping permanent wiring. The clamps can be used for control wiring in panels and are reportedly completely reusable. They are locked closed by slots that are designed to permit reopening at will without damaging the clamp.



Specifications indicate that they can be locked in either of three positions to permit adjustability for varying diameters. The clamps are fabricated of nylon and are available in four basic sizes of ½, 1, 1½ and 2 in. diameters. Thomas & Betts.

31 Channel Transceiver 722

Announced is a 31-channel transceiver that includes all 23 CB channels plus 8 additional part-15 channels that can be used to monitor short range walkie-talkie communications. The



receiver is a dual-conversion superheterodyne with a Nuvistor RF amplifier and mixer stages for a rated 0.15μv sensitivity at 10db S/N. Price $329.50. Polytronics.

Square Wave Generator 723

An all solid-state, squarewave generator reportedly produces clean squarewaves over a wide frequency range from 1Hz to 10MHz. Accord-

ing to specifications the squarewave rise and fall times are less than 5 percent and jitter is less than 0.2 percent of the waveform period at any repetition rate. The new squarewave generator weighs only 9 lb. Price $375. Hewlett-Packard.

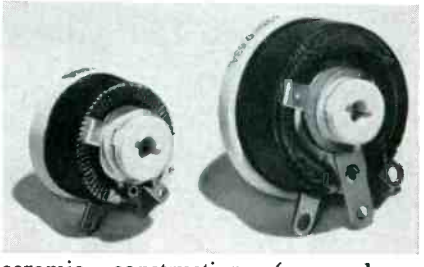
Tone Caller 724

A transistorized private tone caller is introduced that reportedly uses ceramic and resonant-tuning-fork circuitry instead of conventional reed

relays. The unit features 9-transistor, 2-diode circuitry; push-button switches for standby, normal, call and reset; a volume control and indicator light. Size: 1 7/16 x 4 x 5 ¾ in. Price $34.95. Lafayette.

Power Rheostat-Potentiometers 725

A line of power rheostat-potentiometers is introduced that features

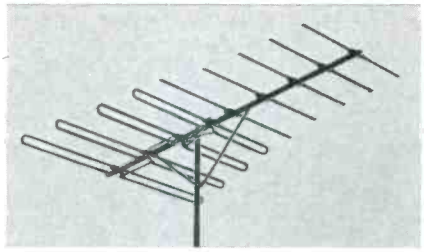


ceramic construction (core, base, hub). Stocked in all popular resistance values of 5K and 10K for 25 and 50w sizes respectively, the units are reportedly directly interchangeable with

those of other major manufacturers. Ward Leonard.

FM Stereo Antennas **726**

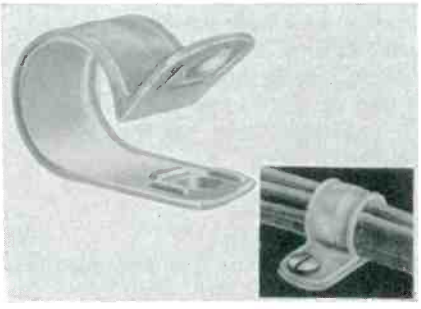
A series of FM antennas is designed to overcome the critical db loss in



multiplex reception which tends to limit fringe area listeners to monophonic reception only. $14.95 to $29.95. Channel Master.

Nylon Cable Clamps **727**

A line of nylon cable clamps offers molded-in, self-aligning ribs designed



to permit easier installation and better locking action. There clips are made in black or natural nylon and come in three sizes, ⅜, 5/16, and ½ in. Weckesser.

Wide-Band Oscilloscope **728**

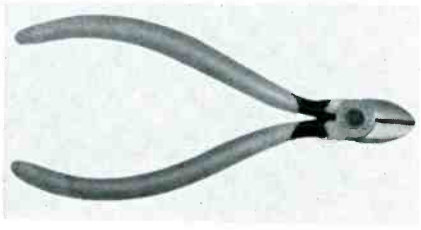
A 5-in wide-band oscilloscope is introduced for audio and TV servicing. The specifications include a vertical

response to 5MHz with 10mv RMS/cm sensitivity, a two stage push-pull vertical amplifer plus cathode-follower input and a squarewave tilt for true display of complex waveform. Price net, $134.95. Precise.

NEW PRODUCTS

Electronics Pliers 729

A new line of electronics pliers features a copper-alloy bearing on a wheel or shaft to eliminate steel-



against-steel friction. The copper-colored rivet is readily visible on both faces of the tool for easy identification. Diamond Tool.

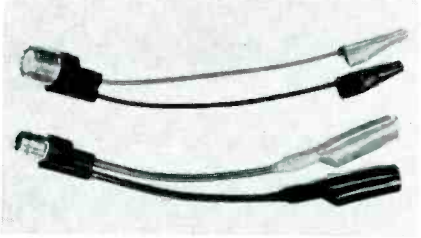
Ten-Band Radio 730

A solid-state, 10-band, portable radio is introduced that features a padded vinyl case with swing-out doors. The radio covers the following reception bands: FM (88-108MHz) with automatic frequency control, long

wave for beacon use, marine-short wave (1.8-5.2MHz), standard broadcast (AM) with tuning meter (540-1600kHz) and six short wave bands. Separate whip antennas are provided for FM and SW reception. Price $150. G-E.

Coaxial Cable Clip Leads 731

A series of "Breakouts," designed to convert standard coaxial cable to test cables, is announced. These units are supplied in eight models, with either BNC, UHF, TNC, or type "N" receptable at one end, and a choice of alligator or minigator clips at the other end. By connecting the proper breakout receptacle to a correspond-



ing cable plug, any standard coaxial cable becomes a test cable equipped with clip leads. Pomona.

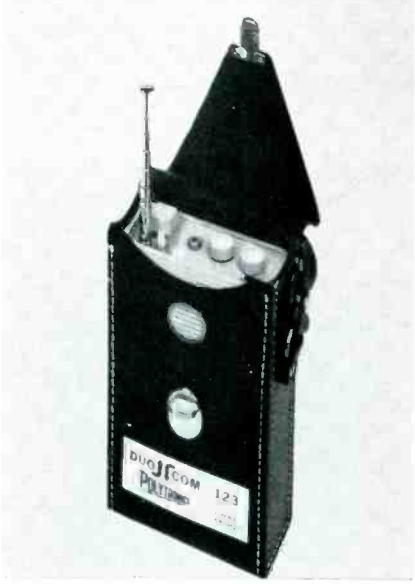
Record Spray 732

A record spray is introduced, which is reportedly safe on all phonograph

records, including the old shellac types. According to the release, the spray cleans and lubricates the records with a fine silicone film that prevents static build up. The lubricant is designed to prolong record life by reducing wear of the grooves. Colman.

CB Walkie-Talkie 733

Announced is a 3w, two channel, CB walkie-talkie that reportedly contains 11 transistors and is powered by



rechargeable nickel-cadmium batteries. The sealed Speaker/Mike transducer is designed to be impervious to weather or humidity. Price $129.50. Polytronics.

For more information on these NEW PRODUCTS
See pages 103 & 104
READERS SERVICE

New design for color ...and all other!

QUICK-CHECKS MORE COLOR TV TUBES WITH Gm* ACCURACY

*Makes test under actual set-operating conditions

NEW B&K model 707 DYNAMIC MUTUAL CONDUCTANCE TUBE TESTER *with obsolescence protection*

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NEWS OF THE INDUSTRY

Capitol Records Will License 4-Track Cartridges With Selections from Its Catalog

Capitol Records, Inc., has announced that it will license the manufacture and distribution of 4-track, stereo-tape cartridges containing selections from the Capitol catalog. This is a departure from previously-stated policy of confining their tape-cartridge product to 8-track.

According to Capitol Record's President, Alan Livingston, "Large quantities of 4-track cartridges illegally dubbed from recordings are now being sold throughout the nation. It is estimated that the number of bootlegged 4-track cartridges may be equivalent to the number that would be sold if Capitol itself released such a product.

A $1 reduction in the total price of most Capitol 8-track single cartridges was also reported by the company. The price reduction is reportedly in response to prevailing marketing conditions and competitive price levels.

ITT and ABC Assail Dept. Of Justice Merger Evidence

International Telephone and Telegraph Corp. and the American Broadcasting Cos., have charged that the Dept. of Justice's new evidence in opposition to the merger of the two communications companies is "glaringly insufficient, for the most part irrelevant" and in many respects "seriously misrepresented."

The charges were contained in a joint filing by ITT and ABC with the Federal Communications Commission in response to the Justice Dept.'s petition to the FCC to reconsider the merger situation.

ITT's and ABC's joint filing declared that the department, in its plea for reconsideration by the FCC, through the medium of full hearing, failed to prove its contentions in all six areas raised by the department. These were: potential entry of ITT into network operation, the CATV issue, the merger's possible effect on technological innovations, the issue of fusion of diverse communications interests, the issue of reciprocity and the issue of ABC's financial needs.

To refute the Justice Dept.'s claims of possible fusion of adverse communications interests, the petition says that ABC's interest in cheaper domestic rates continues with no conflicts since ITT is not a domestic carrier, and that the proposed merger would, in fact, strengthen ABC's bargaining power with AT&T.

EIA Reveals Official Statistics for 1966

Final tabulation of December distributor sales by the Electronic Industries Assn's. Marketing Services Depts. confirms industry estimates of sales records in all major product categories.

During 1966 color TV showed a gain of 71.2 percent over 1965 while there was a 13.4 percent decrease in the sales of B/W TV sets.

Table, clock and portable home AM radios managed a gain of 2.4 percent while all home FM radio sales were up 19.9 percent. The auto radio trend was just the reverse with an 8.1 percent decrease in sales during 1966.

Portable and table phonographs showed a 6.5 percent increase while console phonograph sales were up 4.9 percent for the year.

All of these items listed in the news release accounted for $44,449,023 in sales during 1966.

RCA Announces 20w Overlay Transistor For Marine Communications Equipment

A high-power, RF-amplifier for marine communications equipment in the 2 to 3MHz frequency band is announced by RCA Electronic Components and Devices.

This amplifier uses a 20w overlay transistor, operating from a 13v power supply, that is primarily intended for marine communications equipment as a Class B and C, RF-amplifier for medium frequency service with amplitude modulation.

Specifications indicate that the transistor exhibits a typical gain-bandwidth product of 100MHz at 3-amp and produces an output of 20w minimum with a 1w RF-power input at 2.5MHz. It is an epitaxial, silicon, NPN overlay emitter electrode type transistor.

Snowbound Factory and Office Workers Cheered With Cool Music

While thousands of Kalamazoo, Mich., workers were forced to remain at their places of employment during a 26-hour storm that deposited 27in. of snow last January, they were cheered with a special selection of music. They heard such musical selections as How Long Has This Been Going On?, Look For The Silver Lining, In The Cool, Cool Of The Evening and Spring Will Be A Little Late This Year.

James White, general manager of the Fetzer-Muzak franchise operation, a subsidiary of WKZO-TV and WKZO Radio, said that his office had received hundreds of telephone calls for his company to continue the unusual musical selections.

React Publishes New List Of Emergency Radio Teams

A pocket size folder listing the locations and membership of 1185 Radio Emergency Associated Citizens Teams (REACT) throughout the western hemisphere has been published by the organization's National Headquarters at Chicago.

Sponsored as a public service by The Hallicrafters Co., REACT comprises volunteer groups of CB radio owners organized on a local basis to provide their communities with emergency two-way radio communications for all types of local emergencies and disasters.

It is estimated that since its inception, the four-year-old organization has rendered assistance in over 1,200,000 situations requiring emergency aid or road information. Nearly 72 percent of these emergencies involved motor vehicles and nearly a third of these involved accidents.

REACT pioneered the move several years ago to establish channel nine in the citizens radio spectrum unofficially as the "emergency" frequency, which has been universally accepted by CB'ers. REACT teams monitor channel nine 24 hours a day. A motorist equipped with CB equipment may call "REACT control" in over a thousand communities on channel nine. The chances are very good that his call will be received by a REACT mobile or base station and whatever assistance is required will usually be dispatched quickly.

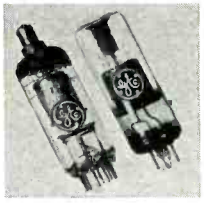
Blank Continuous-Loop-Tape Cartridges Now Marketed

The introduction of blank 4- and 8-track, continuous-loop-tape cartridges for the consumer market has been announced by Audio Devices, Inc. The new blank cartridges are reportedly designed to fit both home and automobile playback and recording systems according to Herman Kornbrodt, Audio Devices vice president.

"While the market for unrecorded, continuous-loop cartridges is modest at this time, a survey we have made indicates that loaded blanks will represent a substantial portion of the cartridge market in the future," Mr. Kornbrodt said.

Currently there are two continuous-loop cartridge systems being sold that record as well as playback — the Roberts 1725-8L and Muntz. In addition, two other firms —Lear-Jet Corp. and Pioneer — have announced intentions to produce systems that will record.

G-E Announces Miniature Filamentary Diode With Recessed Anode Connector



The 1BL2, a miniature filamentary diode with a recessed anode connector, has been announced by the General Electric Tube Dept. The recessed-connector feature reportedly reduces space requirements and allows the use of a lower-cost anode connector, holding corona to a minimum.

In developing the recessed anode feature, a cantilever technique was employed, with the anode connector supported by the tube glass. This eliminated the need for a mica-disk support, and the overall result is a 18kv rating with a greater safety factor than the 1X2B tube.

NEWS OF THE INDUSTRY

Littelfuse Develops Degaussing Switch

An automatic operating degaussing switch, that is designed to eliminate annoying picture blurs and color distortions in color-tv sets, has been developed by Littelfuse, Inc.

With the degaussing switch, each time the set is turned ON, the degaussing coils in the receiver circuitry are automatically energized to wipe off the residual magnetism on the shields, restore true color definition and eliminate blurs. The degaussing action reportedly occurs in a matter of seconds.

Motorola Prepares for New FCC Requirements For 450 to 470MHz Radio Equipment

Motorola communications division has announced the availability of new 450 to 470MHz radio equipment that meets the split channel requirements recently announced by the FCC.

These new rulings, built around 25kHz channel spacing rather than 50kHz spacing, will make operational changes necessary for present owners of UHF radio equipment and will eventually make additional channels available for more radio users.

The new requirements include: the reduction of deviation to ±5kHz by June 1, 1967; the use of full split channel equipment for all stations authorized after Nov. 1, 1967; and the conversion of all existing stations to full split channel requirements by Nov. 1, 1967.

New Motorola base stations will reportedly include a modification and a ±0.0002 percent channel element to provide better than the 0.00025 percent frequency stability required by the FCC.

Plectron Corp.'s President and Sales Manager Fatally Injured

Mr. Arlyn H. Collins, president, and Mr. John R. Mayberry, sales manager, of the Plectron Corp. were fatally injured in a plane accident February 24, 1967. The management of Plectron, although deeply saddened by the loss of these two executives, wishes to assure their customers and suppliers that Plectron will continue to strive for the kind of service that was established by Mr. Collins.

Integrated Circuit Sales Climb

The Electronic Industries Assoc. reports that U.S. manufacturers sold $148 million worth of semiconductor integrated circuits during 1966.

With a 40 percent decline in the average value of IC's during 1966, the unit sales have climbed 210 percent to reach a 29.4 million total last year.

Digital IC's currently comprise more than 90 percent of the unit volume and about 80 percent of the dollar volume of the total semiconductor IC business. This represents only a very moderate decline of digital IC's share of the total unit and dollar volumes during 1965.

Sales of analog IC's reached 2.3 million units valued at $31 million during 1966, up 303 percent and 115 percent, respectively, from the unit and dollar sales during 1965. Average value declined from $25.06 to $13.37.

EIA Supports National Commission's Objectives on Product Safety

The Electronic Industries Assn.'s Consumer Products Div. has endorsed the objectives of the proposed National Commission on Product Safety.

In written testimony submitted to the Consumer Subcommittee of the Senate Commerce Commission, which has been holding hearings on the administration-backed-commission, the CPD went on to detail EIA's and the industry's efforts in consumer safety.

The CPD listed 10 examples of the Safety Committee's work with Underwriters' Laboratories. The list includes the reduction of leakage current standards from 15ma in 1946 to the present level of 2.5ma, the widespread use of interlock switches, the use of special fuses, improvement of CRT tubes to eliminate implosions, the setting of standards for plastic material enclosing hazardous equipment and the use of circuit breakers.

Another protential risk factor cited by the Consumer Products Div. has been the growing popularity of portable, miniaturized models of all consumer electronic products. This development has greatly increased the amount of physical contact between user and instrument and consequently multiplied potential hazards.

The fact that the "statistical likelihood" of greatly increased electronically induced injuries has not taken place was attributed in the report to the work of the Safety Committee and the individual manufacturers to protect the consumer.

RCA Announces Mobile Radio Contract With California Highway Patrol

A $680,000 contract to supply 834 solid-state, 50MHz, mobile radios for installation in California Highway Patrol vehicles has been announced by RCA.

A custom-designed control head will fulfill the Highway Patrol requirements for switching among the four transmitting and two receiving frequencies used in the communications system.

The control head will carry color dot identification of the frequency bands, with one color indicating a state frequency and a county frequency, making the available channels instantly identifiable to the police officer using the radio.

A single tone selector will permit the mobile radio user to key a "repeater" transmitter to automatically rebroadcast the message. This provides communications service when the vehicle is in mountainous or otherwise difficult terrain for radio signals.

Regency's Complete Line Placed on the Road

Every one of Regency's products has been placed in a "rolling stock" display called the "Regency Communications Caravan."

The display unit is a Dodge Motor Home with the interior customized to show working models of the company's line of CB transceivers, monitoradios, tone alerting systems and aircraft communications equipment.

In addition, sample models of military products are put into the display. Included in this category is a Morse code read-out device that the U. S. Army has called the "world's smallest computer."

The caravan is equipped with four antennas for two-way communications in the 30 to 50MHz and 152 to 174MHz bands as well as aircraft frequencies.

CATALOGS AND BULLETINS

Tools **400**

A six-page flyer lists an assortment of electronics tools including spring adjusters, gages, burnishers, wrench sets, pliers and clamps. Jonard Industries.

Scissors, Shears, Snips **401**

A 16-page catalog lists forceps, wire and electronic filament cutters, rubber shears and many other scissors for industrial, commercial and home use. Compton.

Test Instruments **402**

A palm-sized VOM is featured in a 16-page test instument brochure. Also included are VTVMs, scopes, a recording VOM, general purpose microtesters and temperature measuring instruments. Simpson.

Mobile CB Antennas **403**

A data sheet descibes three CB antennas designed to be mounted by two small set screws on the underside of the trunk lid. Also shown are adapters for mounting in the same manner ⅜-in. snap-in antennas or antenna bases normally requiring a ¾-in. hole. Antenna Specialists.

Electronic Components **404**

Every electronic component stocked by a manufacturer's distributors are reportedly illustrated in a 25-page catalog. Included are plugs, jacks, switches, connectors, molded cable assemblies, adapters and audio accessories. Switchcraft.

Tape Recorder **405**

A flash-light-battery powered, 4-lb, portable tape recorder, that reportedly has a good enough frequency response to be used for music, is described in a data sheet. Channel Master.

Wireless Microphone **406**

A data sheet describes an FM, wireless microphone with a reported frequency range of from 90 to 106 ±2MHz. Specifications indicate that this unit measures only 3¼ x 2½ x 1in. and operates from a 9v battery. Channel Master.

Multi-Band Radios **407**

Two multi-band, portable, solid-state radios, one a six-band model and the other a four-band model, are described in two data sheets. Both radios include FM and AM bands and operate on batteries or an accessory ac adapter-charger. Channel Master.

Transformers **408**

A 34-page catalog lists an expanded line of transformers and toroids for commercial/industrial constructions. Included are charts, graphs, schematics and notes describing transformer specifications. Microtran Co.

Power Drills **409**

A four-page, three-color catalog describes nine new electric ¼-, ⅜- and ½-in. power drills with a "machine-gun" auxiliary handle. These drills reportedly feature double-reduction gear trains and self-aligning bearings. Wen.

FM Antennas **410**

An eight-page bulletin describes a line of FM antennas with drawings of the antennas and characteristic curves comparing decibel responses over various frequencies. Rotators, boosters, band separators and set couplers are also included. Channel Master.

Phonograph Cartridges **411**

A total of 6600 cartridge listings are cross-referenced in a 28-page manual. The first listing cross references the manufacturer's cartridges with other cartridges on the market, while the second listing cross references the manufacturer's cartridges with the phonographs that they reportedly will fit. Sonotone.

Potentiometers and Resistors **412**

A 32-page, illustrated catalog contains engineering drawings and descriptions of a line of potentiometers, field-assembled controls, power rheostats and resistors. Clarostat.

LETTERS TO THE EDITOR

continued from page 24

'Flash' Schematic

Can any ET reader help me locate a schematic for a PCA X-100 or X-200 electronic flash? It was made in Belgium by Photronic Corp. of America and I understand the company is no longer in business.

A. ALTRO
Hartsdale, N.Y.

Organ Schematic

I enjoy reading ELECTRONIC TECHNICIAN because you seem to have plenty of solutions to a variety of

problems. Here's my problem: I need a schematic for a Bradford (2 manual, 13 pedal) electronic organ. Can any reader help me? Write via ET.

ROY LARRICK

Streetsboro, Ohio

Problems—But No Solutions

I enjoyed reading the article "The Growing Pains of CB Radio," in the January 1967 issue of ELECTRONIC TECHNICIAN. It covered the problems very good but didn't give any answers on how to solve the problems. We have used CB for over a year and it is an excellent tool when we can use it but instead of the situation getting better, it is worse . . . May I suggest that the FCC could appoint one or two responsible people on a part-time basis in each locality who could monitor and report rule violators and then the FCC could do something about them. Also, if the violators know that they are being reported, this alone would stop a lot of violations . . . You failed to touch on the problem of skip which under the present set up is something we have to live with but it is still annoying. I would like to suggest that if the channels were divided on an east, central and west basis this would help everyone. For example, channels 1, 4, 7, 10, 13, 16 and 19 could be restricted to the eastern area; channels 2, 5, 8, 11, 14, 17 and 20 to the central area; channels 3, 6, 9, 12, 15, 18 and 21 to the western area and the two other channels 22 and 23 could be used in all areas or one more channel could be added. This would not only help clear up the skip problem but also adjacent channel interference. Sure, this would cut back the number of channels available in each area, but I have never heard of all 23 channels being used at the same time and it would be much better to wait 2 or 3 minutes for the channel and be able to use it than not be able to use it at all. Perhaps if you could get your readers to write to their congressmen something would be done about this.

N. N. JONES

Lebanon, Ind.

• *As you know, ET is devoted entirely to the technical and business welfare of its readers. And before problems can be solved, it is necessary to know precisely what the problems are. We called attention to some of these problems but the nature of the problems are such that solutions must be found primarily by the FCC—although legitimate CB users, like yourself, can surely contribute to the solutions by reporting violations to the FCC. Once again, we would like to point out that the problems are being made more difficult to solve primarily because of the "within-the-law" activities of "near-sighted, quick-buck" forces whose actions indicate that they care little or nothing about the future of CB as a useful citizens communications medium.—Ed.*

Home Study

Where can I get a list of accredited private home study schools?

JIM BRADY

New York, N.Y.

• *A directory of these schools is available from the National Home Study Council, 1601 18th St., N.W. Washington, D.C. 20009.—Ed.*

Transistor Tip

Many technicians often mistakenly assume that because a transistor is new or unused, it is in good condition. Transistors — especially the bargain-priced imported types — are sometimes defective or have poor amplification capabilities. To be on the safe side, I always check untried transistors on a transistor tester.

ROBERT APPEL

Newark, N.J.

BOOK REVIEWS

DESIGNING TRANSISTOR IF AMPLIFIERS. *By W. Th. Hetterscheid. Published by Philips Technical Library, 346 pages, hard cover. $11.25.*

Many factors that must be considered when designing IF amplifiers for radio, TV and radar receivers are discussed in this book. Some of these include transistor parameters, automatic gain controls and deviations from nominal conditions. Theories of design are developed into practical circuits with the aid of graphs and charts. This book would be of value to design engineers who already have a good background in electronics.

USING YOUR TAPE RECORDER. *By Harold D. Weiler. Published by Allied Radio, 96 pages, soft cover.*

Many people almost automatically assume that when any electronics supplier publishes a book about electronic equipment, the book will merely describe their line of merchandise. Although a couple of pictures of Allied equipment are included in the book, the book does not discuss any specific line of equipment. The author assumes that the reader has had only a limited experience with tape recorders and no understanding of sound. The nature of sound and the frequency range of musical instruments are described to familiarize the reader with what will be recorded. The proper use of microphones, phonograph records and tuners for making home recordings are discussed. Sections of the book describe tape surfaces, sound effects, proper editing and the addition of sound to slides and movies. This book should be of value to anyone who has a tape recorder capable of pleasing sound reproduction, whatever the reader's level of experience. It has potential value to service-dealers as a promotional piece for tape recorder customers and prospects.

THE SEMICONDUCTOR DATA BOOK, 2nd edition. *By Motorola Semiconductor Products Inc., 1536 pages, hard cover.*

The characteristics of silicon zener diodes, silicon rectifiers, silicon rectifier assemblies, thyristors and trigger diodes, power transistors, germanium milliwatt transistors, switching and general purpose transistors, RF transistors, FETs, dual transistors, dual diodes, field-effect current limiters, varactors, digital and linear integrated circuits, along with related hardware, are described in this handbook. The book contains a numerical and alphabetical index of semiconductors. Each section assigned to a particular type of semiconductor is preceded by a listing of semiconductors according to characteristics. Characteristic curves are provided for many semiconductors. A special section near the end of the book contains additional semiconductors too recently included to be among the others. Although not all semiconductors are listed, there is such a large volume of them and this book would be of value to circuit designers.

THIN-FILM AND SEMICONDUCTOR INTEGRATED CIRCUITRY. *By John Doyle. Published by McGraw-Hill Book Co., 314 pages, hard cover. $6.95.*

The technology of fabricating thin-film and integrated circuits is discussed in interesting detail. The author discusses the equipment used to lay out the circuit design and reduce it by as much as 500X; cathode sputtering and evaporation techniques used for thin-film deposition; using a quartz-crystal to monitor the thickness of the film being deposited; the epitaxial growth of the quartz wafer; and the use of scanning electron microscopy for heating portions of the circuit, observing the surface of the circuit and seeing voltage levels of 0.5v in the integrated circuit, on the face of a CRT. Thin-film cryotrons as superconductive cryogenic switching devices, magnetic film memory cores and photon-coupled amplifiers were included as special components in integrated circuits. Despite the apparent complexity of the material covered in this book, the reader will find that, even if his knowledge of chemistry and mathematics is rather limited, he will be able to understand the major portion of the book. Although the book does not tell how integrated circuits are used as components in other circuits, it does discuss the internal function of several practical integrated circuits. It is of little value to practicing technicians in our industry but may be of interest to those who look forward to new areas of the electronics field.

ELECTRONIC TESTING. *Compiled and edited by L. L. Farkas. Published by McGraw-Hill, 316 pages, hard cover. $12.*

The function and electronic testing of a wide assortment of systems, including receivers and transmitters, intertial-guidance platforms, and analog and digital computers, are dis-

cussed. The author assumes that the reader has a good background in electronics, and block diagrams are frequently used to illustrate portions of circuits and components. Some simplified circuits are also shown. Such a wide scope of material is covered that the depth of each description is rather limited. The book may be of interest to any reader with a good science background who wishes to broaden the scope of his knowledge.

BEST'S SAFETY-MAINTENANCE DIRECTORY. *Edited by Harry Armand, Ralph Eames and Kendrick Taylor. Published by Alfred M. Best Co., 772 pages, hard cover. $10.*

The editors prepared this book more as a directory, as indicated by the title, than as a text. There are, however, quite a number of safety articles, mostly written by the staff of various industrial concerns, that may be of interest to managements in other industries. Most of these safety problems, however, would not be encountered by the average electronic technician. The major portion of the book contains directories listing sources of safety equipment, which are supplemented with ads from about 190 companies who manufacture various types of safety equipment.

DATA PROCESSING FOR THE SMALL BUSINESS. *By Byron L. Carter. Published by Macfadden-Bartell Corp., 190 pages, soft cover, 95 cents.*

The time is near when even small TV repair shops, in order to maintain a competitive stance, must decide whether their bookkeeping, inventory and over-all business check-up and control is to be handled manually or with the data processing techniques used by others in their field. This book tells how even the cash register can be used to print paper tapes that are read directly by a computer in a data processing center. With this process, even salaries and bank loans can be tabulated as part of a bookkeeping process that takes only a few minutes of the computer's time. The author indicates that payrolls, customer billing and other more complicated services can also be handled by the computer center at an additional cost. The book shows how such programs have worked for other small businesses and how an analysis has shown weak points in their profit-picture that could be corrected. This book may be of interest to progressive small business men who have not yet considered using data processing systems in their businesses.

Semiconductors . . .

continued from page 67

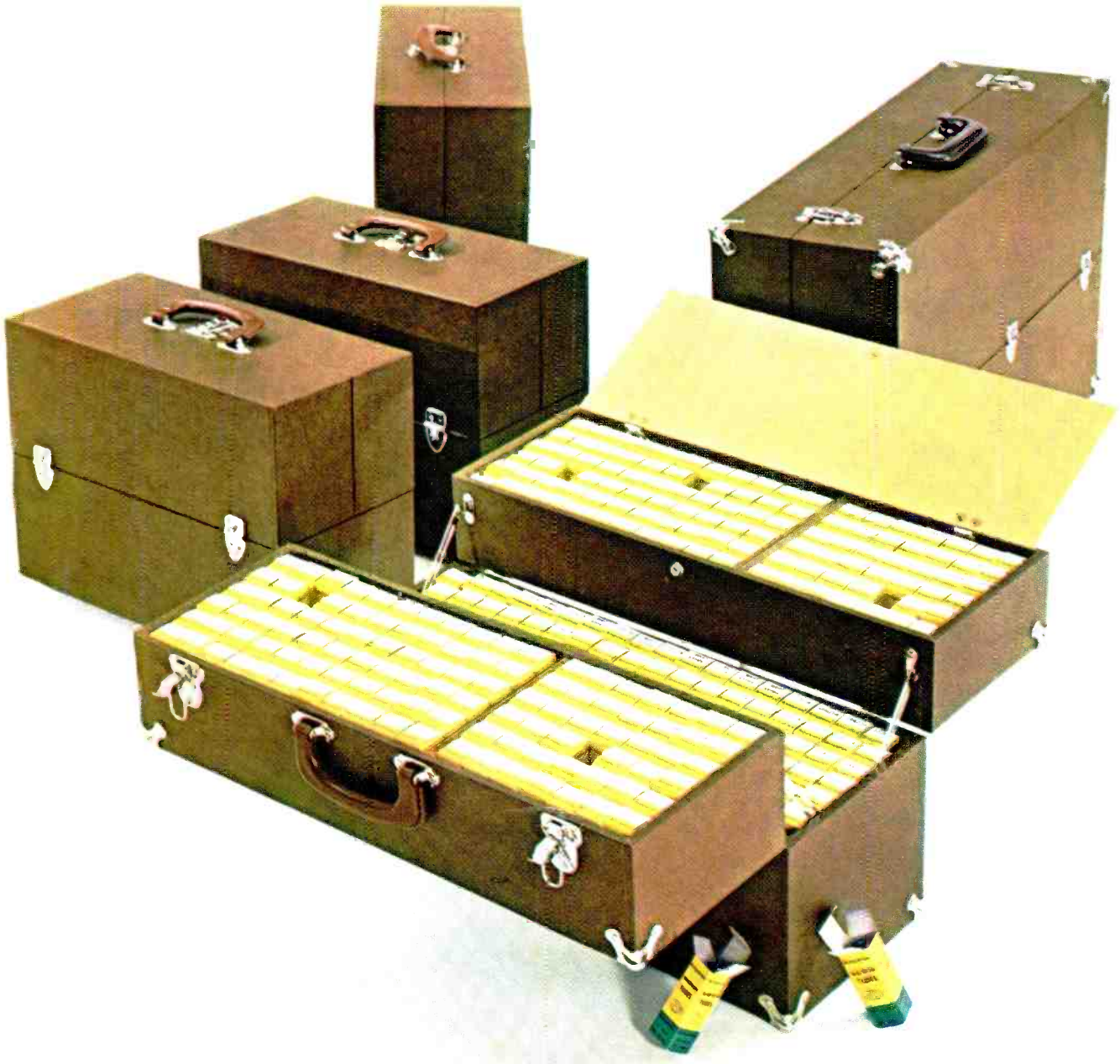
1.60 to 8.00ma while the current flowing through the second transistor fluctuates from 2.00 to 6.40ma.

Thus, we see that there is a 6.40ma change in current flowing through the first transistor while there is only a 4.40ma change in current flowing through the second transistor. This agrees with the earlier statement that the signal current through the first transistor must be greater than the signal current through the second transistor. Since this unbalanced condition does exist, the voltage drops across the two resistors are not quite equal at alternate intervals of time. If the value of each collector resistor is 550Ω, the voltage across the first transistor's collector resistor (R_1) will actually vary from 0.88 to 4.40v rather than the desired 1 to 4v fluctuation, while the voltage across the second transistor's collector resistor will actually vary from 3.52 to 1.10v rather than the desired 4 to 1v fluctuation (1.6ma × 550Ω = 0.016a × 550Ω = 0.88v, and 8ma × 550Ω = 4.4v, etc.).

When the voltage drops across the common emitter resistor (R_3) varies from 8 to 10v while the voltage drop across the first transistor's collector resistor (R_1) varies from 0.88 to 4.40v, the voltage drop across the first transistor (V_1) must actually vary from 7.12 to 1.60v [16.00v − (8.00v + 0.88v) = 7.12v, and 16.00v − (10.00v + 4.40v) = 1.60v]. With the corresponding 3.52 to 1.10v fluctuation in voltage drop across the second transistor's collector resistor (R_2), the voltage drop across the second transistor must actually vary from 4.48 to 4.90v [16.00v − (8.00v + 3.52v) = 4.48v, and 16.00v − (10.00v + 1.10v) = 4.90v].

By substituting voltages, we have seen that the differential amplifier circuit (Fig. 10) is unbalanced. A forthcoming article will show how a current regulating transistor can be usel to make this differential amplifier virtually balanced. The balanced differential amplifier circuit will then help us understand an FM tuner currently on the market. ■

ADVERTISERS INDEX



One out of every five professional servicemen has switched to Amperex TV replacement tubes

It takes a lot of quality to change the buying habits of 20% of the most knowledgeable technicians in the business. These servicemen are following the pattern set by the leading TV manufacturers, who are designing more and more of their quality lines around tubes originated by Amperex. The Amperex line of popular types is expanding all the time. Look for the green and yellow cartons at your distributor's or write: Amperex Electronic Corp., Hicksville, L. I., N.Y. 11802.

Amperex

TOMORROW'S THINKING IN TODAY'S PRODUCTS

How else but with RCA HI-LITE color picture tubes can you bring today's color to your customers?

Your service reputation is the cornerstone of your business. That's why there's no room to compromise with quality in the components you install.

RCA HI-LITE picture tubes enable you to offer your customers TODAY'S COLOR . . . incorporating the latest technology of the world's most experienced picture tube manufacturer. They're the same tubes that go into today's original equipment sets.

RCA's new Perma-Chrome process for rectangular picture tubes, for example, means locked-in color purity from the moment the picture comes on. Faster servicing for you. Added customer satisfaction.

Install an RCA HI-LITE and you literally "up-date" your customer's set while, at the same time, enhancing your service reputation.

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

RCA The Most Trusted Name in Electronics