

ELECTRONIC TECHNICIAN

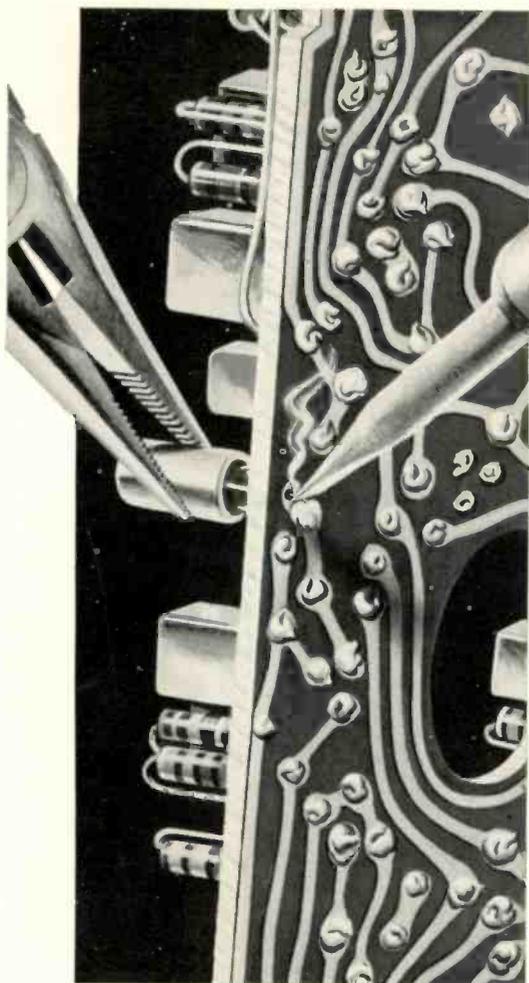
WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION



September 1965

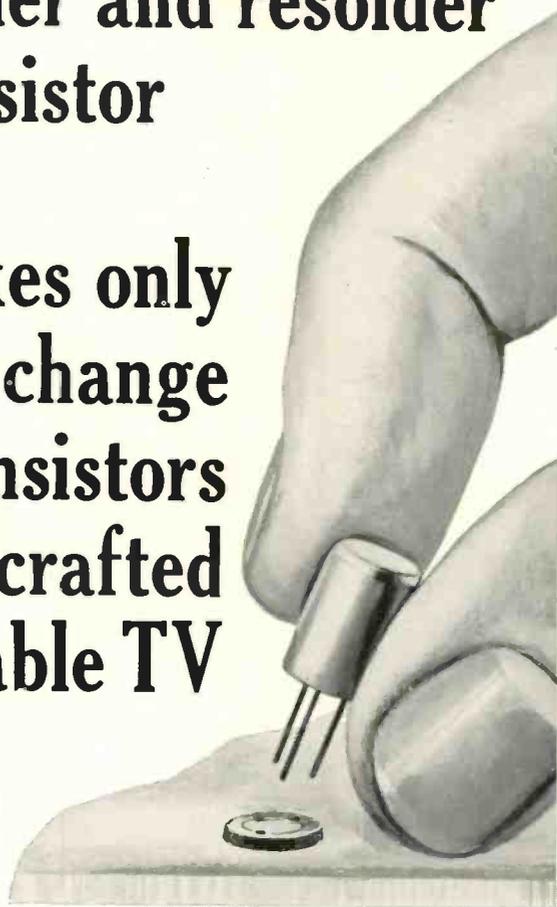


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INSTRUMENTS**



**In a
printed circuit
TV set it can take
20 MINUTES to
unsolder and resolder
a transistor**

**It takes only
3 SECONDS to change
one of the plug-in transistors
in Zenith's new Handcrafted
transistorized portable TV**



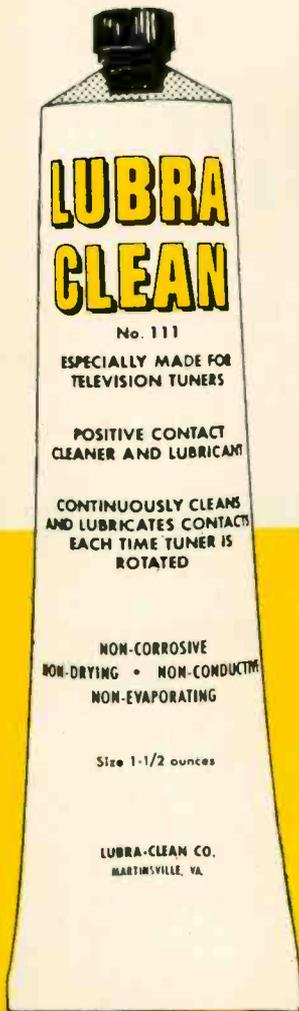
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HANDCRAFTED TV



IS BUILT WITH THE SERVICEMAN IN MIND!

... for more details circle 70 on postcard



LUBRA CLEAN

...A T.V. TUNER CLEANER THAT REALLY WORKS!

MADE ESPECIALLY FOR TELEVISION TUNERS

Finally, a tuner cleaner that really works. Apply LUBRA CLEAN and let it do the work for you. Physical cleaning and polishing contacts is no longer necessary. Simply apply—and LUBRA CLEAN continues to polish and lubricate tuner contacts for months after all other cleaners and lubricants have failed.

LET LUBRA-CLEAN DO THE WORK!

APPLICATION

TO STANDARD COIL TUNER:

- A—Do not remove tuner drum from standard coil tuners, Lubra Clean will transfer from strip contacts to brass spring contacts, cleaning and lubricating them.
- B—Apply a *small quantity* of Lubra Clean to one row of contacts on channel strip, rotate tuner 180 degrees, apply again and rotate in opposite direction. This will deposit cleaner and lubricant on both sides of spring contacts where it will come in contact with each channel strip as the tuner is rotated, continuously polishing and lubricating contacts.
- C—Now rotate the tuner vigorously several times in both directions and replace tuner cover.

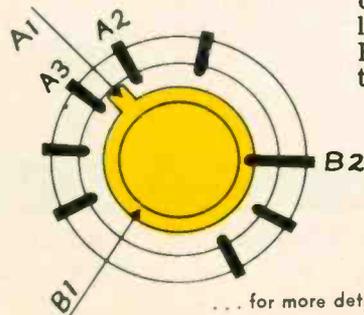
BRASS CONTACTS



APPLICATION

TO WAFER TUNER:

- A—Apply Lubra Clean in a *very small quantity* at the points indicated by arrows.
- B—By rotating the channel selector you may bring contact A1 inbetween A2 and A3, apply a *small quantity* of Lubra Clean with a slim screwdriver, rotate channel selector back and forth, depositing Lubra Clean on contacts A2 and A3.
- C—Apply Lubra Clean at point B1, (both sides of wafer if necessary) rotate channel selector several times vigorously depositing cleaner and lubricant on contact B2 and the balance of the channel contacts.



... for more details circle 43 on postcard



LUBRA CLEAN COMPANY

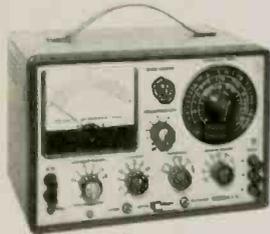
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9

money-saving

NEW REASONS FOR BUYING EICO

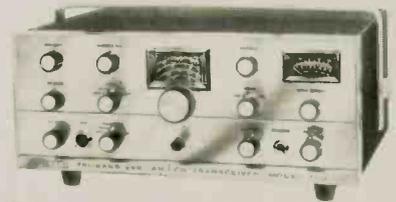
UNCOMPROMISING ENGINEERING AT LOWEST COST ■



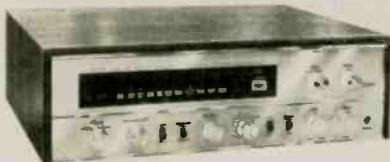
1 New Model 965 - FaradOhm Bridge/Analyzer. 9-range, low-voltage capacitance-resistance bridge safely measures even 1-volt electrolytics. Metered bridge balance, leakage test voltage (6 DC VTVM ranges 1.5-500 V), leakage current (11 DC VTAM ranges 0.15 ua-15 ma). DC VTVM & VTAM externally usable. \$129.95 wired.



2 New Model 342 - FM Multiplex Signal Generator. Design lab quality. Both composite audio and FM RF outputs. Inputs for stereo audio source for store demonstrations, critical A/B listening tests. \$149.95 wired.



3 New Model 753 - The one and only SSB/AM/CW Tri-Band Transceiver Kit. 200 watts PEP on 80, 40 and 20 meters. Receiver offset tuning, built in VOX, high level dynamic ALC. Unequaled performance, features and appearance. Sentionally priced at \$179.95 kit, \$299.95 wired.



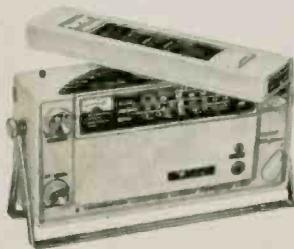
4 New model 3566 - All Solid-State Automatic FM MPX Stereo Tuner/Amplifier, kit or wired. No tubes, not even nuvistors. Delivers 112 watts IHF total to 4 ohms, 75 watts to 8 ohms. Completely pre-wired and pre-aligned RF, IF and MPX circuitry, plus plug-in transistor sockets. \$219.95 kit (optional walnut cabinet \$14.95), \$325.00 wired including walnut cabinet. UL approved.



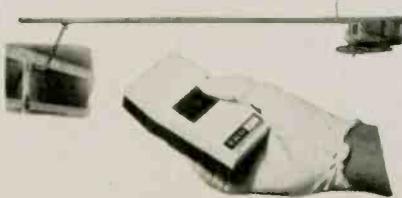
5 New Model 435 - D-C Wideband Scope. Top-quality DC-4, 5Mc scope with 3" flat-face CRT, Zener calibrator. Outperforms 5" scopes three times its size, facilitates on-location color TV and other servicing. \$99.95 kit, \$149.95 wired.



6 New Model 779 - Sentinel 23 Dual Conversion 5-watt CB Transceiver. All crystals provided for 23 crystal-controlled transmit and receive channels. Delta tuning for receiving off-frequency transmissions. Panel switches for standby and use as 3.5 watt PA system. Transistorized 12VDC & 117VAC dual power supply. \$169.95 wired only.



7 New Bendix NAVIGATOR 420 - BFO for CONSOLAN navigation, antenna post for pulling-in weak signals, illuminated dial for night navigation. Battery saver cord permits use of external 6 VDC sources. \$99.95 complete.



8 New Doormatic 4000 - Automatic Garage Door Opener. Quick, dependable, silent radio-controlled operation of garage doors with exclusive TONEEIVEE (audio modulated transmitter and receiver). System includes garage door mechanism, electronic control box with radio receiver, transistorized portable transmitter, and all mounting hardware. Furnishes completely wired, UL approved. \$59.95 mechanism only. Complete ready to install only \$159.95.



9 New Model 380 - Solid State NTSC Color Generator generates exact NTSC color signals individually and all required dot-bar patterns. Super-compact, 4 pounds light. Instant operation. \$109.95 kit, \$159.95 wired.

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ET-9

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1945-1965: TWENTY YEARS OF LEADERSHIP IN CREATIVE ELECTRONICS

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ELECTRONIC TECHNICIAN

SEPTEMBER 1965
VOL. 82 NO. 3

ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

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Cover

When our artist first set up his easel in a corner of ET's TEKLAB, he had a skeptical expression on his face. Some time later, after rubbing elbows with new color TV chassis, scopes, bar/dot generators and other test instruments, he showed us what he had coaxed from a few tubes of colorful paints. It clearly symbolized this month's editorial emphasis. We told him so and he went away smiling.

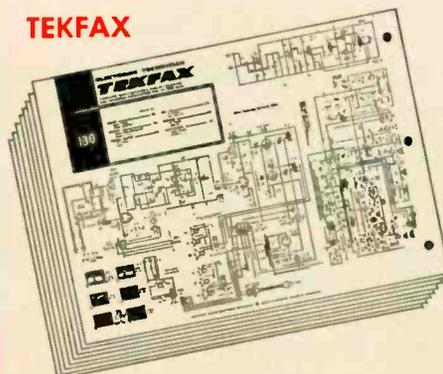
FEATURES

- You and Your Oscilloscope**49
John Holmes begins an in-depth article series on scopes, how they work, what to look for in a service scope and how to use it in troubleshooting and repair
- Troubleshooting Printed Circuit Boards**53
Bob Goodman tells how he uses an electronic switch, audio generator and scope to rapidly pin-point PC board faults
- Impedance Measurements With A Scope and Signal Generator**56
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TEKFAX



Group 157 September • 1965

GENERAL ELECTRIC: Color TV Chassis CB

MOTOROLA: Color TV Chassis TS-914A-00
through A-07

RCA VICTOR: Color TV Chassis CTC17X

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New! For universal soldering including heavy-duty chassis work. Temperature control is in the tip. Interchangeable tips give a choice of 500°F, 600°F, 700°F and 800°F controlled temperatures. Operates on 24 volts. Small, lightweight, highly efficient. Complete with 1/16" 700°F tip and 60 watt, 120 volt, 50/60 cycle power unit which has stand for soldering pencil attached. Model W-TCP—\$26.00 list.

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LETTERS TO THE EDITOR

Precision Tester Charts

Please inform Howard Williams of Monroeville, N. J. (July Letters to the Editor) that Precision tube charts are now available from Coletronics Service, Inc., at 78-63 76th St., Glendale, L.I., N. Y. 11227.

SID'S SERVICE

Bronx, N. Y.

• We also received dozens of letters from other readers who gave this information. Thanks to all. —Ed.

Time To Live

I have enjoyed reading ELECTRONIC TECHNICIAN very much. I can say that it is one magazine that no active service technician can be without. But I have now reached age 77 and am giving up active TV-radio servicing. I really regret having to give up such a wonderful service magazine. My wife and I are planning to visit our children and grandchildren, nieces and nephews, scattered all over the states of New York, Tennessee, Alabama, Louisiana, Nebraska, Arizona and Florida. Wish you much continued success.

HENRY H. CARTER

New Orleans, La.

Tips For Soldering Gun

Wonder if any reader could help me get soldering iron tips for a Gregg 250 w (G250A) soldering gun. All supplies are gone here and I have had no answer to my letters from the company in Lawrence, Mass.

BOB BAPTIST

Erie, Pa.

Grundig & Telefunken Parts

Regarding D. J. Matthew's letter in July Letters to the Editor. A year or two ago I had to order some parts for either Grundig or Telefunken from Germany. The service was good, in fact the parts arrived air parcel post just 72 hours after they were mailed. The supplier is Rudolf Axtmann, Erlangen, Heuwegstrasse 8, Germany.

WILLIAM SCHLICKBERND, JR.

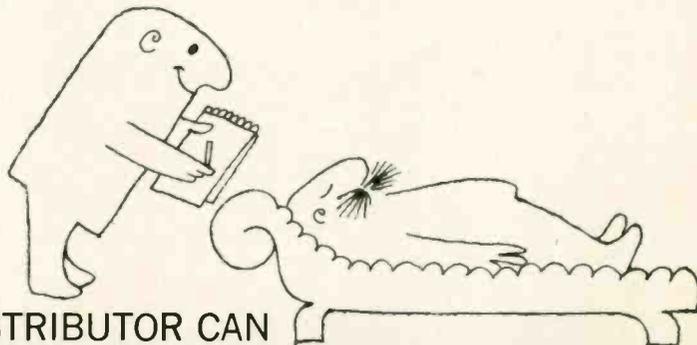
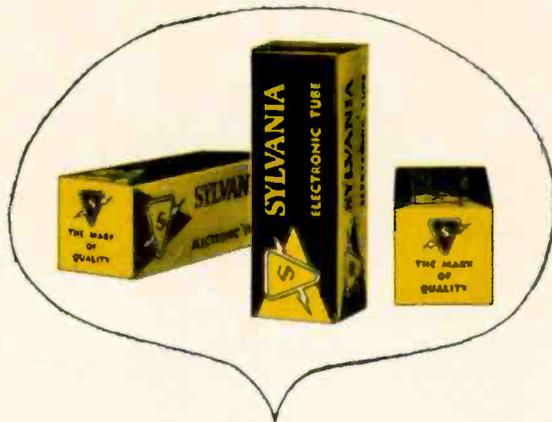
Chadron, Neb.

Offers TEKFAK

I have the complete series of TEKFAK for the years 1959 through 1964. I have retired and don't need them. I found ET interesting and helpful during the years I was active and it seems to have improved recently.

J. MCGUIRE

St. Michel, P.Q., Canada



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LETTERS TO THE EDITOR

Institute for the Certification of Engineering Technicians, 2029 K. St., N.W., Washington, D.C. 20006. Please direct all further requests for information to the Institute.—Ed.

A New Subscriber Comments

I have subscribed to your magazine for the past nine months and want to say it's the best of its kind. I need more info on the Certified Engineering Program . . .

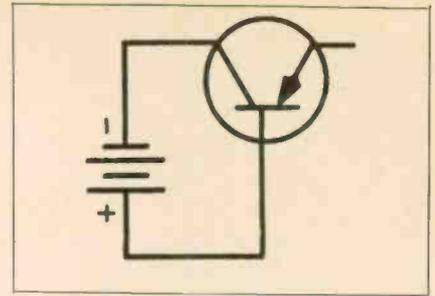
D. R. ORAVEC

Tallmadge, Ohio

• We have forwarded more than 800 similar requests from readers to the

Transistor Questions

I would like to call your attention to "Transistor Circuit Fundamentals," an article by William Ganglinger, Jr., which appeared on page 55 of the May 1965 issue of ELECTRONIC TECHNICIAN; specifically to Fig. 8 on page 56, where it is mentioned that I_{CO} measurements were taken as follows: (referring to Fig. 8).



Is it not correct that $I_{CO} = I_{CBO} =$ the reverse biased collector diode current with the emitter open-circuited, and would be measured as shown?

ROBERT V. FLOYD

Ridgewood, N.Y.

• The author replies: "It is immaterial whether the emitter junction is shorted or not. The emitter itself does not come into consideration in this check. Actually, either method is viable. The method shown in ET merely shorts out the emitter junction and makes it completely passive." Does this answer your question? —Ed.

We Helped

. . . Now that the little problems are taken care of, let me thank you and congratulate you for the terrific job you are doing. We have recently set up a "tough dog" specialty shop for TV and transistor gear and can thank ET for contributing greatly to knowledge needed in this type of operation.

WAYNE RODERICK

Pocatello, Idaho

Needs Capacitor Analyzer Manual

I am looking for the instruction manual of a SOLAR "exam-eter" model CE capacitor analyzer. I have written to the manufacturer and the letter came back that they have gone out of business. Could an ET reader help me?

ROSS R. SHERMAN

Schaghticoke, N. Y.

Slight Problem

. . . Like your magazine very much, but am sorry the Industrial section was discontinued. One other slight beef: I find I have a problem with TEKFAK as printed in May issue. I punch them and file in a loose leaf binder. Can't be done with May issue. Please, let's have the old format in the future. Thanks for an otherwise very excellent magazine.

ED BLOCH

Glen Cove, N.Y.

• We plan to include some industrial electronics articles when possible. TEKFAK is running color TV schematics in that form because of their size.—Ed.

Jackson

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the most versatile and accurate of all CRT testers... for all

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look

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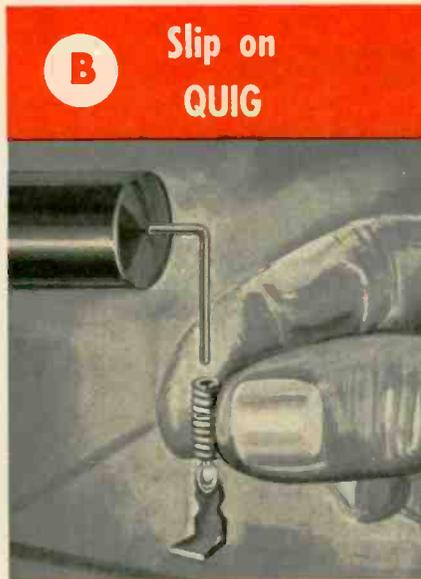
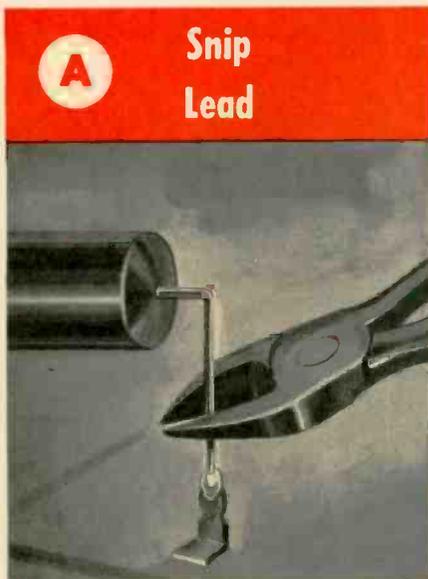
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The 3-in-1 QUIG is brand new and different . . . Copperweld wire inner core, a layer of flux, and an outer jacket of solder . . . all you need is heat!
Makes one-handed soldering possible!

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WORLD'S LARGEST MANUFACTURER OF CAPACITORS

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It Won't Go Away

The demand for skilled and fast service on solid-state home entertainment equipment is increasing. But too many technicians are attempting to provide service without being technically prepared and equipped. Hence, a simple adjustment or insignificant repair frequently ends up as a self-inflicted "dog" or a burned-up circuit. And once again the *entire* industry suffers another black eye.

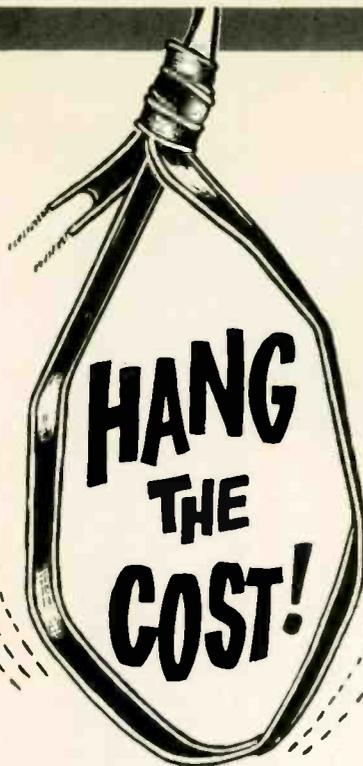
A significant number among us have failed to keep up with developments in solid-state technology. And a few still won't even support color TV. They prefer to wait for that will-o-the-wisp of never-arriving perfection to come rocketing around a corner that's infinitely long.

Practically every major FM/stereo, phono, Hi Fi package and component manufacturer will have 100 percent solid-state equipment on the market by the end of this year. What is more, despite a recent temporary lull in home entertainment solid-state developments caused by a roaring color business, TV sets are also moving rapidly toward hybrid or total solid-state form.

Some manufacturers repeatedly claim that the real reason they offer or plan to offer factory-type service to the public is because of a shortage of qualified, dependable independents able to give the kind of service the public demands. Whether this is true or false is not an issue here.

The claim can be affirmed or it can be refuted. It can be refuted only if our unprepared cohorts move fast. They can refute it by learning the basics of solid-state circuitry and techniques for servicing the equipment rapidly and effectively. Or they can ignore the sights and sounds of solid-state equipment and affirm the claim. The choice is theirs.

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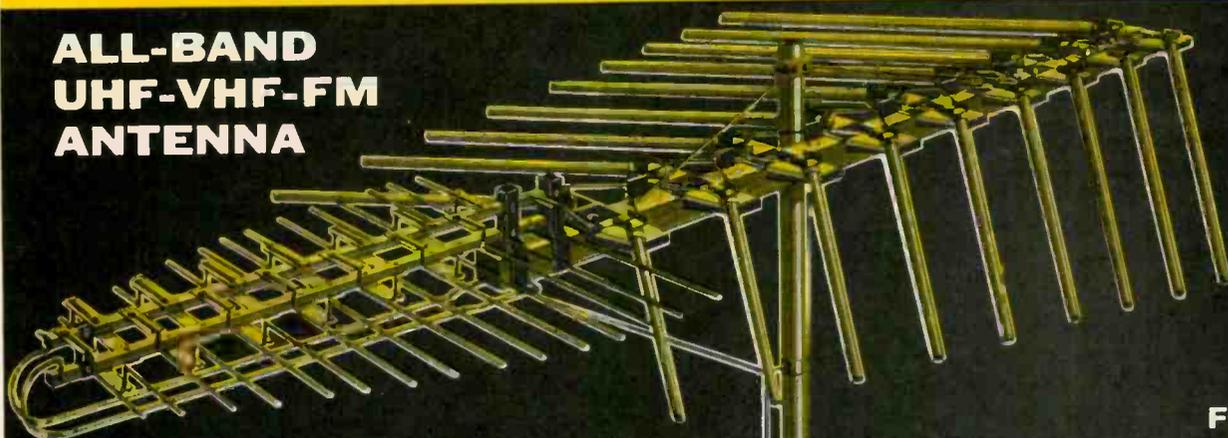
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ALL-BAND UHF-VHF-FM ANTENNA

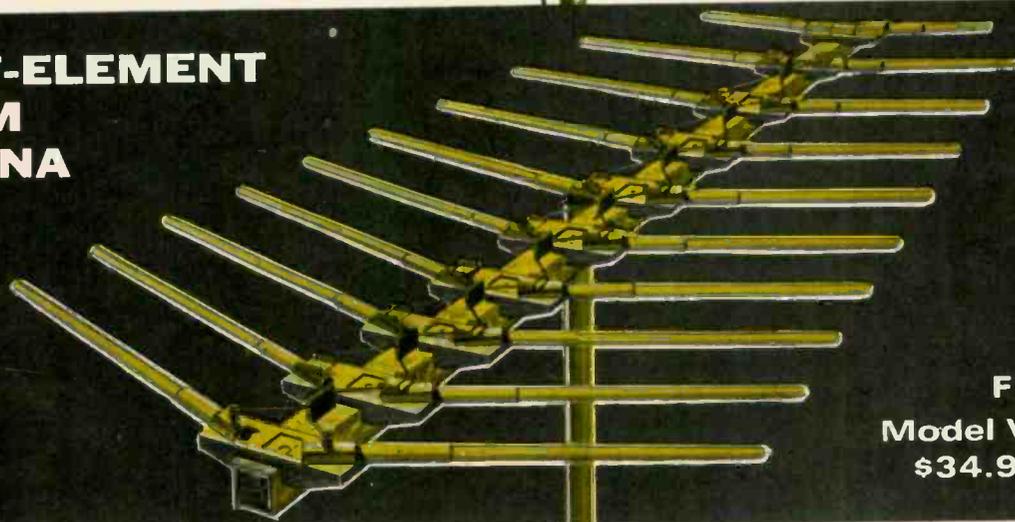


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Model UVF-24
\$59.95 list

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TECHNICAL DIGEST

EMERSON

TV Chassis 120771—Circuit Descriptions Sync Separator, AFC, Horizontal Oscillator and Horizontal Sweep.

The basic function of the sync separator circuit is to remove the video from the composite signal while retaining the sync pulses necessary for proper operation of the vertical and horizontal oscillator circuits.

The sync-positive signal which drives the base of the sync separator transistor is taken from a tap on the video amplifier collector load to obtain the correct amplitude for driving the sync separator and to avoid excessive loading of the video amplifier. The video information of this signal charges C43, and holds the sync separator transistor in an almost off state until such time as a positive sync pulse appears at C43. This slight forward biasing helps to provide clean sync on weak signals. The transistor is turned on only for the duration of the positive pulse at its base, at which time the collector voltage drops, resulting in negative sync pulses at the collector for application to the vertical integrator and horizontal phase detector circuits. The vertical sync is taken from a tap on the collector load resistance to provide the proper amplitude for the vertical oscillator. Horizontal sync is taken directly from the collector of the sync separator.

Horizontal sync is applied, through C51, to the base of the horizontal phase splitter, Q1. At the collector of Q1 an amplified positive pulse exists and at the emitter a negative version of the same pulse appears. These two opposite pulses are fed to the phase detector diodes X5 and X6. A reference pulse taken from the primary of the high voltage transformer is applied to the other side of these diodes and compared to the sync pulses. Any difference in phase between the sync pulses and the reference pulse will appear as a dc level on the base of the horizontal control transistor, Q12, resulting in variations of collector current proportional to the phase difference. A change in the collector current of this transistor will change the effective capacitance of the circuit consisting of C60, C59 and L8. This capacitive change will result in a shift of phase, so as to correct for possible variations in horizontal output phase.

The frequency-controlled horizontal oscillator is a sine wave Hartley type and is tunable by varying the impedance of L8 (horizontal hold control). A low im-

pedance winding on L8 couples the oscillator to the base of the horizontal driver (Q14). This stage reduces loading on the oscillator, thus improving stability.

The horizontal yoke current is supplied by a gate-controlled switch (GCS1). This is a fairly recent development in the solid state field. The action of this diode is similar to a grid-controlled thyatron tube except that the anode current can also be shut off by a negative pulse on the gate. Conduction does not occur in the GCS until a substantial amount of forward voltage is present at the anode. The anode voltage required for conduction can be varied, however, by the application of a positive voltage to the gate lead. In this circuit the anode voltage is constant and conduction is obtained by the application of a positive pulse at the gate. Conduction ceases when the pulse goes negative.

Conduction of the GCS permits current to flow through C65 and the yoke. The rise of this current is limited by the inductance of the yoke and its duration is limited by the length of the positive pulse applied to the gate. The relatively short duration of the GCS gate pulse causes the yoke current to rise in a linear manner until the GCS is turned off by the negative-going side of the gate pulse. At this time the yoke current falls rapidly toward its previous level. The damper diode (X8) across the yoke inhibits further oscillations after retrace, and conducts only after retrace when its cathode swings negative.

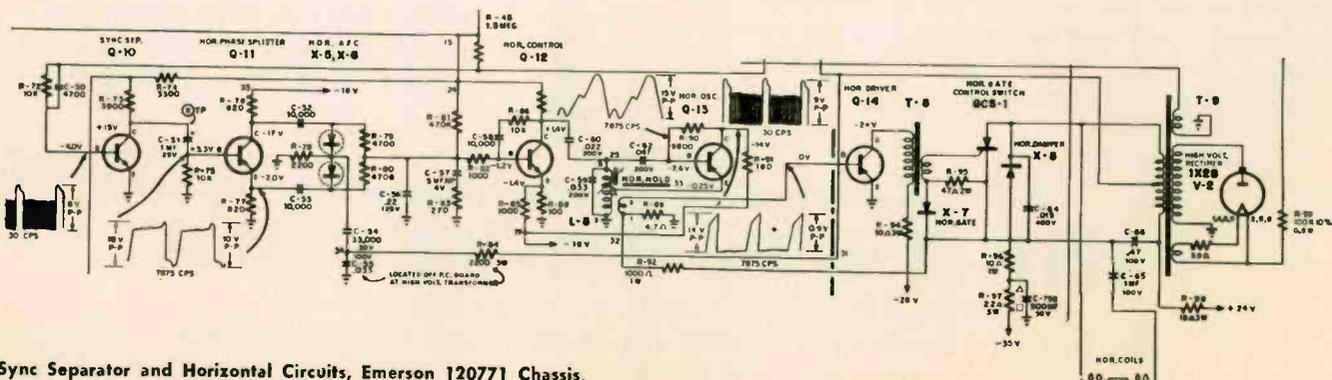
The GCS is turned on again slightly before the yoke current reaches zero, so as to provide a smooth transition of current from the damper diode to the GCS.

The high voltage transformer (T9) supplies the CRT voltage of 12 kv through the high voltage rectifier (V2).

GENERAL ELECTRIC

TV Chassis QX, QY and Early EA — CRT Replacement

The following 16 in. CRTs, with bonded plastic implosion plates, will not be manufactured when current stocks are exhausted: 16ATP4 A11 QX, 16AZP4 A11 QY, 16BUP4 Early EA models M501A, M505A. Replace these tubes with type 16BYP4. This tube is equipped with tension band implosion protection. This tube requires a minor alteration to the plastic cabinet. To alter the cabinet, remove approximately 4 in. of the plastic rib which sur-



Sync Separator and Horizontal Circuits, Emerson 120771 Chassis.

Fall lineup of STANDARD KOLLSMAN Television Stars

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Now available for replacement profits.

NEW STANDARD KOLLSMAN COLOR and black and white VHF ARBOR TUNER WITH PRE-SET FINE TUNING

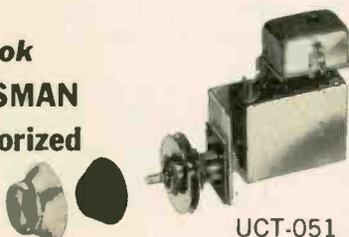


Guaranteed positive adjustment to eliminate service callbacks.
Created to replace TV tuners in practically every set manufactured in the United States since 1956. A simple adjustment of the knob automatically adjusts the oscillators for easy, perfect tuning. Specially designed brackets permit simple installations in any position—guaranteed to eliminate all previous mechanical problems of replacement installations.

Three new models to sell.

New SKi Arbor Tuner installed with the SKi UCT-051 UHF Tuner converts any set into a modern 82 channel TV.

Sell the custom look STANDARD KOLLSMAN BUILT-IN Transistorized UHF Converter



UCT-051

Easily installed in about 45 minutes

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- Compact size: 5½" x 1½" x 3¾"; weight 1¼ lbs.
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Model TA

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- All Channel TV sets



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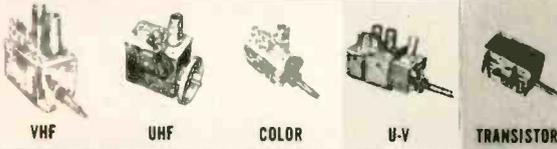
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And remember—for over a decade Castle has been the leader in this specialized field... your assurance of the best in TV tuner overhauling.



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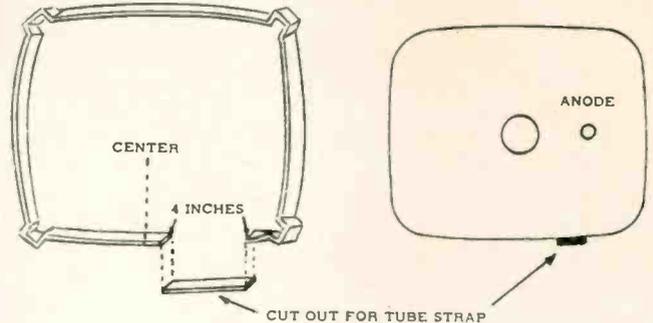
TV TUNER SERVICE, INC.

MAIN PLANT: 5713 N. Western Ave., Chicago 45, Illinois
EAST: 41-92 Vernon Blvd., Long Island City 1, N.Y.
CANADA: 136 Main Street, Toronto 13, Ontario

*Major Parts are additional in Canada

TECHNICAL DIGEST

rounds the picture tube. This allows the clamp on the tension band to fit properly into the cabinet. The illustration shows the area to be cut out and the dimension. The plastic can be easily snipped out with side cutters.



SYLVANIA

All 1965 TV Sets—Transistor Noise Gate Operation

A transistor noise gate is incorporated in all 1965 set for better noise suppression. The unit is located in series with the sync separator. Noise picked up from the detector output opens the sync separator circuit so it cannot trigger the sweep circuits.

The operation of the transistor noise gate located in the sync separator cathode circuit may be checked as follows:

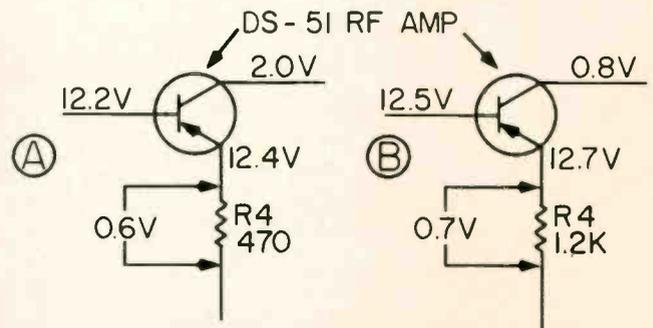
Advance the AGC control as far as possible while still maintaining a stable picture. Short the noise gate transistor's base to its emitter (ground). The picture should have a tendency to bend and be otherwise unstable if the noise gate is operating properly since this partially opens the transistor.

If the transistor is shorted it may not be noticed unless the set is installed in a fringe area or an area where a great deal of noise is present. When the transistor is open the picture will be unstable.

PONTIAC

Radio Chassis—Model 7291582 Production Change in RF Stage

A portion of the F amplifier stage used in early production of this chassis is shown at "A" in the schematic. The same portion of the RF amplifier as revised and used



in later production is shown at "B." The result of this change is a minor increase in sensitivity which may not be noticeable. The important point is that the normal voltage readings differ somewhat.

... for more details circle 21 on postcard

The new Amphenol 860 Color Commander cuts alignment time in half!

Ever finish a convergence job to find the raster off center. Lose convergence when you re-centered? Can't happen with the Amphenol Color Commander, battery-powered, solid-state color generator. A special, single-crossbar pattern consists of one horizontal and one vertical line, crossing just where the center of the raster should be. No need to guess when centering the raster with this new pattern.

See dots before your eyes when you want only one to start static convergence? The 860 gives you that single dot, right at center screen. You'll be switching back to this important dot during dynamic adjustment to make sure you haven't gone off the track.

Even the old patterns offer something new. Line spacing in the cross-hatch pattern is rigidly maintained for the 4:3 aspect ratio. You can rely on it for linearity, height, and width adjustments. The pattern gives you finely etched line width at normal brightness levels. What good is perfect convergence at reduced brightness if you lose it when the set's readjusted for normal viewing? This special crosshatch also eliminates receiver fine-tuning error. Among the 860's nine (most generators have only 5 or 6) are: multiple-dot, single vertical line, single horizontal line, vertical lines only, and horizontal lines only.

Finally, the Color Commander's unique color bar pattern (just three bars: R-Y, B-Y and -R-Y) simplify color adjustments. You can get a rapid, overall check of color circuits. Then adjust color demodulator phase or pre-set the hue control and check its operating range. In each step, you know precisely how the color bars should look and how they should change during adjustment.



A new timing circuit eliminates instability and loss-of-sync problems. Silicon transistors maintain built-in precision and stability indefinitely. RF output is on channel 3 or 4, switch selected. An attenuator simulates weak-signal conditions. It has gun killer circuit. Uses 9 penlight cells. Weighs 3½ lbs. in compact leatherette carrying case. \$149.95. Optional AC power supply, \$19.95.

AMPHENOL CRT COMMANDER, MODEL 855. Solid-state. Checks all black-and-white or color CRT's with the same techniques used by tube manufacturers. Rejuvenates where others fail. Versatile 5-socket cable accommodates 7 different sockets. With CRT chart, \$89.95.

See the new Color Commander test instruments at your Amphenol distributor.

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MODEL 310
Volt-Ohm-Milliammeter



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- 1** HAND SIZE AND LIGHTWEIGHT, but with the features of full-size V-O-M's.
- 2** 20,000 OHMS PER VOLT DC; 5,000 AC (310)—15,000 AC (310-C).
- 3** EXCLUSIVE SINGLE SELECTOR SWITCH speeds circuit and range settings. The first miniature V-O-M's with this exclusive feature for quick, fool-proof selection of all ranges.

SELF-SHIELDED Bar-Ring instrument; permits checking in strong magnetic fields. FITTING INTERCHANGEABLE test prod tip into top of tester makes it the common probe, thereby freeing one hand. UNBREAKABLE plastic meter window. BANANA-TYPE JACKS—positive connection and long life.

Model 310—\$37.50 Model 310-C—\$44.50
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310-C PLUS FEATURES

1. Fully enclosed lever range switch
2. 15,000 Ohms per volt AC (20,000 O/V DC same as 310)
3. Reversing switch for DC measurements

MODELS 100 AND 100-C

Comprehensive test sets. Model 100 includes: Model 310 V.O.M., Model 10 Clamp-on Ammeter Adapter; Model 101 Line Separator; Model 379 Leather Case; Model 311 leads. (\$67.10 Value Separate Unit Purchase Price.)



MODEL 100—U.S.A. User Net. . . \$64.50
MODEL 100-C—Same as above, but with Model 310-C. Net. \$71.50

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THE TRIPLETT ELECTRICAL INSTRUMENT CO., BLUFFTON, OHIO
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New Conduction Cooling System For 2-Way Tubes

■ A new development in the technology of conduction cooled electron tubes may result in lower costs for radio communications equipment and provide design engineers with more flexibility.

Conventional conduction cooling systems have the beryllia brazed to the tube. When a replacement is needed, the conduction cooling system has to be replaced as well — even if still good.

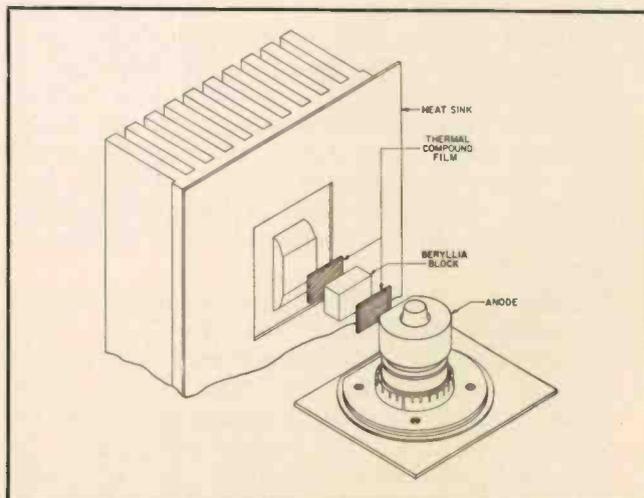
A system has been developed that uses a separate beryllia cooling block that is clamped to the tube's anode. This makes a flexible cooling system possible. When the tube fails, only the tube need be replaced.

Conduction cooling is ideal for those applications where cooling air or water cannot be used and where radiation cooling is not sufficient. Conduction cooling results in more reliable equipment by making it possible to dispense with blowers, air filters, and other mechanical parts.

A compact power tetrode has already been designed with the new system and it is expected to find extensive use in both fixed and mobile equipment, not only for the popular commercial 50, 150 and 470 Mc communications bands, but for SSB and point-to-point AM and FM communications.

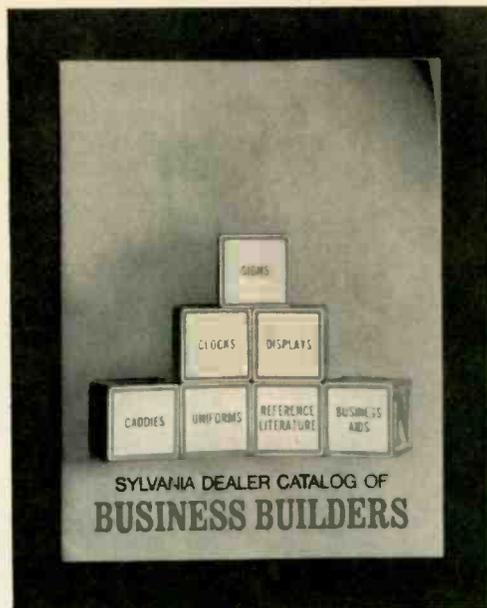
The tube is made with metal and ceramic construction for use as an RF power amplifier at frequencies up to 500 Mc. It will produce 270 w output at frequencies up to 500 Mc, and 270 w output at 175 Mc from 4 w drive as a class C amplifier under CCS conditions, the manufacturer stated. At 470 Mc, 12 w driving power is required.

It was also said that the tube's plate dissipation is solely a function of the parameters of the conduction cooling system — if the system is able to conduct sufficient heat, the full maximum input power of 500 w may be safely dissipated in the event drive power is lost. Under normal circumstances the plate dissipation is that difference which exists between the power input and power output which is a function of tube and circuit efficiency. ■



Cross-sectional diagram of new conduction cooling system designed by Amperex Electronic Corp.

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This 12-page booklet can help you boost your business and profits.

It shows you how to promote the many services you specialize in.

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Buffalo, New York 14209
Please send me my free copy of Sylvania's Dealer Catalog of Business Builders.

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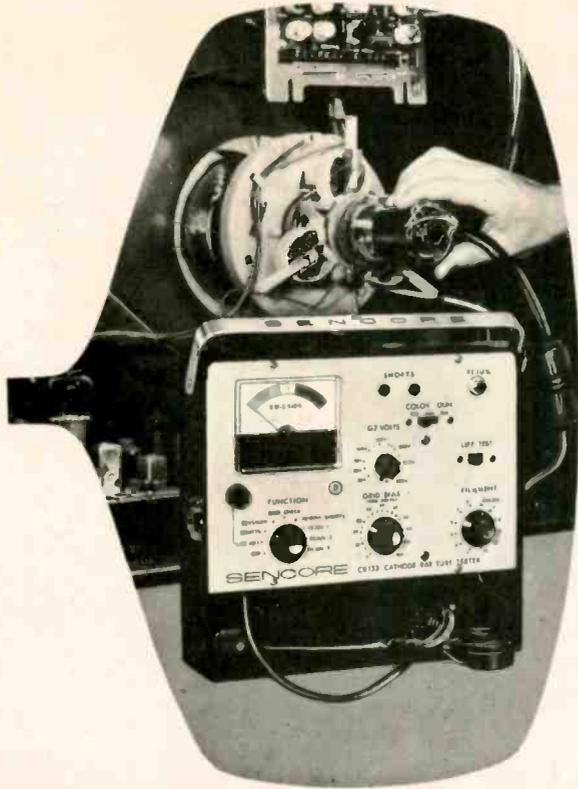
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The new, improved CR133 CRT Checker is designed to test all present picture tubes — and it's ready for future tubes too! Two plug-in replaceable cables contain all sockets required. The compact, 10 lb., CR133 checks CRT emission, inter-element shorts, control grid cut-off capabilities, gas and expected life. Checks all tubes: conventional B&W, new low drive B&W, round color tubes and new rectangular color picture tubes. Exclusive variable G2 Volts from 25 to 325 Volts insures non-obsolence when testing newly announced "semi-low" G2 CRT tubes. New Line Voltage Adjustment insures the most accurate tests possible. Uses well-filtered DC for all checks to avoid tube damage and reading errors. Color guns are individually tested as recommended by manufacturers. Exclusive automatically controlled rejuvenator applies rejuvenation (ACR) voltage as required by individual tube condition; precisely timed to prevent over-rejuvenation or tube damage. The ACR feature is most useful for color tube current equalization to insure proper tracking. Hand-wired and steel-encased for protection of meter and panel in truck or shop, the new improved CR133 is only . . . **\$89⁹⁵**

The famous CR128 CRT Checker and Rejuvenator is similar to above, but with a three position G2 slide switch and without Line Voltage Adjustment at \$69.95

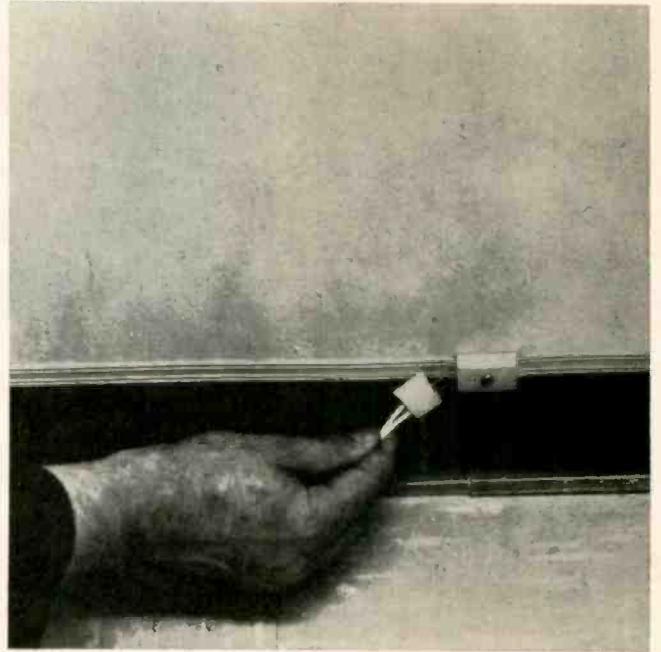
professional quality — that's the difference!

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FLAT AUDIO CABLE



■ A flat cable designed especially for custom stereo, Hi Fi, intercom or background music systems has four No. 22 AWG stranded wires embedded in a flat vinyl strip, with an adhesive backing that will adhere to any clean, relatively smooth, firm surface.

Known as "Scotchflex" No. 800, the cable was designed for audio specialists and technicians who need a slightly heavier system to carry an extra load or operate over extended distances. It is adaptable to nearly every type of music or intercom arrangement and to any room or building, the manufacturer reported.

A series of accessories for termination, splicing and transition connections are also available. These include terminals, four-post transition devices for connecting amplifiers or speakers to the cable system; units for splicing flat cable when extending the main system; plugs and receptacles to connect amplifiers or speakers into the system and corner covers to protect and secure corners made with the cable.

The cable may also be modified for long run applications by using shorting bars which parallel-connect adjacent wires to provide the equivalent of a 19-gage, two-conductor system. The shorting bars are provided with individual terminals or connectors.

The cable has a rated current capacity of 4.5 amp per conductor, with a resistance of 0.016 Ω per conductor foot at 68°F. The cable is said to be chemically inert to moisture and most common solvents, once applied to a dry surface. The insulation material may also be painted over with any common house paint. It is manufactured by the 3M Co. ■

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Greyhound Package Express never stops for lunch, never quits at five, never sleeps at night. Not on weekdays. Not on weekends. Not even on holidays. Your shipments travel on regular Greyhound buses... via fast, frequent Greyhound schedules. Your shipments get moving *faster* so they can arrive *sooner*. Packages shipped hundreds of miles frequently arrive the very

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CLEVELAND— COLUMBUS	10	3 hrs. 5 min.	1.80	2.05	2.40
LOS ANGELES— SAN FRANCISCO	28	9 hrs. 20 min.	2.10	2.45	2.80

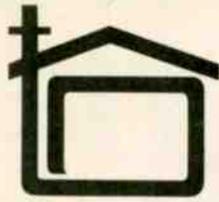
*Other low rates up to 100 lbs.



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

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The move's on to



JERROLD

Coloraxial™

**best for color . . . best for black-&-white
. . . best for FM . . . best for business**

The days of twinlead are numbered. Spurred by Jerrold's introduction of Coloraxial, both the TV trade and the public are moving unmistakably towards this revolutionary shielded coaxial antenna system—not only for great color TV, but for black-&-white and FM stereo too.

And, starting this Fall, a big national advertising program in TV Guide will have your customers asking even more for the perfection in reception that only Coloraxial offers.

So important is 75-ohm Coloraxial in your future that Jerrold now offers a wider line than ever of Coloraxial products to meet every reception need from metropolitan to deepest fringe areas. On these pages are described a

complete range of Coloraxial antennas with 75-ohm output; matching transformers for converting existing 300-ohm antennas to Coloraxial operation; Coloraxial Powermate preamplifiers; and 50- and 75-foot lengths of Coloraxial cable complete with screw-on fittings. One of the easiest—and most profitable—jobs you can do is install a Coloraxial reception system.

There's a pocket-size Jerrold Blue Book waiting for you at your distributor's. It's yours to use in figuring installed Coloraxial prices for your customers. The Jerrold Blue Book is just one part of a big five-part program your distributor has ready to help you sell Coloraxial installations this Fall. Talk to him now.



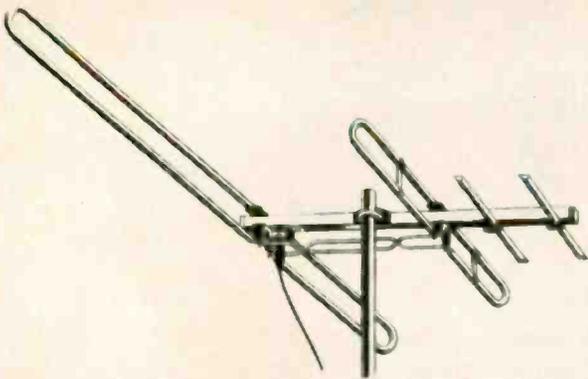
COLORAXIAL MATCHING TRANSFORMERS AND KITS Model TO-374A mast-mounting transformer converts any existing 300-ohm outdoor antenna to 75-ohm Coloraxial operation. Model T378 mounts on set to match it to 75-ohm coax. Available separately or as a set in Kit Model CAT-2.



COLORAXIAL SHIELDED CABLE Here's the heart of every Coloraxial installation—the reason for it all. Coloraxial is the highest-quality shielded RG-59/U cable, factory sweep-tested and complete with screw fittings and a weatherboot for the outdoor connection. Models CAB-50 and CAB-75 contain 50 and 75 feet of cable respectively. Model K-CAB-50 contains 50 feet of cable and one each of Model TO-374A and T378 matching transformers.

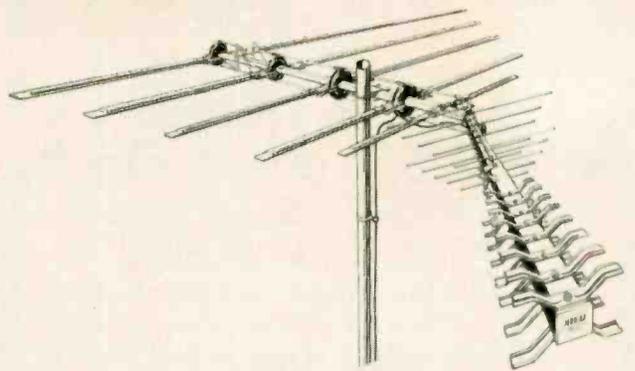


COLORAXIAL POWERMATES The coaxial versions of the transistor antenna amplifier that set an industry standard, made "fringe area" a thing of the past; Model SPC-103 has two transistors, Model SPC-132 "De-Snowter" has five transistors in two-stage preamp-postamp. Both Powermates are pre-matched to antenna and receiver, making separate matching transformers unnecessary.

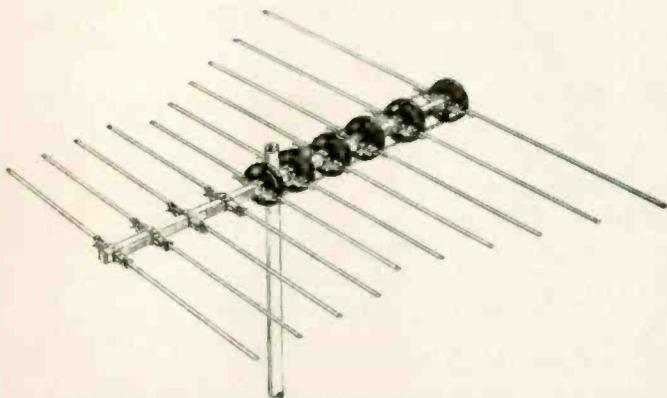


COLORAXIAL COLORGUARD ANTENNAS AND ANTENNA KITS

Like all the antennas shown here, Coloraxial Colorguards are already equipped with 75-ohm output to coaxial downlead. Three models (CAX-16, 17, and 18) for metropolitan and suburban reception areas. Model CAX-16 is also available in kit form with 5-foot mast and trimount, CAB-50 cable with fittings and weatherboot, and set-mounting T378 matching transformer—everything you need for a complete Coloraxial installation.



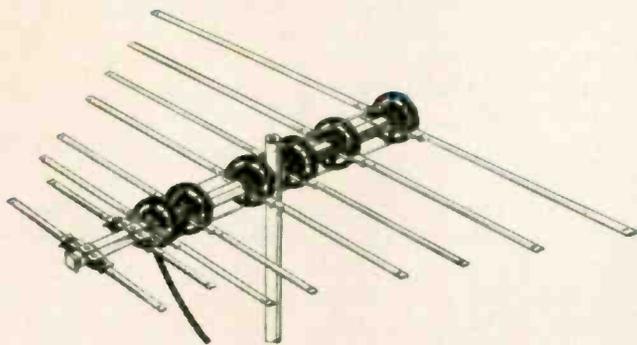
COLORAXIAL PATHFINDER VHF/UHF/FM ANTENNAS The first all-channel antennas with 75-ohm output and individual orientation of VHF and UHF sections in one hinged unit. All the flexibility of separate antennas without splitter losses. You have a choice of five PATHFINDER models, PXB-30, 45, 50, 70, 90.



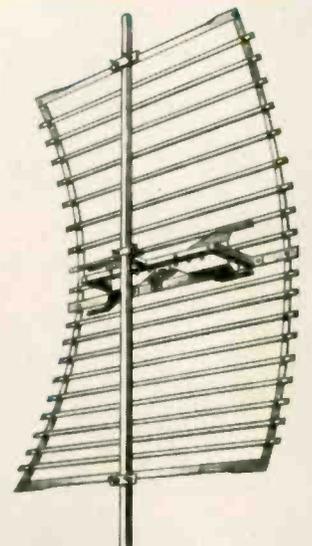
COLORAXIAL PARALOG FM ANTENNAS FM stereo needs Coloraxial too! So the outstanding Paralog FM antenna line is now offered also with Coloraxial 75-ohm output. Three models, FMPX-8, 10, and 16.



COLORAXIAL Stratophonic FM YAGI AND KIT This fine five-element yagi antenna, pre-matched to 75-ohm Coloraxial operation, keeps stereo signals in, keeps interference out. Model FAX-5, available also in kit form with mast, trimount, 50 feet of cable with fittings and weatherboot, and set-mounting matching transformer—everything you need for a complete Coloraxial stereo installation.



COLORAXIAL PARALOG TV ANTENNAS The full line of seven renowned high-gain Paralog log-periodic VHF antennas is now available pre-matched to 75-ohm Coloraxial cable. In the wide range of Paralogs (Models PAX-40, 60, 100, 130, 160, 190, and 220) you can choose the perfect antenna for metropolitan to deepest fringe reception.



COLORAXIAL PARACYL UHF ANTENNAS

These five famous all-band UHF antennas, now available with 75-ohm Coloraxial output, feature an extended-resonance driver which assures effective operation over the entire UHF band (Ch. 14 to 83). Models JUX-1, 2, 3, 4, 5.

JERROLD ELECTRONICS CORPORATION

Distributor Sales Division ■ 15th & Lehigh Ave., Philadelphia, Pa. 19132

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JERROLD

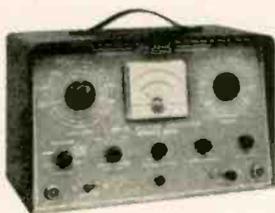
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**Model 800
Dealers Net Price
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Close-Out Price **\$69⁹⁵**

DYNAMIC SWEEP & SYNC CIRCUIT ANALYZER

MODEL 820

3 INSTRUMENTS IN ONE



- Horizontal and Vertical sawtooth/square wave generator
- Complete compatible flyback and yoke tester
- Horizontal and Vertical sync generator

**Model 820
Dealer Net Price
\$69.95
over 5000 sold
at this price**

COMPATIBLE FOR COLOR AND BLACK & WHITE
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■ A growing awareness of the importance of personal attention to customers is developing throughout the business world. That concern shows up in the findings of the Customer Relations Research Foundation, in Philadelphia, Pa.

It shows up in customer analysis data accumulated by various firms across the country.

It shows in the establishment of the Consumer Advisory Council and in plans of the National Retail Merchants Association to study "consumer frustration."

It shows up in the "wholesome, happy" advertising approach of a large national food processor who is attentive to the housewife's preference for the wholesome sell. The company is winning new business by giving the customer something for nothing — syrup in a reusable glass pitcher, coffee in a reusable glass carafe, or apothecary jar, or thermos bottle — or whatever: *the extra gift*.

That gift or something extra can come in many ways: the something extra with a purchase or service; a "determination to be good to your customers."

What Business Executives Think

The sales executive of a leading chemical company is quoted as saying, "Providing extra service for our customers has become a way of life for us. It's the only way to keep up with, or forge ahead of competition."

A bank president said recently, "There is no such thing as an unimportant customer. The best source of new business is our present customers."

The list of such statements is seemingly endless and they come from all sections of the country. But for all that, a great deal is still left to be done in the field of customer relations. Not all is sweetness and light. Every day, everywhere, all around us, customers are being given, to put it mildly, less than the best treatment.

Perhaps this arises because of misunderstanding. Perhaps it is the abruptness or rudeness of some employee, a curt business letter — any of which may make the customer feel that his business is not appreciated. As Joseph M. Segel, Chairman for the Customer Relations Research Foundation, puts it, "Indifference is the Number One customer killer."

The list of complaints is as seemingly endless as that of the firms who are working so diligently to keep such things from happening in their own business.

Keep Your Image Shining

All of the dollars spent on advertising, to sell products and services — to create a fine image for your business — can be washed down the drain by careless,

Continued on page 40

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thoughtless, disinterested attitudes toward customers.

Customers *are* the most important people for any business. The thing is to let them know it! How do you go about letting the customers know that you appreciate them?

At the top of the list is personal attention. An automobile distributor in New York says, "Personal attention is the only way to build a long-term relationship."

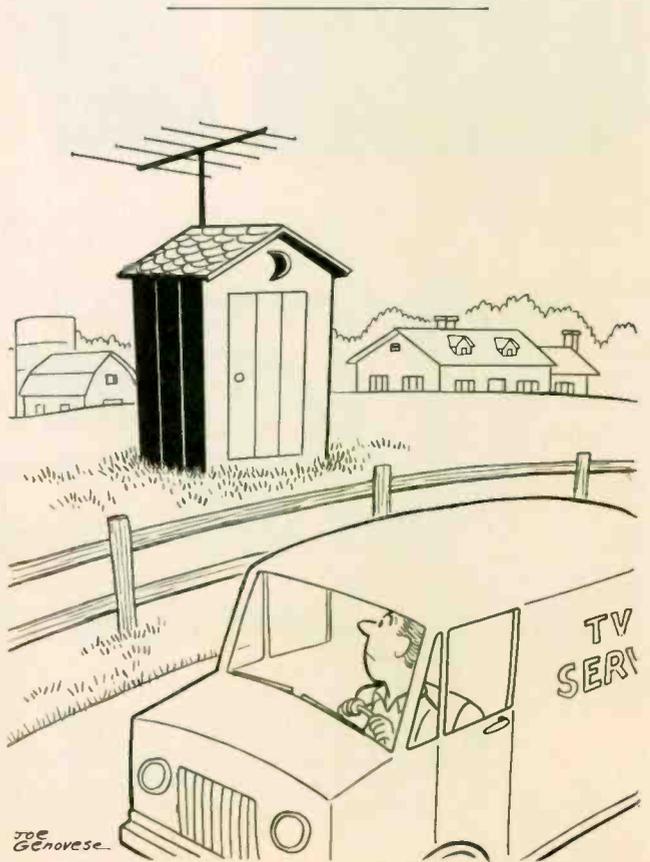
Many business establishments have devised new, unusual and thoughtful ways to give their customers personal attention. A beauty salon set up a gift shop for Christmas — and of course gave token gifts to their patrons, to say "Thank you." A small, inexpensive gift is a wonderful way to say "Thank you," to show appreciation, and that you are really thinking about your customers.

People like to be remembered, to be shown appreciation, to know that you feel they are very important. It is a rare occasion when a recipient gets mad at a gift giver.

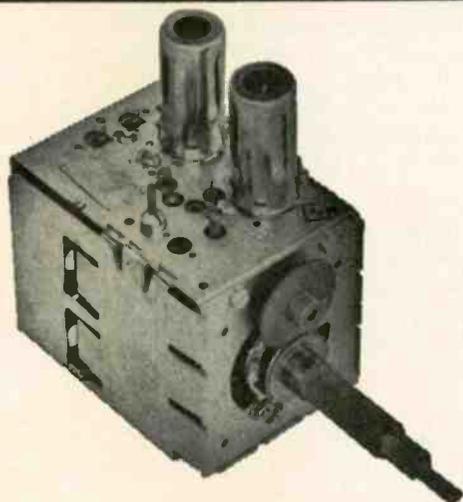
Over \$300,000,000 are spent on business gifts each year, and the figure continues to rise. Slightly more than half of those gifts are bought for customers, and about ten percent for prospective customers.

Customers are people, people are human, and humans — all of us — like to get presents.

In fact, customers *are* important people, very important people. The most important people in the world for *you*. They keep you in business. Appreciated customers can keep your business growing. It is good business to let them know how important you feel your customers really are! ■



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Ⓢ Tarzian-made tuners are identified by this stamping.

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SYNC ON BUSINESS

Alert service-dealers and technicians can do a profitable pre-Christmas business catering a little to the do-it-yourself urge of the man-around-the-house. An attractive "Season's Greetings" soldering gun package will appeal to a wife, a son or a daughter looking for a gift. And the recipient can find plenty to do with it around the house—without poking it into his TV, radio or Hi Fi. The model 8200PK-X kit comes in assorted colors, features a 100/140 w dual gun, 3 soldering tips, tip-changing wrench, a roll of Kester solder, soldering aid and flux brush. Write on your letterhead to William L. Bender, vice president-marketing, Weller Electric Corp., 601 Stone's Crossing Road, Easton, Pa. 18043, and ask for details.

Rebuilding your own CRTs may not be your forte, but Windsor Electronics, at 999 North Main Street, Glen Ellyn, Ill., says many small, independent servicers are doing quite well with their 4-tubes- and 8-tubes-a-day rebuilding equipment.

A 20-page pocket book lists 3000 transistor and diode items and shows how they are replaced by only 140 Semitron units, according to Semitronics Corp. At your distributor, or by sending 25¢ for handling costs to the company at 265 Canal St., New York 13, N.Y.

An electronics educator, J. E. Smith, founder and Chairman of the Board of the National Radio Institute, 3939 Wisconsin Ave., Washington, D. C. 20016, has been



presented with the Robert H. Goddard Award for outstanding professional achievement. NRI is the oldest and largest TV-radio Electronics home-study school in the United States.

An exploding tape-recorder market is seen by Wybo Semmelink, assistant vice president of North American Philips Co. He expects sales of quality tape recorders to go over a million units this year.

A Hi Fi speaker balancing record, a 7 in. 45 rpm recording, explains how to balance high fidelity stereo or monophonic speaker systems to achieve maximum performance in the actual listening environment. No other instruments are required, the producer says. It sells for \$1.25 and is produced by KSC Systems. At your jobber.

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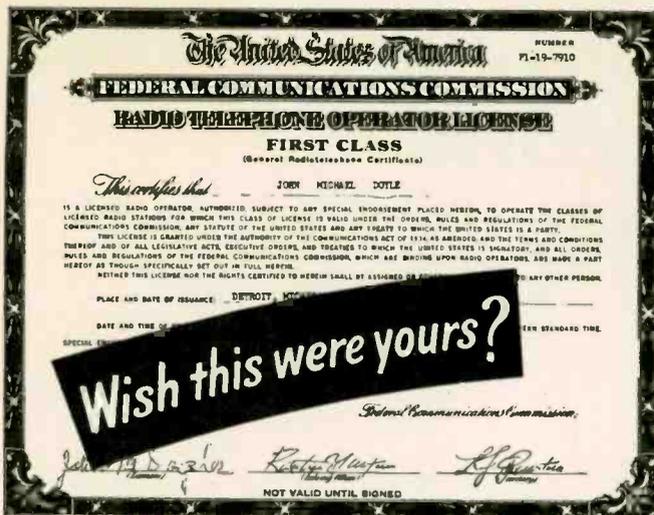
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SYNC ON BUSINESS



Allen

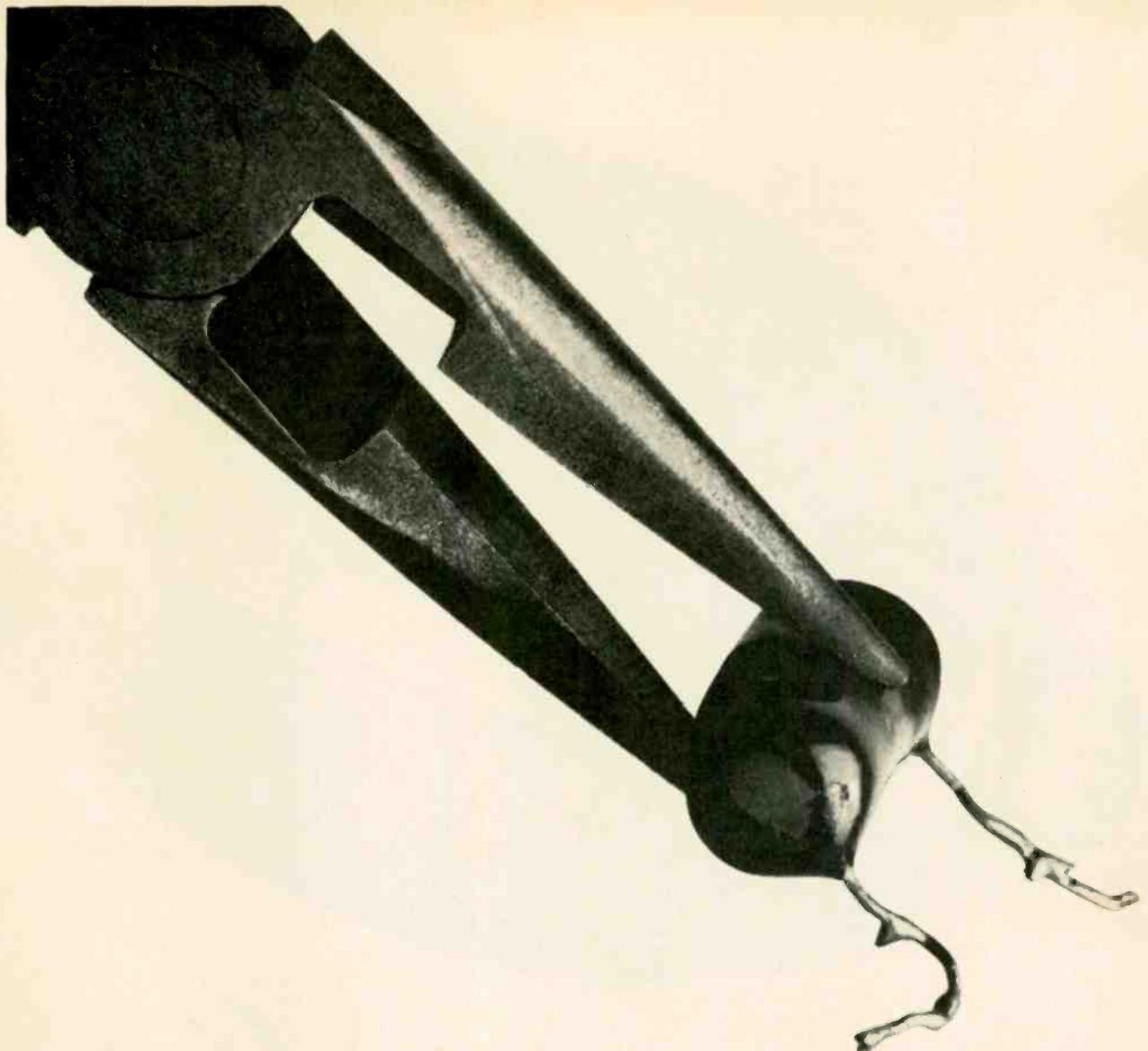
The National Home Study Council has a new president. He is Gerald O. Allen, president, Cleveland Institute of Electronics. There are now 1,500,000 people in the nation who are trying to better themselves through home study. Allen says, "One of NHSC's responsibilities is to make certain these individuals obtain the best instruction possible." Only 72 of the country's nearly 500 correspondence schools have been accepted for accreditation by the NHSC thus far.

The Modern Approach To Business Communications is a valuable booklet that you can use to promote your two-way specialty or sideline. It tells the history of two-way communications, explains who is eligible to use it, how it works, what specific equipment is needed and answers many other questions that prospective users are asking. Ask for the booklets on your letterhead. They're available without charge from Pearce-Simpson, Inc., PO Box 800, Biscayne Annex, Miami, Fla. 33152.

A sapphire phonograph needle is worn out after about ten months of play — yet the average needle only gets changed every two and a half years, according to Karl Jensen, president of Jensen Industries. He indicated that laboratory tests prove that after 60 hours an ordinary sapphire needle is definitely worn out. And the trouble is, the damage cannot be seen. Nor can you accurately tell by detecting a difference in sound reproduction. But after 60 hours a needle starts to damage records, and the damage is irreparable to records. . . Which reminds us of one service-dealer we met who always carried a little magnifying glass, with pocket clip, in his jacket pocket. It was designed to show customers how a worn phono needle looks. We heard he owned two houses, a Cadillac, a Volkswagen and an unnamed last-year's model as a "fishing-car." It was also said that he had recently been lingering over Rolls-Royce ads.

"An estimated 100,000 new technicians will be needed in the nation over the next three years," Clarence H. Stephans, director of industry relations, Newark College of Engineering, said recently. The college is creating a new division of technology to include a total of 60 courses, including electronics courses. For details write the college at 323 High Street, Newark, N. J. 07102.

Replacement rectifiers for color sets are available in a special "convenience package" at more than 800 distributors across the nation. The selenium cartridge rectifiers, catalog No. 61-8968 for voltage boost, and No. 61-8969 for focus, have peak reverse ratings of 800 and 6500 v respectively. The focus rectifier is used to replace the older 1V2 tube. A handy cross-reference guide on color TV rectifiers and a 1.0 amp 600 v silicon diode most frequently used in color TV circuits, are included. The kit, catalog No. K896, sells for \$4.40. It's from International Rectifier Corp.



This defective capacitor came from a four-month-old TV set. And you want to put in another just like it?

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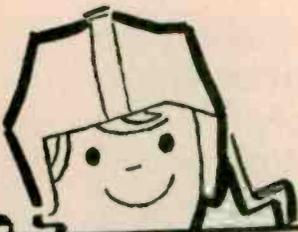
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COLOR TV COMPONENTS


COLOR RECEIVING TUBES

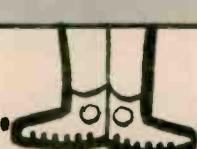
Did you know that General Electric has introduced more new receiving tubes for color TV applications than any other manufacturer? In 1965 G. E. has produced 7 new types alone for the new, soon available "Porta-Color" 11-inch color set. Stick with G-E tubes and fill all your tube replacement needs from one manufacturer.

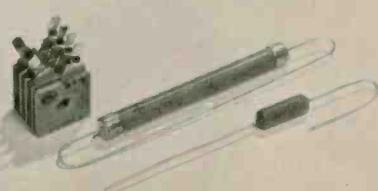




DAYLITE III PICTURE TUBES

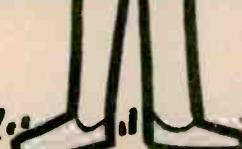
Four basic G-E Daylite III color picture tubes (21AXP22, 21CTP22A, 21FBP22, 21FJP22) will fill over 95 percent of your replacement needs — another example of the broad-line color component coverage that General Electric offers.





COLOR TV RECTIFIERS

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Stock up! Call your local Authorized G-E Electronic Components Distributor for receiving tubes, picture tubes, rectifiers, and other color components you'll need this fall. He has exciting deals you'll want to hear about.*

Your G-E Distributor also has a brand new Color Component Replacement Guide and a new promotional portfolio featuring the 1965 *Football Facts* guide — to help you attract new business.

Distributor Sales, Owensboro, Kentucky

*All specials available at the option of your G-E Distributor.

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COLOR COMPONENT REPLACEMENT GUIDE

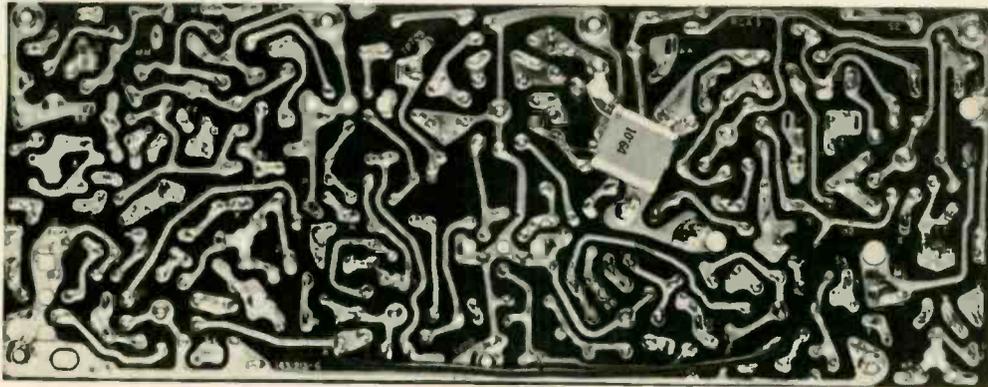
New! In a new small reference size (3 $\frac{3}{4}$ x 8 $\frac{1}{2}$ inches), your G-E Distributor has a free complete G. E. Color Component Replacement Guide. Get yours now and be prepared to service any color TV chassis.

COLOR CRITIC'S CHOICE PROMOTION

Specially designed to help you attract more business, this new promotion includes ad mats, decals, mailers and other tools to identify you as a Color TV specialist. Pick up the free descriptive brochure at your distributor.

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More TV servicemen own RCA Victor Color TV than all other leading makes combined



PART I OF A SERIES

YOU AND YOUR OSCILLOSCOPE

by John Holmes

Know the one instrument that
serves you best in
black-and-white and color TV
troubleshooting and repair

■ A cathode ray oscilloscope, sometimes abbreviated CRO, frequently incorrectly called oscillograph — popularly known as just plain “scope” — is basically an instrument that visually displays ac voltage waveforms on its screen.

A scope is the most versatile single instrument you can have on your workbench. It can be used to service every section in a B/W or color TV set, most circuits in radios, Hi Fi sets, two-way communications gear and industrial electronic equipment.

It is a sensitive dc and ac voltmeter. It can measure P-P voltages of sinewaves and nonsinusoidal waveforms. With a demodulation (rectifier) probe, it is ideal for signal-tracing IF amplifiers. Ripple in power supply and B+ circuits can be checked and traced. Composite video signals, including those in color sets, can be signal-traced. It's indispensable for accurately and rapidly checking the frequency response of video amplifiers and for aligning TV tuners and IF amplifiers. It serves as an accurate tool for aligning FM detectors and FM

IF amplifiers. And you'll need it for adjusting bandpass amplifiers in color TVs. But these are only a few of the jobs your scope can do well. Lengthy books have been written covering the hundreds of different tasks your scope can perform better than any other single instrument. Additionally, perhaps until the digital computer was built, it was the most valuable electronic research tool in the laboratory.

Those technicians who know how to use a scope *effectively* as a test and troubleshooting tool — how to employ it to its maximum potential — have a decisive advantage in terms of time saved and more reliable service work.

It is impossible, however, to employ your scope at full potential unless you know how it works, what it can do better than any other instrument and how to quickly apply it to particular jobs.

We mentioned previously that your scope was basically a device for visually displaying ac voltage waveforms. Just what does this mean? How can we use a scope to probe into the depths of electronic

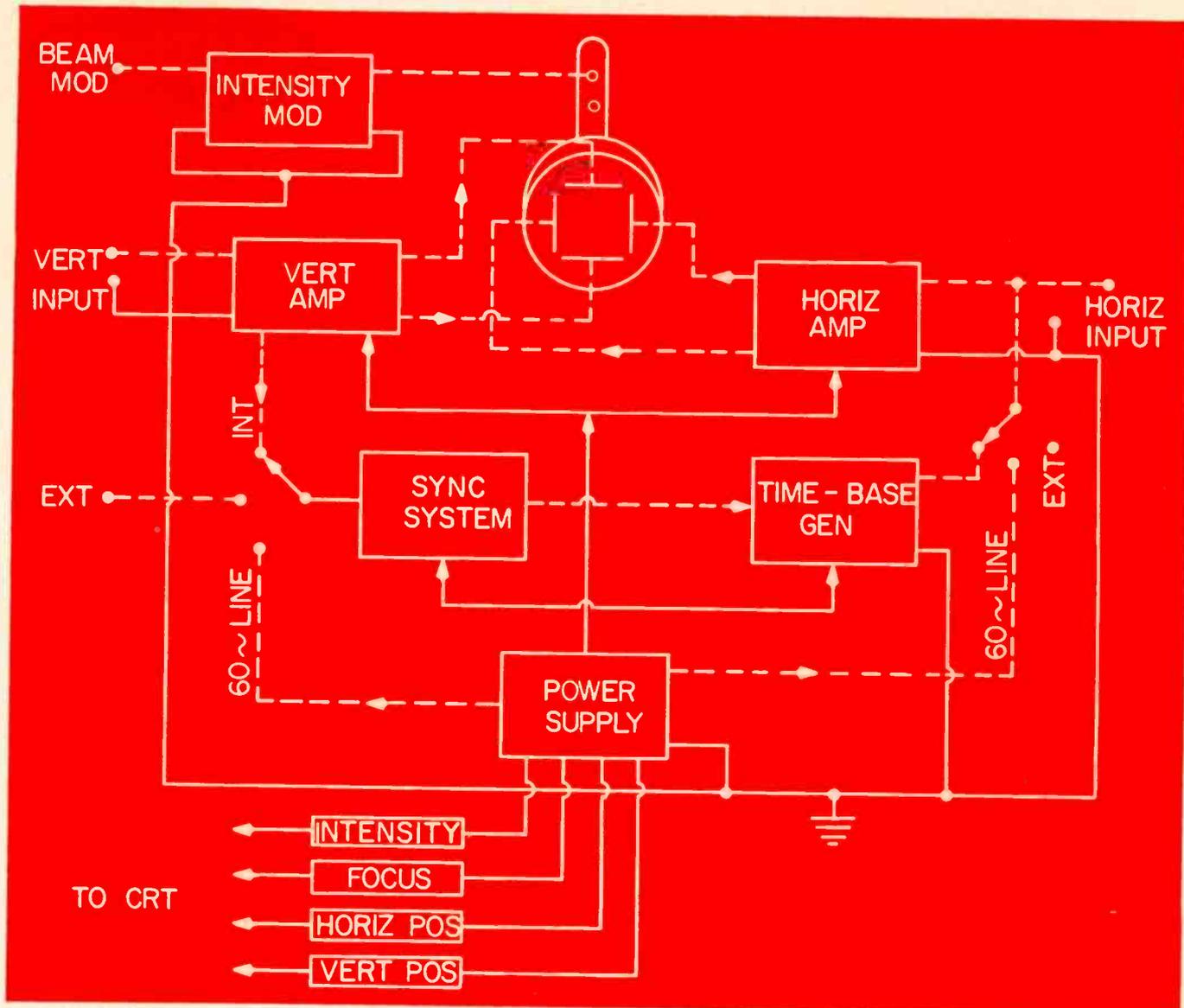


Fig. 1—Block diagram of the basic elements in a typical service-type scope.

circuits and display the waveforms that circulate through those circuits? How can these waveforms reveal faulty circuit operation? To answer these and other important questions we must look with inquisitive eyes into the scope itself.

Basic Circuitry

If you already know how the sweep circuits operate in a TV, how an electrostatic deflection CRT functions, then you are well on the way to understanding how a scope performs, what it can do best and how you can use it effectively.

A block diagram of the basic elements in a typical service-type scope is shown in Fig. 1. Secondary circuits will be covered later.

Because the electrostatic-deflec-

tion CRT has made the entire scope concept possible, let's begin by taking a brief look at the CRT and its functions.

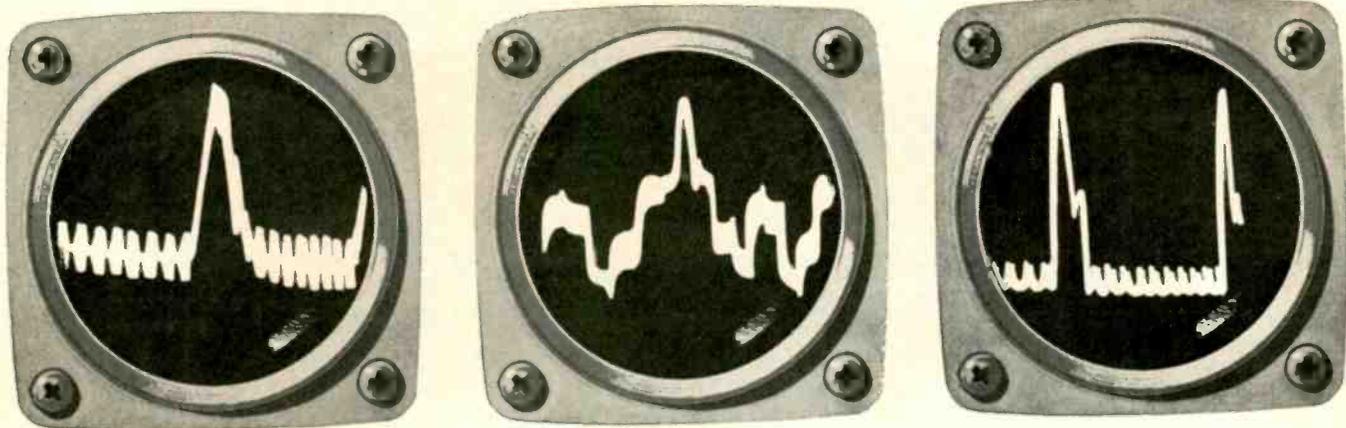
The Cathode Ray Tube

An electrostatic-deflection type CRT (Fig. 2) has two vertical and two horizontal deflection plates. It also has a cylindrical grid surrounding the tube's cathode which controls the intensity of the electron beam like the grid in an ordinary electron tube. The grid has a small aperture in its front end which helps form into a narrow beam the electrons emitted by the heated cathode.

Following the grid is a cylindrical focusing anode, or plate, and directly in front of it is an accelerating anode. These anodes concen-

trate the electrons still more and speed them on their way until they strike the phosphor coating on the inside face-plate of the CRT — where they form a small, bright spot. This is the spot which sweeps back and forth at high speed across the phosphor screen to trace and display various waveforms.

The CRT's cylindrical focusing plate is known as the *first anode* and the accelerating plate is called the *second anode*. The second anode is supplied with a much higher dc potential than anode number one. All of these CRT elements combined, including the filament, or heater, compose the familiar "electron gun" which "fires" the electron "bullets" at high speed and acts as an electronic lens system to



focus the electron beam sharply on the CRT screen.

If no voltages or if equal voltages are applied to the vertical and horizontal deflection plates, our glowing spot will stand still in the center of the CRT screen. Hence, the spot isn't much use to us unless we get it moving.

Because the beam from the electron gun is composed of electrons — negatively charged particles — the beam can be deflected by rapidly varying the potential on each of the vertical and horizontal plates.

If we place a sinewave voltage on the vertical plates only, for example, the spot will sweep straight up and down, without moving to

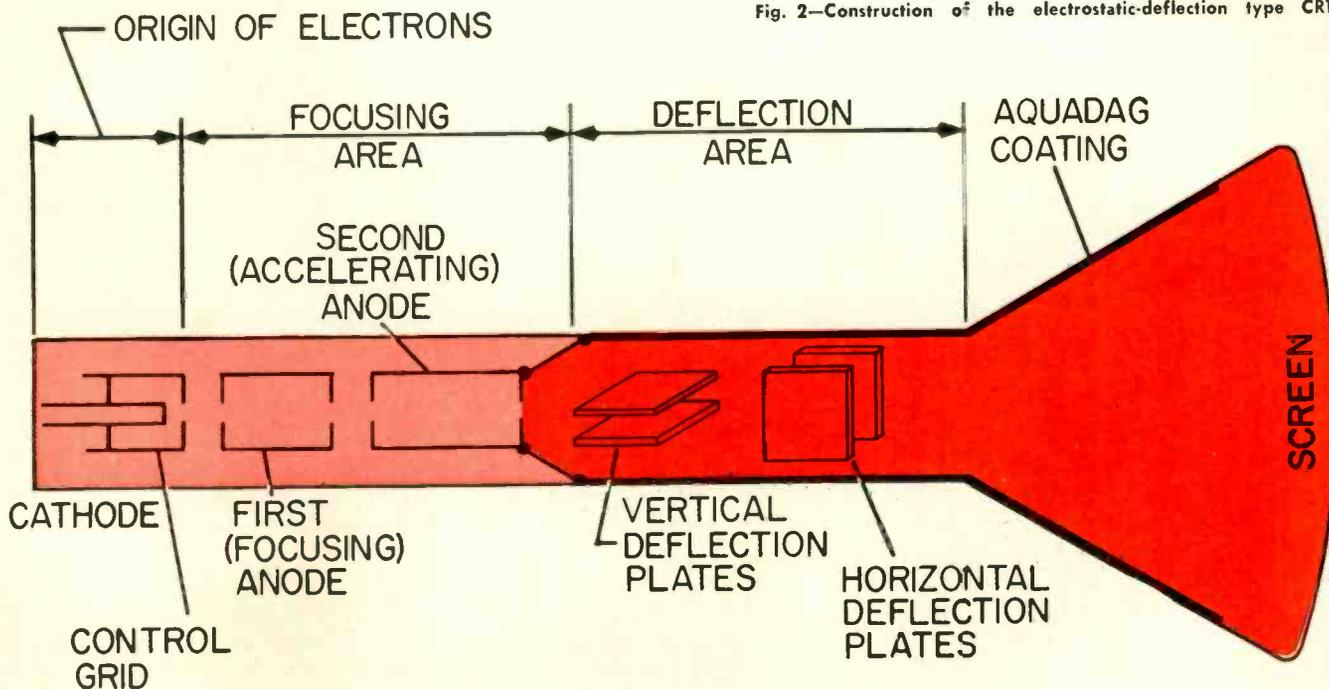
the right or left, and will display a solid bright vertical line (Fig. 3). The amplitude of the applied signal voltage will determine the height of the vertical line. But this would still not be very helpful to us except to measure the peak or P-P value of the sinewave voltage applied to the vertical plates. To be really useful, we must move the spot back and forth horizontally as well. In other words, we have to add another "dimension" — time — before we can display a conventional sinewave — or the frequency of an ac voltage. We do this by supplying a *time-base* sweep, or sawtooth oscillator voltage, to the CRT's horizontal plates.

Time-Base Oscillator

The sawtooth oscillator's voltage will sweep the spot horizontally back and forth across the screen in a regular period of time. And to be practical, its sweep frequency must be variable over a wide range so we can observe one or more cycles of the signal waveform which we normally place on the vertical plates of the CRT.

Scopes may employ thyratrons, silicon controlled rectifiers, or triodes in multivibrator horizontal sweep circuits but blocking-type oscillators may also be used. And the sawtooth generator circuit must be designed to give a linear time-base. The schematic of a basic thyatron

Fig. 2—Construction of the electrostatic-deflection type CRT.



.... YOU AND YOUR OSCILLOSCOPE

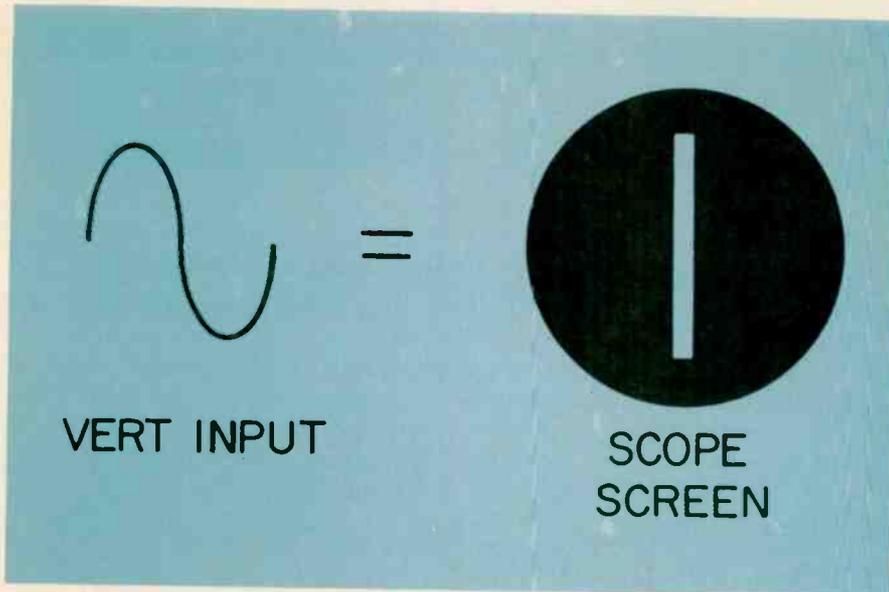
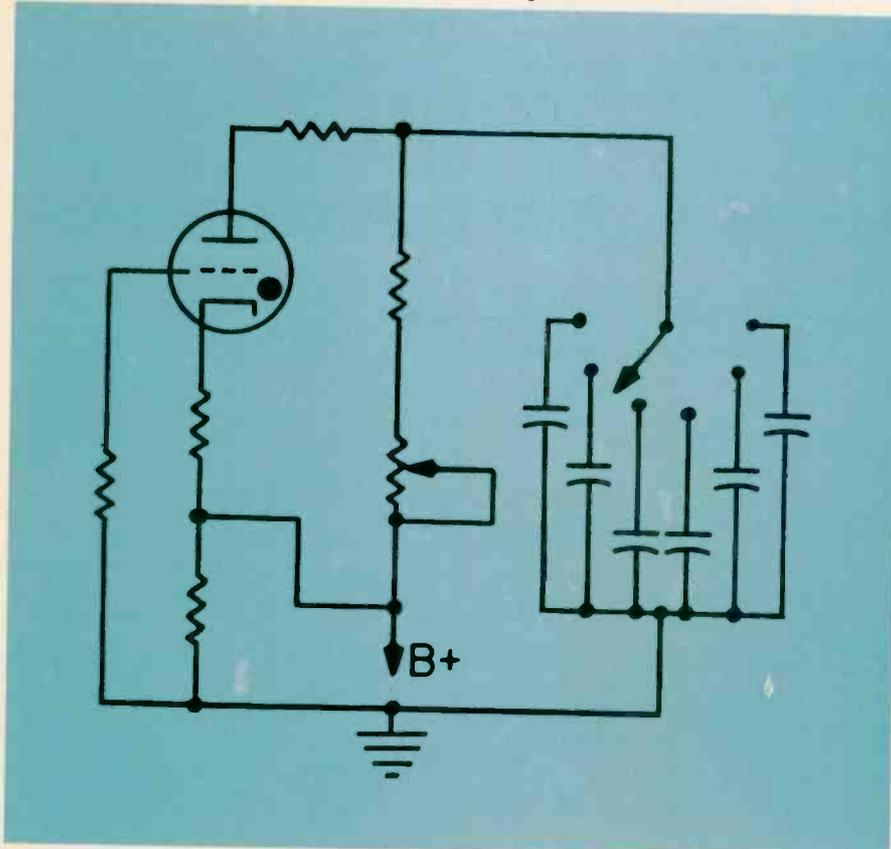


Fig. 3—A sinewave applied to the vertical plates will cause a straight vertical line on the CRT—if no sawtooth voltage is present on the horizontal plates.

Fig. 4—Simplified schematic of a thyatron sawtooth generator.



sawtooth generator is shown in Fig. 4.

Now, by simultaneously applying a time-base sawtooth signal to the horizontal plates and the signal we want to see to the vertical plates, we are almost, but not quite, ready to use our scope. If our scope is to be really practical, then, it must have good vertical and horizontal deflection amplifiers.

Amplifiers

As we already know, the purpose of the vertical deflection amplifier, called the Y-axis amplifier, is to boost the low level signals that we feed to the scope's vertical input. And this amplifier must have certain special characteristics because we may want to observe signal waveforms extending from dc, through slowly pulsating dc and low frequency ac, all the way up to frequencies of several Mc—at least to 4.5 Mc for color TV work. In other words, the vertical deflection amplifier should have high over-all gain and a reasonably flat, wide-band frequency response.

The primary purpose of the horizontal sweep amplifier, known as the X-axis amplifier, is to amplify the time-base sawtooth voltage. But its frequency response does not have to be as wide as that of the vertical amplifier.

The horizontal amplifier, in effect, makes it possible to increase—or "stretch out" the time base and, hence, make the observed waveforms wider, simply by varying its gain. And perhaps we should mention at this point, since the electron beam goes across the screen in both directions, we'd end up with a pretty confusing, possibly useless, "picture" if we could see the trace while the beam is going both ways, so a special circuit cuts off the beam while it is returning to the starting position. This is called "retrace blanking" and will be discussed more fully in another article.

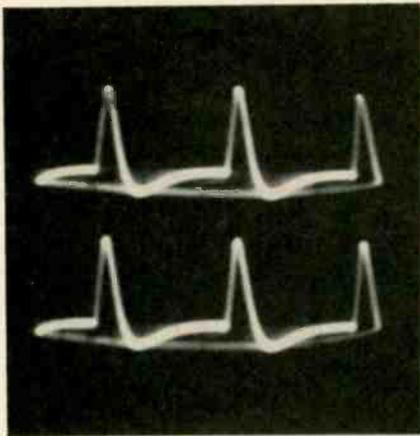
Characteristics and qualifications of vertical and horizontal amplifiers—necessary to be fully known when selecting a suitable scope—will also be discussed at length in a forthcoming article of this series. ■
Illustration credit: Courtesy John F. Rider, Publisher.

Troubleshooting Printed Circuit Boards

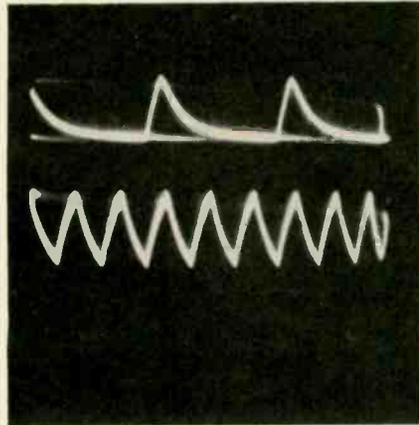
Add an inexpensive 'flip-flop' to your bench and make accurate and rapid repairs

by Bob Goodman

TV Technical Engineer



A



B

Fig. 2 (A)—Scope pattern indicating no defect in PC board. (B)—Trace indicated a defective circuit board in horizontal sync section of a color TV receiver.

■ Want to add a new dimension to your TV servicing? Then add an electronic switch to your bench.

Printed circuits *do* develop cracks and leakage between foils. This trouble can be very time consuming and difficult to trace. Serious service problems can also develop in areas where humidity, temperature and salt content of the air is high.

The technique described here is used very successfully in our TV service shop for testing and checking printed circuit boards, phenolic tube sockets and other components.

The System

The system employs a scope and electronic switch in conjunction with a pulse or audio generator for signal tracing and comparing signals from the printed circuits. When a defective section or stage is isolated to a portion of the board by conventional troubleshoot-

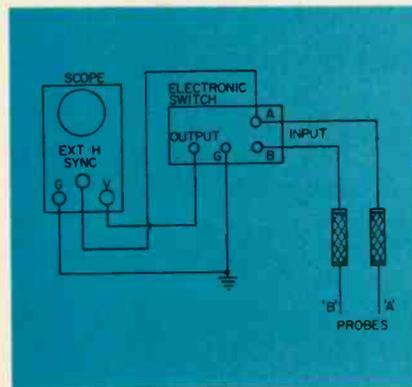
ing procedures, then probe "A" from the switch (See Fig. 1) is placed at one end of the circuit and probe "B" is connected at the other end of the same circuit. The two signal traces obtained on the scope can be compared or superimposed for exact analysis. This method is employed under dynamic circuit conditions — using normal signals existing in or produced by the set. If the circuit is not defective, the two wave shapes will be the same, but if the circuit board is cracked, open or has a high resistance, one pattern will not appear on the scope screen or it will have less amplitude or will be distorted. When checking for an intermittently open PC, you simply flex and bend the board slightly while observing the scope screen. A scope pattern indicating no defect in the PC is shown in Fig. 2A. You will observe that Fig. 2B indicates a defective circuit board in the horizontal sync section of a color TV receiver.

Testing Passive Circuits

When testing passive circuits, boards or modules that have been removed from the equipment by unplugging or unsoldering, a different setup is used.

An audio generator (Fig. 3) is used to inject a comparison signal into the circuit with probe "B" and probe "A" is placed at the output of the circuit. The two waveforms are then compared for a difference which would, of course, indicate a circuit defect. A scope pattern indicating a very high resistance solder

Fig. 1—Setup for troubleshooting PC boards with electronic switch and scope.



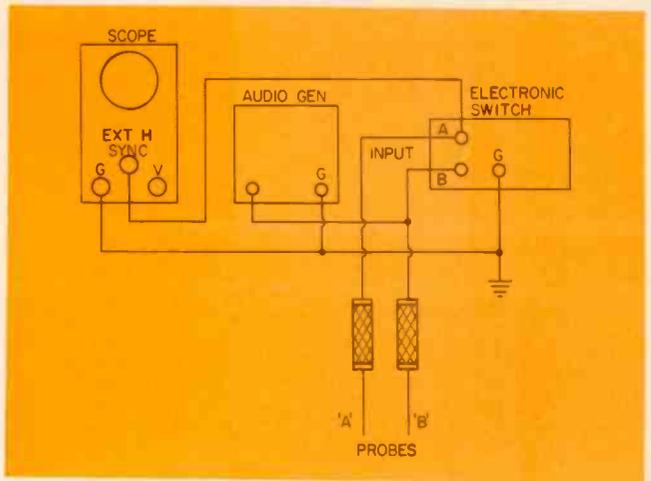
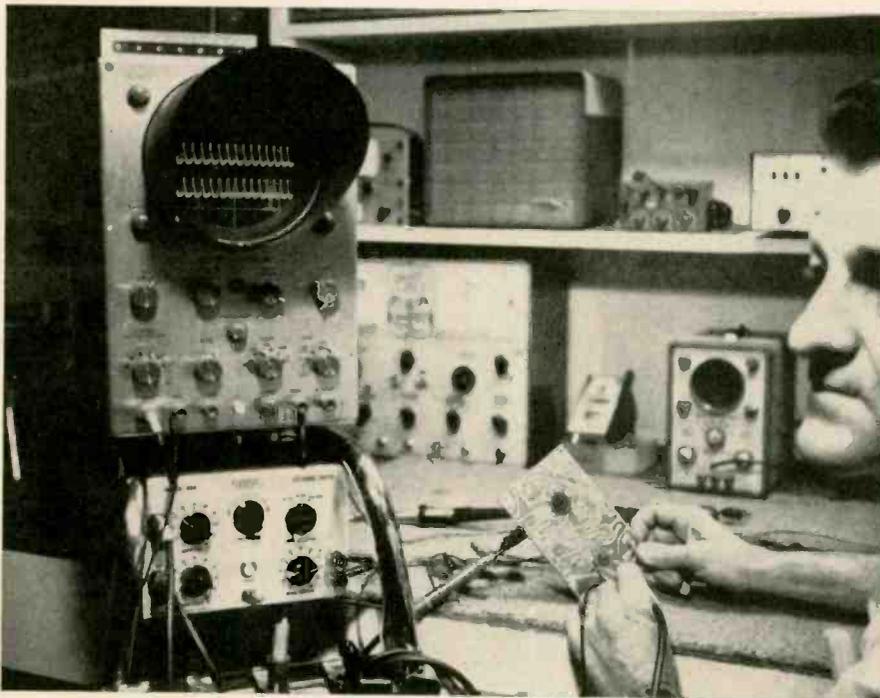


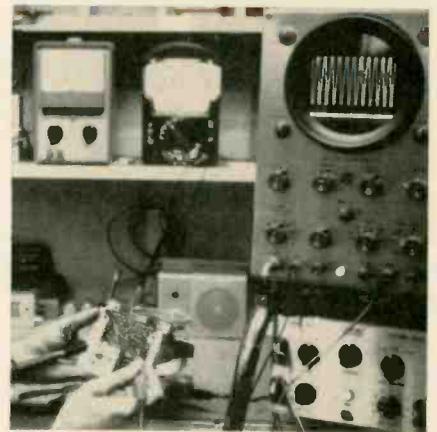
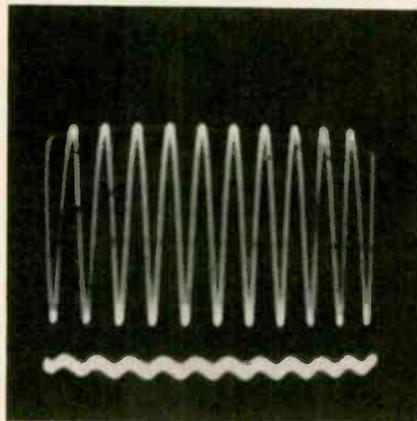
Fig. 3—Setup employing audio generator, switch and scope.

(Lower right)—Technician locates cold solder joint in transistor radio.



Technician testing a passive printed board removed from equipment.

Fig. 4—Scope pattern indicates high resistance solder joint in transistor radio.



joint in the PC foil of a small transistor radio is shown in Fig. 4.

Leakage Tests

I have often used another system to locate leakage between foils and from foils to ground. This system also works nicely for locating leakage points between pin terminals of a phenolic tube socket and PC R/C component networks.

The set-up here (Fig. 5) employs a pulse generator that produces pulses from 200 to 800 v P-P at a frequency of 60 to 8K cps. Before injecting this pulse, however, all components: transistors, coils and resistors should be removed from the circuit with a desoldering iron; only one lead of each component is removed. This prevents possible damage to one or more components.

Probe "B" is placed on the circuit foil in the suspected area and probe "A" is placed on adjacent circuit foils and the scope trace is observed. In this test you should use a voltage divider probe to pre-

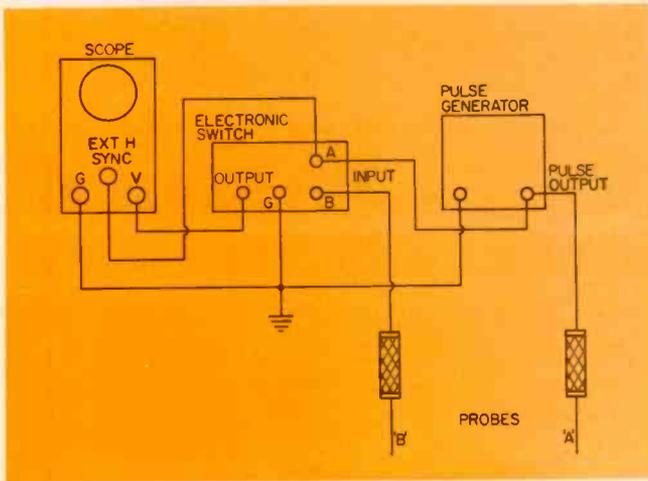
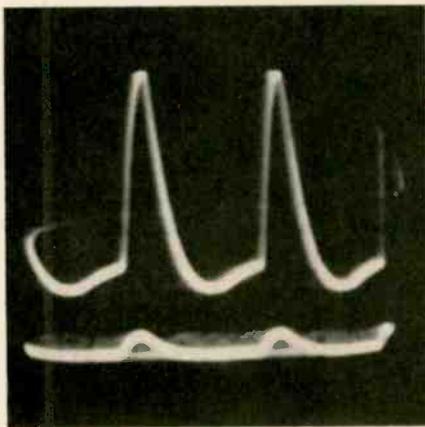


Fig. 5—Setup employing pulse generator, switch and scope.

Fig. 6 (Lower left)—Closeup of the two waveforms with leakage indicated. (Lower Right)—Technician locates leakage in the IF section of a color TV printed board.



vent damage to the switch or scope. A straight horizontal line indicates no leakage, but a line with any waviness will indicate trouble. Do not ground the circuit board to the equipment in this test. You can then move probe "A" to circuit ground and detect any leakage from foil to ground. The technician shown in Fig. 6A has located leakage in the IF section of a color TV printed board. The scope pattern shows a small amount of leakage. A closeup of the two waveforms is shown in Fig. 6B. The leakage is clearly indicated by the bottom trace.

Now you may wonder why we do not use a VTVM for these resistance and leakage tests. The answer is simple: The average VTVM will not show up this type of leakage. The circuit board will not break down and show leakage until a high pulse voltage is applied and a sensitive scope is used to detect the leakage.

For those "hot" intermittents, use a heat lamp. For "cold" intermit-

tents employ spray-can "freeze."

The advantage of using an electronic switch in printed board servicing is obvious: you have two waveforms, one from each end of the circuit foil, which are easily compared on the scope or may be superimposed for exact analysis. There's little room for guesswork with this technique.

We use this system for the more difficult service problems too. If you keep in practice by using this system you can pinpoint circuit board defects very quickly.

The electronic switch need not be too costly. One that has horizontal sweep up to 8 kc and vertical amplifier response to 500 kc will do a fine job. The switch does not need to be a wide band type even for color TV servicing because you do not need to see the 3.58 Mc burst or the complete bandwidth in chroma circuits. Only a comparison waveform is needed. In color TV service work about 95 percent of the testing can be done with a general purpose scope.

The system has proven to be highly successful in checking color and B/W TV, stereo amplifiers, two-way FM radios and small transistor radios.

The electronic switch is a very versatile instrument and can be used in many different testing techniques. It can be used with a scope for checking the delay line in color TV sets. The amount of delay in the line can easily be determined. Various components and leakage between elements of multi-packaged R/C networks can also be checked with the scope and switch setup. At the present time I am working out a method for testing micro-module units with switch and scope.

I believe the techniques outlined here can speed servicing and repair, produce more realistic returns on labor involved and provide a higher level of customer satisfaction. I believe the system will prove especially attractive to technicians in the near future when solid-state component PCs are widely used in consumer products. ■

Impedance Measurements with

Do the job with two regular bench instruments
if a bridge is not available

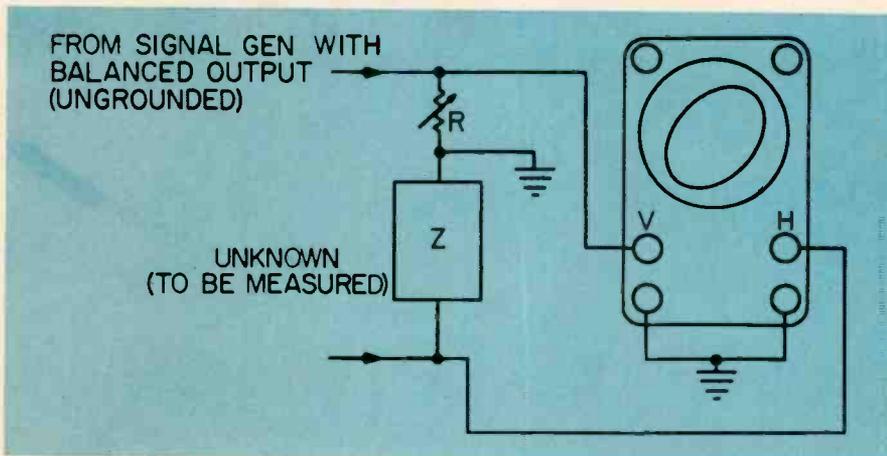


Fig. 1—Setup for making impedance measurements.

■ Many technicians run into impedance problems every day that can't be solved because an impedance bridge is not available. And they do not know how practical measurements in all areas can be made with a signal generator and a scope.

For example, I once wanted to know the radiation resistance of a broadcast tower. By using this method it came out to 79 Ω . Several months later I measured it on an expensive RF bridge and it checked out at 77.6 Ω . We use the system here in our measurements course and students check results against a \$500 bridge.

The Basic System

The system uses a single signal, split into two fractions by a voltage divider network. One fraction is sent to the scope's vertical input and the other fraction to the horizontal input. The resulting pattern on the CRT screen is stationary but

the shape varies from a straight line through various proportions of ellipses to a circle. The magnitude and phase of the unknown can be determined to a fair approximation from the pattern.

The frequency of measurement is limited only by the scope's vertical amplifier capabilities. And if high RF measurements are to be made, the signal must be fed directly to the CRT's deflection plates. The signal must be strong enough to give a sizable pattern on the screen. In many cases, the measurement is a comparison to a known resistance and this resistor should be non-inductive, of course. And the signal generator must have a balanced output (ungrounded) or an isolation transformer must be placed between the generator and the circuit. On RF, a pickup coil coupled to the signal generator will serve. The setup is shown in Fig. 1.

The setup shown in Fig. 2 must be used for high RF which the

scope amplifiers will not pass. The procedure here is as follows: (Refer to Fig. 3.)

Adjust R so that the H deflection equals the V deflection. Then (if the deflection in v/in. or v/cm is the same in both directions), the magnitude of Z (the unknown) is equal to R. The phase angle of Z can be determined from the following (eq. 1):

$$\sin \theta = \frac{X}{H} \text{ or } \sin \theta = \frac{Y}{V}$$

The two deflections per unit length can be easily set to be equal. Apply any ac voltage to first the V input and then the H input and adjust the vertical and horizontal gain controls so the amounts of deflection are equal. Now (by eq. 2) the magnitude of:

$$Z = R \frac{H \times \text{volts per inch horizontal}}{V \times \text{volts per inch vertical}}$$

and $\sin \theta = \frac{X}{H}$ as before because both X and H are in the same direction.

This procedure takes care of the general case in which a "black box" impedance is unknown. Depending on how things are connected internally, the axis of the ellipse will be rising to the right or left for an inductive or capacitive reactance. This can be determined by placing a capacitor (or inductor) in series with a resistor of like magnitude and placing in the "Z" position and observing the slope.

Special Applications

For measuring the impedance of any unknown inductance, place

a Scope and Signal Generator

by Bob Baird

Oregon Technical Institute

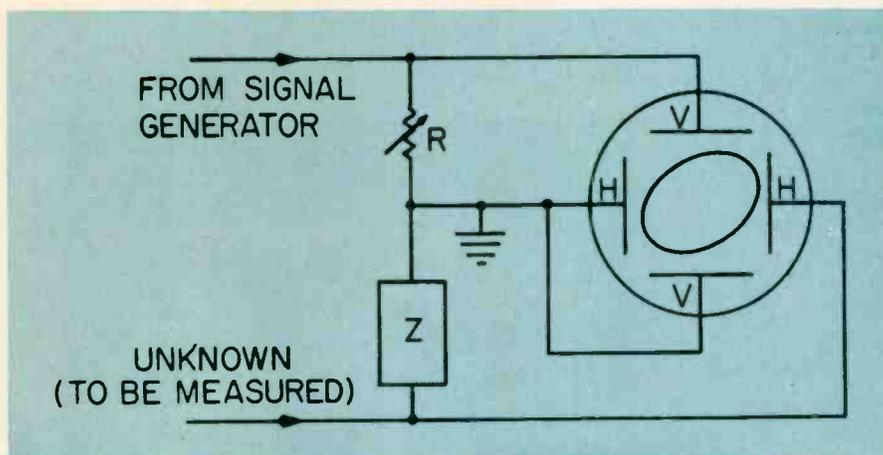


Fig. 2—Setup for high RF measurements when vertical amplifier response is not sufficiently high.

the inductance in series with a known capacitor and a resistor approximately the size of R. Adjust frequency of the signal generator until the ellipse changes to a straight line. (Make sure it changes back to an ellipse if the frequency is changed farther in the same direction.) At this point you have series resonance and:

$$L = \frac{1}{4\pi^2 f^2 C}$$

Approximately the same answer will be derived by using parallel resonance but the effects of distributed capacity of the coil may be more noticeable.

An unknown RF resistance, for example, a vertical antenna, can be measured by using the general case previously mentioned. It may be better, however, to resonate the circuit by putting either a capacitor or inductor in series with the circuit and adjusting until a straight line appears. Then: $R_x = R$ when de-

flection in H direction equals the deflection in the V direction. Here R becomes critical as to possible inductive properties. A standard dummy load might be used in which case equation 2 holds. Another possibility is a straight carbon resistor approximately the value of the unknown. The resistance can be determined with a VTVM after the measurement has been completed.

To determine the frequency at which an antenna resonates while observing from the transmission line end, connect the feeders in the "Z" position. Adjust the signal generator until the ellipse goes to a straight line vertically and note frequency. Assuming non-resonant feeders into a 72Ω antenna, the magnitude should be near 72Ω .

Many other special applications of this system will occur to alert technicians. And, although the system does not yield precision measurements, it is usually close. ■

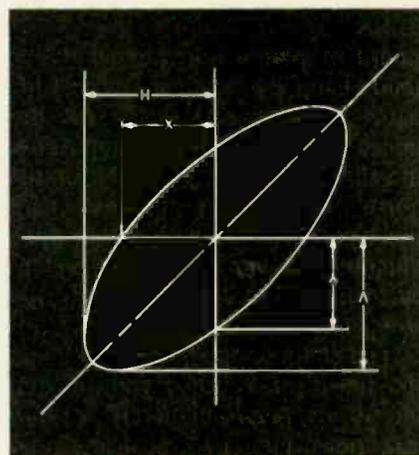


Fig. 3—Method of calculating impedance from scope pattern. A slightly different arrangement can be used for calculating phase differences also.

Test and Troubleshooting

They won't think for you but the job can be done more

■ The nature of the TV service business today — particularly in the fast-growing color TV service area — renders obsolescent the “wet finger” and “screw-driver-to-chassis” techniques that worked successfully in past years.

No one who has been around the service business for 20 years or longer, however, can say that these primitive methods did not produce results. When practiced by those old-time experts who knew precisely what they were doing, the methods worked.

But times have changed, most of these experts have retired and more production per-man-hour has become a universal space-age byword — particularly in the service industry.

Now most consumers want the job done immediately — or *yesterday!* And if we don't give fast service — and the best service possible at the lowest cost consistent with modern business methods — we won't survive the competitive pressures.

But even if we are fortunate enough to have a complete array of the most modern test and troubleshooting instruments, this won't solve our problems unless we understand how the instruments work, what they can and can't do, and practice using them until their applications, in each particular case, become automatic — producing efficient and rapid results. The finest test instrument made won't automatically apply itself to a job and it won't do your thinking for you. But some of the instruments made today will do almost everything else. Most of these instruments have been designed to get specific jobs done faster and more efficiently.

ELECTRONIC TECHNICIAN is now putting some of these instruments “through the mill.” Various items are being checked, under practical service conditions, in our new TEKLAB section.

Some of these instruments are shown here and briefly described. Others will follow from time to time. And operating functions, procedures and circuits will be thoroughly detailed in forthcoming issues. ■



B&K Model 1076 Analyst Keyed rainbow type color signals. In addition to this instrument's broad TV signal substitution and troubleshooting facilities for all primary B/W TV circuits, this complete flying spot scanner provides white dot, white line and cross-hatch patterns for color TV convergence, adjustments and for signal tracing color circuits. It produces color bar chroma and burst signals. Has 16 tubes plus 5 in. scanning tube.



Heath Model IG62 Color Bar/Dot Generator Keyed rainbow type color signals. Patterns include dot, cross-hatch, horizontal, vertical, shading and color bars. Has 13 tubes.

Instruments for Color

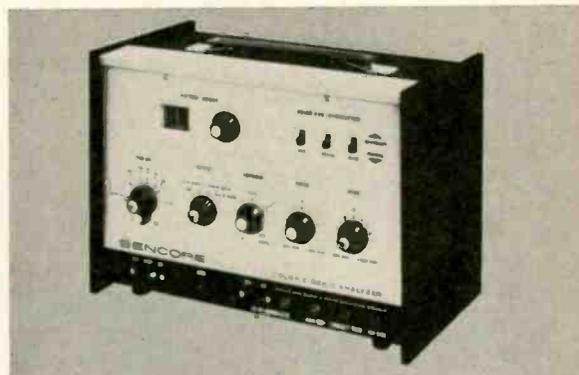
efficiently if you put them to work in your shop



Lectrotech Model V7 Color Generator and Vectorscope Keyed rainbow type color signals. Indicates phase of each color bar with respect to burst on built-in CRT. Hybrid tube/solid-state circuitry. Gun killer. Provides vertical and horizontal lines, cross-hatch, dots and color bars. Enclosed test lead compartment.



Jackson Model 800 Bar/Dot Generator NTSC type color signals. Patterns include cross-hatch, horizontal and vertical lines, dots and color bars. Gun killer. Has 14 tubes.



Sencore Model CA122 Color Circuit Analyzer Keyed rainbow type signals. Provides modulated RF and IF signals with white dots, vertical and horizontal bars, color bars, cross-hatch and shading bars. Has rotating, illuminated color indicator. Gun killer. Enclosed test leads. Has 11 tubes.

ONE MAN CAN ERECT FRINGE AREA ANTENNAS

Mount the mast solidly on the ground instead
of the roof if you have a choice

by Dennis Crisp

■ Last month we reviewed some major considerations in one-man fringe- and far-fringe antenna installations. Suggestions were made regarding mast and accessory selections and we listed the necessary tools required to do the job efficiently. We will now go into the "nuts-and-bolts" details of antenna location and installation.

Locating and Erecting

You'll probably have at least three viewpoints to consider in deciding where to locate the antenna. From your viewpoint it should be located at a gable, free of trees and power lines — 25 ft from the property line. The TV set should be just inside the wall directly behind the mast for shortest lead-in run.

The man of the house normally won't care where the antenna is located if he gets good reception, the antenna doesn't fall on the neighbor's house or car if it should blow down and doesn't interfere with mowing the lawn. The lady of the house will wonder why "all those wires are necessary," why the antenna can't be installed back of the house or better still, hidden in the

attic. Somehow, you must resolve all this diplomatically, compromise very little — remembering that it's your neck, your antenna installation, your responsibility to get the best reception possible and you have to service it or you may even have to take it down and move it to another location.

If the houses are too close together you'll have to choose between going to the back yard or the roof. If you have to trim too many branches off trees to clear guy wires and antenna, go to the roof. But mount the mast on the ground if you have a choice.

Let's put the antenna up at the end of the house. First, referring to Fig. 1 (see inset for motor, antenna mounting details), mount a wall bracket high up, centered on the gable and place one screw-eye beside it. Set two ladders as shown and install two screw-eyes at each location. Install two more screw-eyes on the ridge about 20 ft back from the brackets — and make sure you set these into the ridge beam.

Next, drive a 7-ft tee-post in the yard about 20 ft from the house

and sink it down about 2 ft — depending on the soil consistency. Set the mast base against the house foundation and telescope out the second joint from the bottom, pin and lock it. Lift the top end of the mast and support it on the prop. Pull out the top section about 3 ft and mount the rotator 2 ft from the top. Mount the thrust bearing 3 in. from the top. Use a 4-ft section of 1¼ in. tubing to mount antenna to rotator through thrust bearing. Mount one single 3-in. standoff on stub mast 6 in. above mast top section opposite the mast.

If you use "snap-on" instead of "wrap-around" stand-offs, tape them to the mast, criss-crossing with friction tape — not plastic tape. Mount another single 3-in. standoff on top section just above thrust bearing and 180 deg opposite the first standoff. Slice the end of the lead-in down about 6 in. with a sharp knife and connect twin lead wires to antenna terminals and then attach lead-in to first standoff and clamp it — leaving a little slack. Now spray lead-in terminal screws with insulating plastic, let dry a few moments and tape

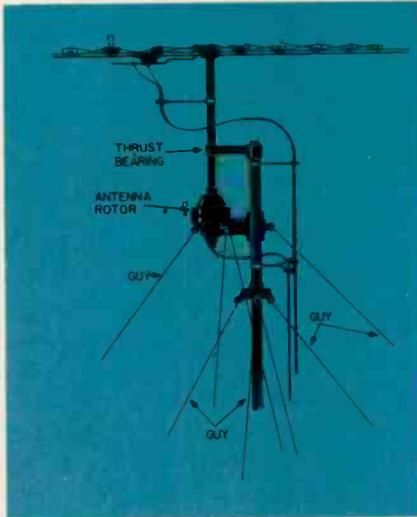


Fig. 1—Setup for erecting 40-ft antenna at end of house.

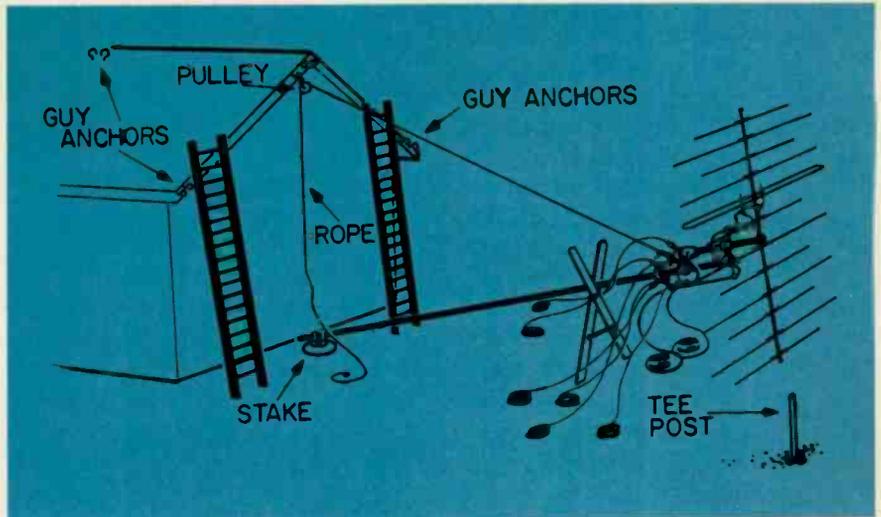


Fig. 2—Setup for mounting antenna on roof.

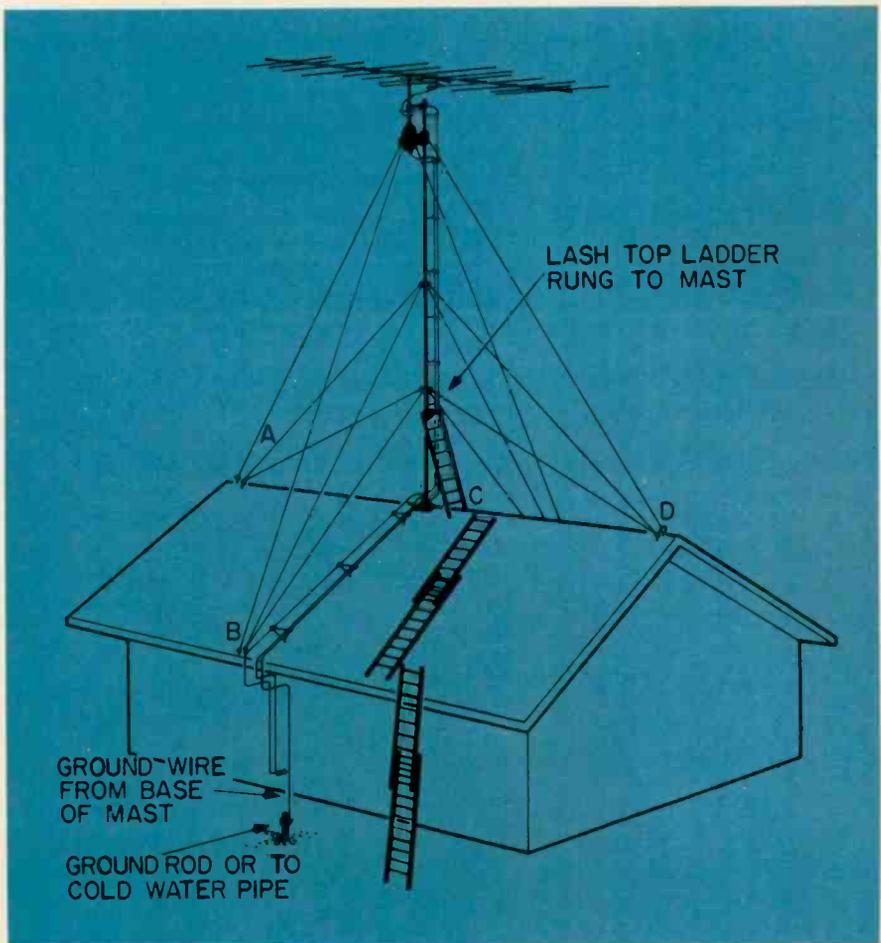
over with *plastic tape* — binding about 2 in. of each wire to the antenna's driven element to prevent tension on the lead-in connections at the antenna terminals.

Check the rotator's position. It should be north — fully counter-clockwise. Leave only enough slack in the lead-in to allow one-half revolution of antenna. The other half of rotation will be away from the lower standoff which will merely place the wire on the other side of the mast.

Mount a double inline standoff just below the rotator. Connect the rotator cable to rotor and clamp it to the inside insulator of the standoff. The lead-in goes to the outside insulator. String lead-in wires down near base of mast and place wire coils or spools on the ground.

String one end of your rope through pulley, snap pulley to screw-eye beside wall bracket and attach the rope to the mast just below rotator.

Now up she goes! Lift the mast to your shoulder, pull on rope and walk forward, lifting mast by pulling on the rope while supporting



and guiding it with arm and shoulder. When the mast is vertical, lift and pull the base end away from the wall about 2 ft, allowing the mast to rest against the open bracket at the gable. Tie the rope to the base of the mast so it won't slip and go slack.

Go to the roof and fasten the mast loosely in the bracket. Return to the ground and position the mast so it is vertical with the bracket. Shift it out of the way a few inches and drive your steel stake at this spot, leaving about 6 in. of the stake above ground. Drop a disc over the stake, curved side up, and set mast down over stake. Go back to the roof with additional guy wire and two double inline standoffs. Tighten wall bracket, tie four guy wires to tie points on rotator, unreel sufficient guy wire to loosely reach screw-eyes — keeping rolls intact to prevent kinking.

Lift the top section of the mast, watching pin holes, to see when end of section clears. These masts are not supposed to pull apart but don't bet on it. Pin and lock mast, check antenna orientation (straight north). Install a double inline standoff just below guy ring on next section, mount lead-in and clamp. Tie second set of guy wires at this point and string them out to anchors — attaching loosely. Now telescope out the second mast section, pin and lock — and the antenna is up.

Go around, first to windward and untie upper guy wire and let it trail

behind you. Pull gently and uncurl wire as you pull, leaving just a few turns. Cut it off—leaving a few ft for leeway and tie temporarily. Now go around to the other anchors and do the same. The dead calm you were experiencing when you started the job has now probably changed to 20-mile gusts and you can see the value of having a ladder at each anchor point. When you have the guy wires anchored temporarily, heave a big sigh of relief, smoke, get a drink of water or take a coffee break.

Now sight up the mast and adjust your guy wires to make it nice and straight. Cut your wire ends off leaving about a ft of excess, thread ends through screw-eyes, pull wires snug and tie by wrapping straight around for four or five turns then spiral the excess up the main wire. Proceed in the conventional manner to hook up lightning arrestor and TV set.

Repair Or Move

Now if you have to repair or move this antenna in the future, you simply loosen guy wires about 6 in. at two adjoining anchor positions, loosen "L" handle just above roof, pull safety pin and telescope down; likewise with the upper section. You don't have to disturb the standoffs (since you have one placed at the top of each telescoping section) unless you need to replace the lead-in. The repairs are made and up she goes again.

To move the antenna, telescope

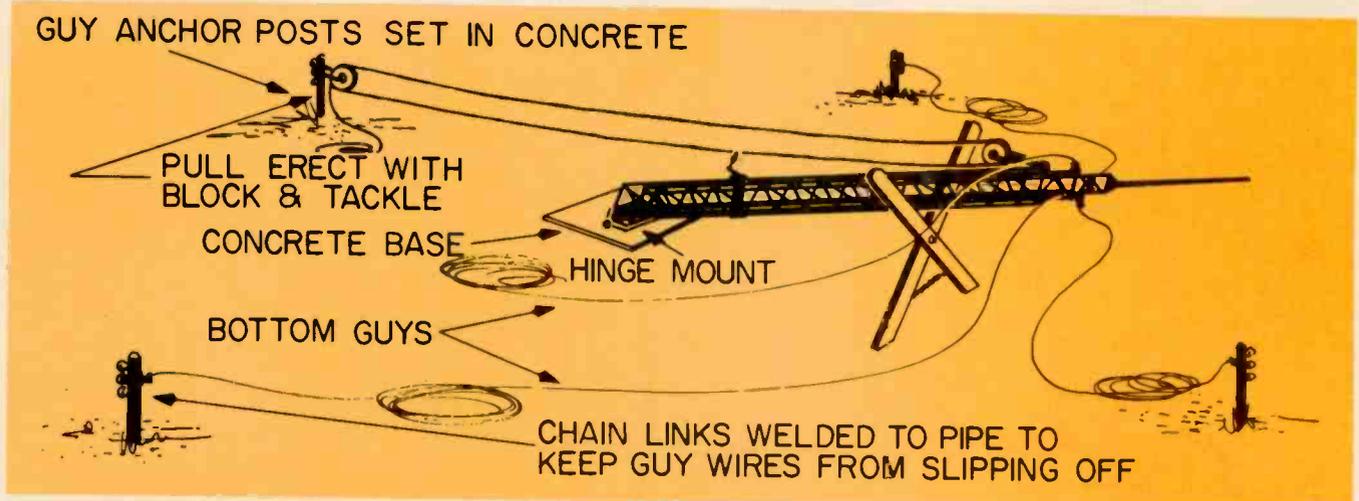
down to the roof, remove antenna and fold up elements, untie and coil up guy wires, tie on your rope, snap on the pulley, let her down, bundle up the lead-in and rotator cable, telescope the mast as far as possible, load ladders and mast on top and away you go. Take the wall bracket and disc with you but leave the screw-eyes where they are. If you don't get the next job for this location — well, your competition will probably be obligated to you in a cheap way.

Roof Mounting

Much of the aforementioned procedure will apply to roof mounted antennas too. Here you should use a hinged saddle mount, locate your guy anchors, attach the lower end of mast to the mount, support mast on prop astride the roof ridge and tie on bottom guy wires as shown in Fig. 2. Estimate length of wires A, B and C and use wire D to pull mast up. If mast will now stand more or less vertically, tie and adjust bottom wires. When the mast is plumb, tie wires tight and secure, making sure anchors are in solid footing. Lean your 10-ft ladder against mast and carefully climb up far enough to tie top rung securely to mast. Ladder legs should straddle ridge. Now climb up all the way and loosen the top mast section, lift out about 2 or 2½ ft and install your rotator and antenna. It may be easier to connect lead-in to antenna before mounting

Continued on page 99

Fig. 3—Details for erecting and anchoring high telescoping tower for TV antennas.



A PROLIFIC SERVICE COMPONENT

Know the basic factors involved in selecting replacement capacitors

by C. C. Turnbaugh

Chief Engineer, Mallory Distributor Products
A Division of P. R. Mallory & Co.



Fig. 1—A 44 pf N750 and 56 pf NPO capacitor are paralleled to obtain a total of 100 pf with TC of N330.

■ An introductory article in a previous issue (*ELECTRONIC TECHNICIAN*, March 1965), outlined the historical development of the two basic capacitor types: electrostatic and electrolytic. Recent developments in both areas were detailed at length. The present article will go into practical considerations in selecting the proper capacitor for specific applications.

Selecting NTC Capacitors

Suppose we need to select a replacement capacitor for a tuned circuit in a front end. The original is a 100 pf, 500 v, N330.

We find some micas and some ceramics in stock but none has N330 stamped on it. How important is the N330 to the circuit? What does it mean? Can a 100 pf mica or a 100 pf NPO or N750 ceramic be used as a replacement? The answer is no. A capacitor with the correct temperature compensating (TC) rating must be used.

The "N" on the N330 means the capacitor will drift or change capacity in a *negative direction* as the temperature rises, 330 parts per million (ppm) per degree centigrade. In doing so, the capacitor compensates for changes in the value of other associated components in the circuit — the coil and interelectrode capacity of the electron tube, for example.

In checking out stock, suppose we find several values of NPO (zero TC) and N750 but no N330. A 100 pf N330 can be made if we

have the correct values of NPO and N750 types in stock. The proper values of each capacitor can be determined from the following formula:

Multiply the desired capacity by the desired TC = $100 \times 330 = 33000$. Divide 33000 by the TC rating of the capacitor on hand (N750) = $33000 \div 750 = 44$ pf (N75). Subtract N750 value from *desired* value = $100 - 44 = 56$ pf (NPO). We can now connect 44 pf N750 in parallel with 56 pf NPO and have a total of 100 pf with TC of N330 (See Fig. 1). Since it is difficult to find a rating of 44 pf, the nearest value of 47 pf N750 will be satisfactory.

The change in capacity of a TC capacitor with change in temperature can be determined from the following formula:

$$C_t = \frac{(TC)(C_{25})(\Delta T)}{10^6} + C_{25}$$

C_t = Total capacity at end of temperature excursion

TC = Temperature compensating rating of the capacitor (N330, N750, etc.)

C_{25} = Capacity value measured at room temperature

ΔT = Number of degrees of temperature change

An example of how the formula is used follows:

Given: A capacitor rated at 100 pf with a TC rating of N330.

Find: Value of capacitance as the ambient temperature increases from 25° to 55°C. What is the total capacitance change?

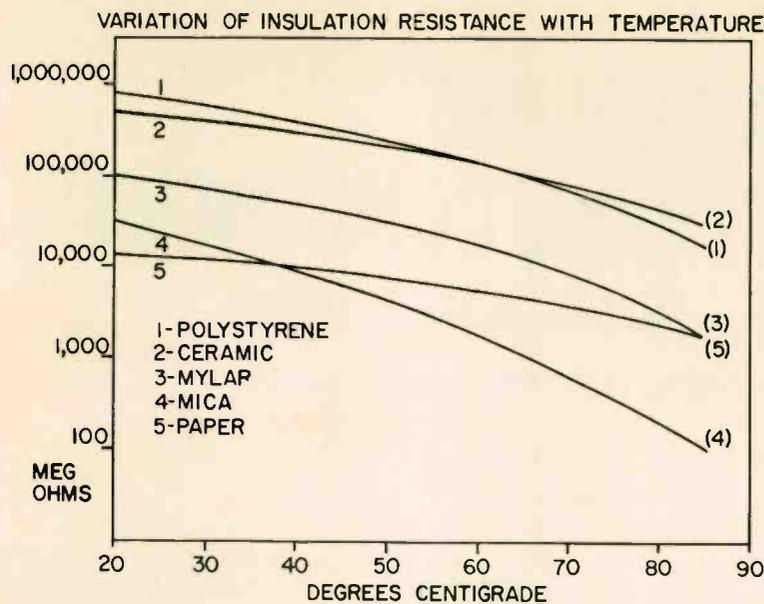
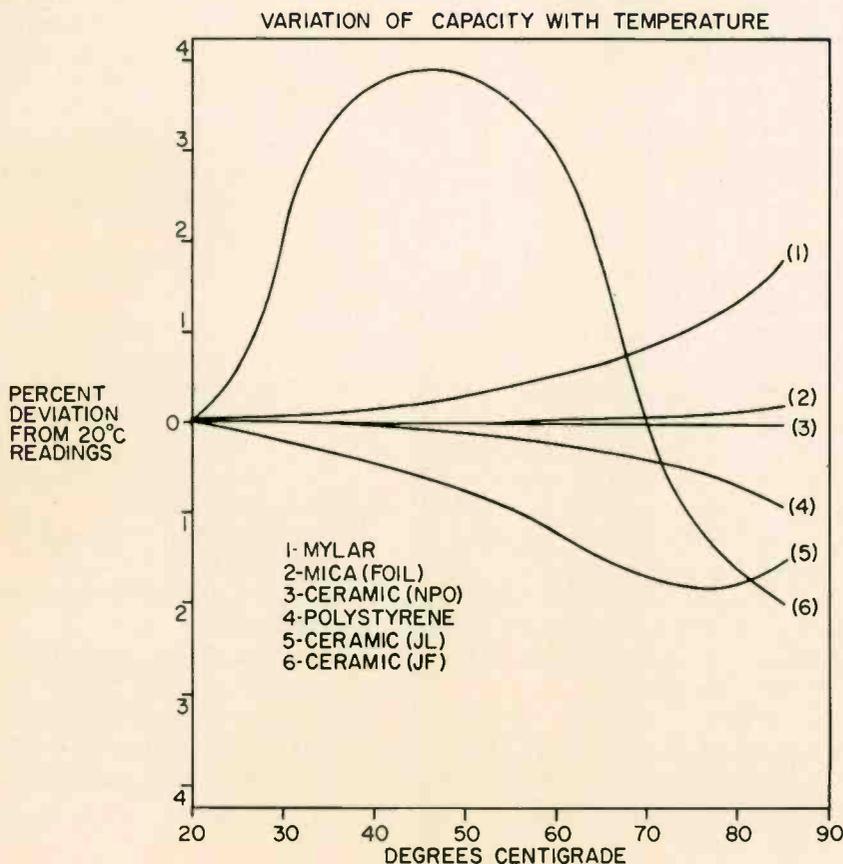


Fig. 2—Drift characteristics of popular capacitor materials.

Fig. 3—Curves indicate drift characteristics of mica as compared to different ceramic types.



$$C_t = \frac{(-330)(100)(30)}{10^6} + 100$$

$$C_t = \frac{-990000}{10^6} + 100$$

$C_t = 99.01$ pf capacity value at 55°C ambient

$\Delta_c = 100 - 99.01 = 0.99$ pf total capacitance change.

Drift Characteristics

Drift with temperature varies widely with different dielectric materials. The graph (Fig. 2) shows drift characteristics of popular capacitor materials.

We can see that it would be impractical to substitute a mica for a TC ceramic, but how about the other side of the coin? Can we replace a mica with a ceramic? The answer is most of the time. The curves (Fig. 3) indicate drift characteristics of mica as compared to different types of ceramic. We can say that it is always negative-positive-zero. This means, drift is negligible with changes in temperature (see curve). If the circuit application is not critical, replacement of mica from the temperature stable GP (general purpose) or the frequency stable (JF) types can be used. Ceramic capacitors that are temperature compensated will have low dielectric constant (K). The physical size will be larger than an equivalent capacitor having a high "K" dielectric.

What is "K?" "K" is the dielectric constant of material and is equal to the ratio of the capacitance of a capacitor using the material under question as a dielectric, to the capacitance of the same capacitor using vacuum as a dielectric.

Dielectric constant (K) of various materials is shown in Table I.

Generally speaking, the higher the value of "K" the more unstable the capacitor with temperature change. TC type ceramics are constructed using low "K" material, hence better stability.

Power Factor

Ceramic capacitors have a higher percentage of power factor (0.001%) than micas (0.0006%), but this is not objectionable in the average circuit. Power factor is the ratio of power loss in the dielectric

to the product of applied voltage and current, or

$$\% \text{ pf} = \frac{\text{total power loss in w}}{\text{volt} \times \text{amps}} \times 100$$

Power factor is a (measure) of the efficiency of a capacitor. The lower the power factor the higher the efficiency. Another term used in connection with capacitors is "Q." "Q" is a "figure of merit" and applies to many components. With capacitors in particular, it is expressed as the ratio of reactance to resistance.

$$Q = \frac{X_c}{R}$$

From the equation, we can see that "R" changes in an inverse direction to "Q." As "R" becomes smaller, "Q" becomes higher in value. The less "R" (resistance) in a capacitor the more easily a capacitor can accept and release an electrical charge and the more closely it approaches a perfect capacitor which to date has never been manufactured. X_c is an expression of true capacitive reactance exclusive of resistance and is equal

$$\text{to } \frac{1}{2\pi fc}$$

Dissipation Factor

Dissipation factor is similar to power factor and is another term used in expressing capacitor losses and can be shown by the formula: DF in % =

$$\frac{6.28 \times \text{FREQ} \times \text{ESR} \times C \text{ in } \mu\text{f}}{10,000}$$

Dissipation factor is also the inverse of "Q." When dissipation factor or power factor readings are below 15%, little difference in readings appear, and they can be considered identical. Above 15%, the divergence becomes more pronounced with dissipation factor increasing more rapidly than power factor.

A Practical Case

Let's consider the horizontal oscillator circuit of a television set, for example, where a 3900 pf capacitor is connected in parallel with the ringing coil (Fig. 4). The original capacitor used in this circuit is usually mica. In replacing this ca-

Continued on page 100

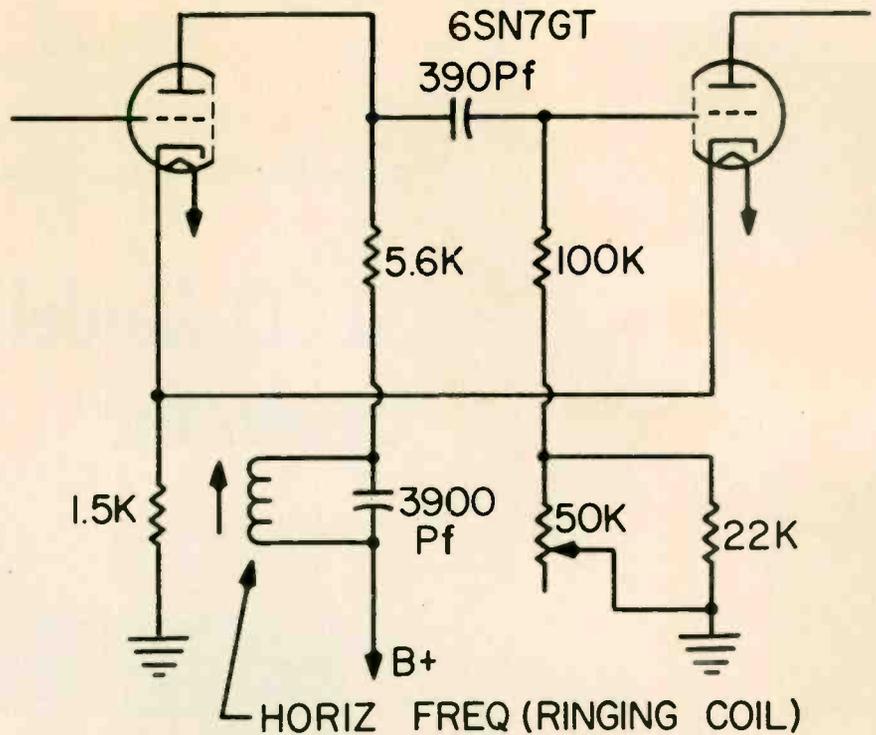


Fig. 4—Simplified circuit of horizontal oscillator using a ringing coil and 3900 pf capacitor.

Table I

MATERIAL	DIELECTRIC CONSTANT (K)
Vacuum	1.0
Dry Air	1.00059
Teflon	2.0
Polystyrene	2.5
Mylar	3.0
Polycarbonate	3.0
Kraft Paper	2 To 6
Steatite	6.3
Mica	6.8
Aluminum Oxide	7.0
Tantalum Oxide	11 To 25
Ceramic (Magnesium Titanate)	10 To 20
Ceramic (Titania)	80 To 120
Ceramic (Magnesium Orthotitanate)	2000
Ceramic (Barium Titanate)	6000

SECO Model 900 Color Generator



Seco Model 900 Color Generator

Functions, controls, signals and circuit description

■ The output of this solid-state generator contains 10 vertical color bars. The bars begin with a yellow-orange and continue through the various hues of red and blue and end up with a green stripe at the extreme right side of the screen. The bars are generated by the off-set carrier method.

The unit measures $8\frac{1}{2} \times 10\frac{1}{2} \times 3\frac{1}{2}$ in. and weighs 6 lb. In addition to the color bars the generator provides dots, crosshatch, vertical bars and horizontal bars. Ten horizontal and nine vertical lines are furnished. The width of the vertical lines can be adjusted with a front panel control. Ninety adjustable-size dots are generated. Dot size is controlled by the same dial used to adjust the vertical line size.

The ON/OFF switch is in the power transformer primary and the unit is all solid-state, requiring no warm-

up. The power supply is zener regulated.

A variable capacitor in the RF oscillator circuit may be employed to select an unused channel in your area. Channels 2, 3 or 4 can be tuned in with this front panel control.

In addition to color bars, horizontal and vertical lines and dots, a crosshatch pattern and clear raster are available. A sync modulated RF signal is fed to the set in the clear raster position. It is not video modulated hence the signal can be used for purity tests and gray scale tracking.

The amount of color modulation is controlled by a front panel COLOR OUTPUT dial. Another front panel control, the COLOR QUALITY dial, is used to stabilize the barber-pole effect present in any color display. The barber-pole effect is present be-

SERVICING RECORD CHANGERS IS A 'SNAP'

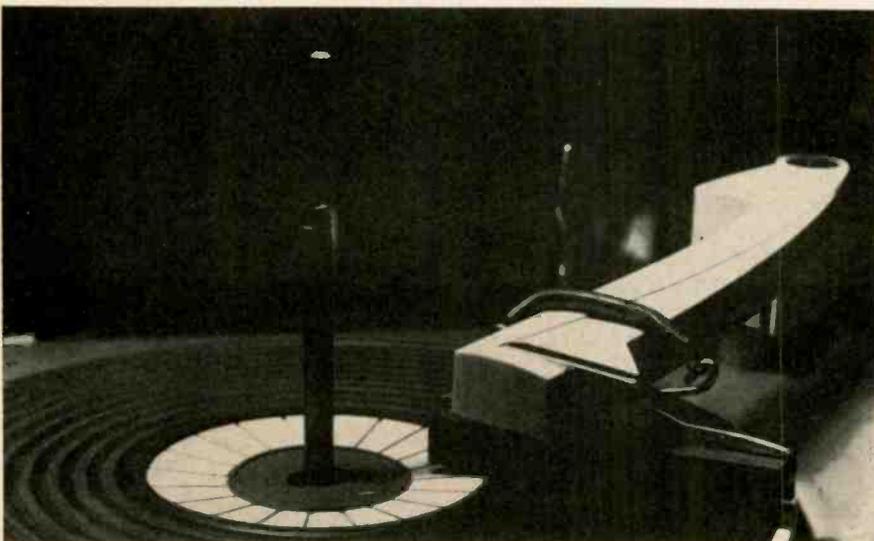
by Homer Davidson

Keep an eye open for unusual things that happen to this equipment



Removing a defective turntable from cabinet.

Phono 'arm keeper' in place.



■ If you're not repairing phonographs, especially stereo types, then you're probably passing up a substantial sum of money each month. The needle business alone is big business. And if the word "stereo" makes you flinch, forget it. The only significant difference between mono and stereo phonos is that stereo has two amplifiers and a "double" crystal.

The schematic of a typical small stereo phono is shown in Fig. 1. And the whole thing can be broken down simply into three parts:

1. The changer
2. The amplifier
3. Speakers



Burned resistors in stereo chassis.

The Changer

Most record changer troubles can be listed as follows: runs too slow, won't reject, the machine won't shut off after the last record plays, a bad needle and a defective cartridge. Other troubles can arise but these are the most common.

A slow turntable is generally caused by a worn idler wheel, slick turntable, insufficient lubrication or over-heated motor. Check the idler wheel for slick and worn spots. If the turntable thumps when it goes around, the idler wheel has a dent in it. Replace the wheel. The turntable can be cleaned with a variety of approved cleaning fluids.



Replacing cartridge in portable stereo record changer.

Lubricate the motor bearings, idler wheel and small turret drive wheels and turntable bearings. Don't put too much oil or grease on the working parts! If you apply too much it will eventually work into the rubber moving parts and cause the turntable to slow down. To prevent this, run the motor for an hour or two and then wipe off the excess oil or grease from moving parts.

A slow motor is usually caused by dry bearings and a shorted field. If the motor gets real hot after being run for two hours and slows down, replace it with a new motor assembly.

Sometimes a turntable will get dry and freeze to the spindle shaft assembly. Look for small metal shavings in the bearing. Check the reject mechanism for lubrication and bent levers. Make sure the reject system works free and easy.

The arm that holds the records down against the spindle determines the shut-off point when the last record is played. Only the thickness of the last record will hold the trip up so the last record will play its required time. The usual trouble here is that the owner will pull on the stabilizer arm at the spindle shaft. This, in time, will spring the arm and cause the changer to shut off before the last record is played. The stabilizer arm is also frequently left off to the right and not in position on the record. This will cause the changer to play the last record over and over again, of course. If bent, the arm should be straightened and the owner notified how to handle it properly to prevent recurrence.

Wow

A slick spot or uneven turntable will cause "wow." As you know, wow is a variation in pitch that takes place very slowly — less than 10 cps. It's the same as flutter except wow variations are at a slower rate.

We had an RCA changer, for example, come in the shop some time ago that had terrible wow. You can check and see this wow condition by placing a speed disc on the turntable. You can observe the slow, jerky movements of the turntable.

At first we thought the turntable had some oil on it. It was cleaned and the turntable drive was dressed down. But we still had wow. A closer look at the changer showed that the idler wheel assembly was bent down and the wheel was rotating partly on the 33 $\frac{1}{3}$ rpm turret drive and at times touched the 45 rpm turret drive wheel — causing the wheel to speed up. The idler wheel assembly was straightened and the wow disappeared.

Needles and Cartridges

Diamond needles will last much longer than sapphires before they be-

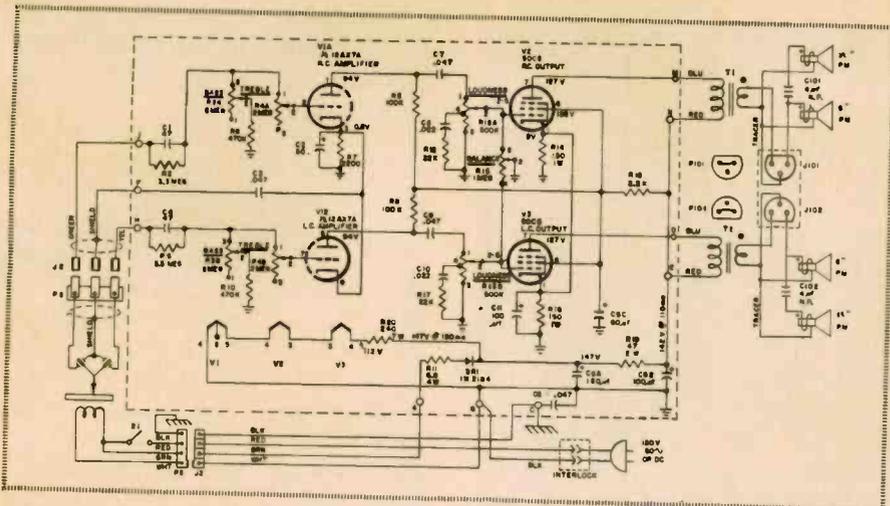


Fig. 1—Schematic of typical small stereo phono amplifier

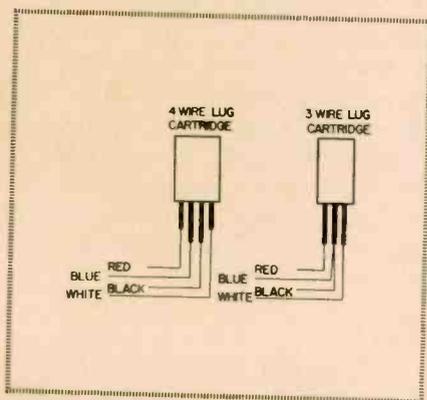


Fig. 2—Four wire and three wire stereo cartridges.

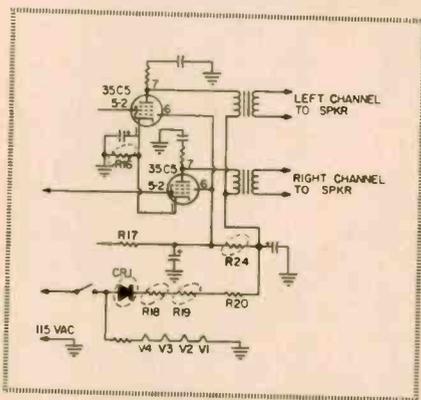


Fig. 3—The 35C5 audio output tube shorted and burned resistors R16, R24 and two 15Ω resistors in series with the rectifier.

gin to damage records. And any needle will begin to gouge away at record grooves long before it causes distortion and noise. Give your customers the facts about needles and then let them decide which they want, however.

Don't forget to keep an eye open for unusual things that happen to record changers. For example, we had one that kept losing needles. They would frequently disappear at weekly intervals usually on Thursday. And then we discovered that the customer had a maid come in to clean on that day. She did a real good job of dusting—often picking up the phono needle in her dust cloth!

Here's some tips to remember when replacing a needle or cartridge. 1) Place a small white cloth or handkerchief under the pickup arm to catch small screws that may drop. A major "dog" job can de-

velop when a tiny screw falls down under the changer and into the amplifier section. 2) Handle the crystal with extreme care. 3) And be exceptionally careful when changing that needle! 4) Use a slotted-wedge screw driver to hold the screw into position when you install a new cartridge and don't drop the cartridge. 5) Use an exact replacement cartridge or the nearest one you can find to the original.

A bad cartridge will cause distortion, mushy audio, intermittent audio, no volume, weak volume and poor balancing. Poor balancing is caused when the voltage on one side of the stereo cartridge is up and down on the other side. If you observe up and down sound or intermittent audio, check the stereo cartridge first. A defect in cartridge can often be made to show up by placing a small amount of pressure on the tip of the pickup

arm — varying the pressure up and down.

No volume and weak volume are easily identified by turning the volume full on. You'll get more-than-normal pickup hum. Touch the ungrounded side of the cartridge connection and a loud hum will be heard.

If you are replacing a three wire cartridge with a four wire job, or vice versa, (Fig. 2) remember the center connection on the three wire cartridge is ground. Be exceptionally careful if you have to solder direct to a cartridge. When substituting a replacement cartridge for the original, check the output voltages and weights. Match them as closely as possible.

The tone or pickup arm should be held in a safe position when working on the changer or when the stereo player is being delivered. Some technicians tie the arm to the center post and some snap the arm into the holder, if one is provided. We use a gadget constructed around an 8-lb-pull magnet, stiff wire and spring as shown in the photo. The spring is spread over the pickup head and the magnet will hold it securely to the turntable or metal base. This is also helpful when the changer is turned upside down while repairs or adjustments are being made. The arm does not dangle and bang against the bench or turntable and damage the needle or cartridge assembly.

The Amplifier

A stereo amplifier has two inputs, two separate amplifying sections and two outputs. The amplifier sections can have low volume, no volume, one section dead or weak, poor balance and an intermittent audio section. You generally begin on a defective amplifier by checking all tubes on a tube tester. If replacement tubes fail to bring the amplifiers up to par, then check beneath the chassis.

Use a signal tracer to check stage by stage if one stage is defective. By placing the signal tracer probe to each tube grid and plate, the defective or weak stage will show up. Another good method is to run a signal

Continued on page 98

10 facts you should know about color-bar generators

If you are going to buy a color-bar generator—or even if you already own one—here are several facts you should know.

While other types of test instruments may lack one or more features, they may still be useful in skilled hands—provided the user is aware of their shortcomings and provided he has other means of determining what he must know.

This is not true of a color-bar generator.

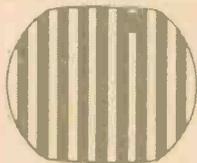
A color-bar generator should allow you to walk away from an adjusted receiver knowing that the owner can turn it on and receive color broadcasts in full-fidelity color and sound.

Not all color-bar generators can give you this assurance.

Let's talk facts.

FACT NO. 1: *A gated-rainbow type generator is accepted as the standard of the service industry*

You do not need fully saturated NTSC colors to achieve perfect adjustment any more than you need an FCC-type broadcast signal for tuner and if-amplifier alignment. The gated-rainbow type signals are used by virtually all TV manufacturers in establishing service procedures for their sets.



Gated rainbow color-bar pattern

Urgent service needs for a trustworthy color-signal source were met years ago when RCA introduced the gated-rainbow system.

Today, this basic system is used in nearly all service-type color-bar generators. The waveforms and procedures in nearly all color-TV service notes are based on this system.

FACT NO. 2: *All gated-rainbow type generators are not alike*

In spite of their basic circuit similarities, available models differ in their features, accuracy, and ultimate usefulness. Some of these differences are critical.

FACT NO. 3: *The offset subcarrier oscillator must be controlled within a few cycles of its true frequency*

This oscillator controls the phase angles (hues) of the color-bar pattern. It is the heart of the color-bar generator.

The subcarrier oscillator should be within ± 20 cps of its fundamental frequency of 3.563795 megacycles. In the crystal-controlled RCA WR-64B Color-Bar/Dot/Crosshatch Generator, this deviation is kept well within the ± 20 cps limit.

FACT NO. 4: *Provision must be included to prevent the subcarrier oscillator from drifting off frequency*

The subcarrier oscillator must not only be accurate when the instrument is new—it must

stay accurate. Top-quality components minimize undesirable frequency changes.

Check, for instance, the trimmer capacitor used in the 3.56-Mc subcarrier oscillator. You'll find a piston-type ceramic capacitor—not a flat mica type—in the RCA WR-64B.

FACT NO. 5: *The generator must have an rf-sound carrier to assure proper setting of the fine-tuning control*

Unless your color-bar generator has this essential feature, it may produce a perfect color-bar pattern on the receiver, but at the wrong setting of the receiver fine-tuning control. In such cases, the receiver may not correctly reproduce a color program.

The WR-64B has this necessary feature. With it, you can accurately set the fine-tuning control before making color adjustments. In the WR-64B the rf-sound carrier is also crystal-controlled.

FACT NO. 6: *The rf picture carrier must be exactly on frequency to assure that the color subcarrier is correctly placed in the receiver bandpass*

Drift, faulty adjustment, or aging of components in the rf oscillator section can move the generator picture carrier off frequency. This shift, in turn, will also move the color subcarrier signal away from its correct position in the receiver bandpass. In some receivers, this shift will affect accuracy of color-circuit adjustments.

A separate crystal-controlled oscillator is used in the WR-64B to keep the picture exactly on frequency.

FACT NO. 7: *The axes of the output color-bar pulses should lie on the zero axis—and not on elevated brightness pedestals*

Elevated pulses necessitate use of an oscilloscope for accurate setting of receiver phasing. A generator having zero-axis color-bar pulses, such as the WR-64B, does not require use of an oscilloscope for checking phasing in the customer's home.

FACT NO. 8: *The generator should not require frequent adjustment of internal counter circuits*

All color-bar generators contain circuits which develop vertical and horizontal sync, and dot-and-bar-pattern signals, by dividing or counting down from a higher frequency: usually 189 Kc. If one of these circuits is unstable, the patterns can jitter, ripple, jump sync or contain the wrong number of dots or bars.

Conventional R-C circuits are used in the counters of most generators. But the RCA WR-64B uses inherently stable iron-core in-

ductors in its counters, thereby assuring long-term counter-circuit stability.

FACT NO. 9: *The proper way to check receiver color performance is to feed the generator signal into the antenna terminals*

Color performance depends on overall receiver condition—not on that of a single section alone. A color-test signal fed directly into the video amplifier—rather than through the antenna terminals—will not provide a proper check of the complete receiver. The only method you should use in adjusting the receiver, therefore, is the rf-signal-input method—the method provided by the RCA WR-64B.

FACT NO. 10: *There is no "best" dot size or bar width for convergence adjustments*

Generator dot size or bar width has no significance for convergence adjustments.

Veteran technicians, however, have found that very small dots or thin bars are difficult to use under average lighting conditions. If receiver brightness is turned up to overcome this handicap, blooming will result. Proper convergence cannot be achieved under this abnormal condition.

The dot and bar size of the WR-64B is small enough to permit exact, speedy adjustment, and large enough to be useful under average lighting conditions.

These are ten specific facts you should know about color-bar generators. They add up to this

FACT: *The new RCA WR-64B has all the features you need for complete color-circuit adjustment*

It's the one color-bar generator that meets all servicing requirements—from the company that pioneered and developed the color-TV system now in universal use: RCA!

Order it today from your local Authorized RCA Test Equipment Distributor.



\$189.50* *Optional distributor resale price. May be slightly higher in Alaska, Hawaii and the West. Prices subject to change without notice.

RCA ELECTRONIC COMPONENTS AND DEVICES,
HARRISON, NEW JERSEY

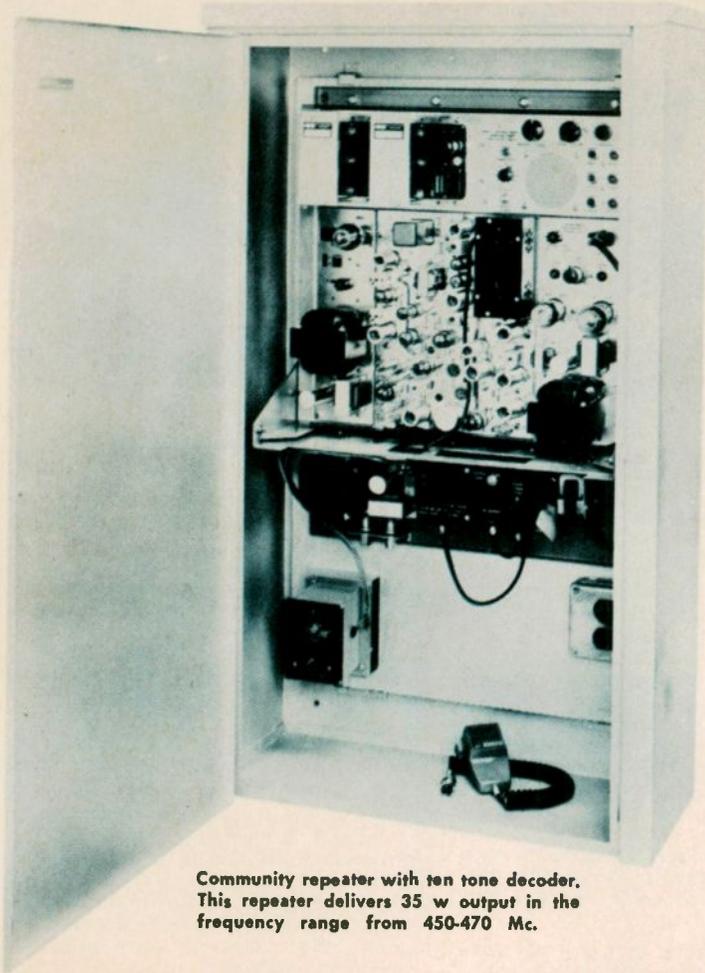


The Most Trusted Name in Electronics

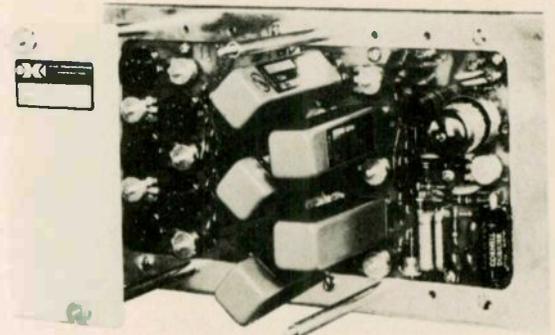
Two-Way

by Frank A. Genocchio

KAAR Engineering Corp.



Community repeater with ten tone decoder. This repeater delivers 35 w output in the frequency range from 450-470 Mc.



Sub-audible tone unit. Five tone reeds are shown installed with provisions made for five more.

■ Press reports on communications satellites Relay, Telstar and Syncom have captured the public imagination with exciting stories about how these orbiting satellites provide long range intercontinental communications. Earthbound counterparts, although certainly less glamorous, are providing a much needed answer to the communications needs of thousands of two-way radio users.

The communications satellite receives and retransmits microwave radio signals from widely separated stations — taking advantage of the strategic position of the orbiting satellite with its built in repeater to provide long range coverage. UHF repeaters, as used in mobile radio systems, perform a similar relay function from a building or mountain top location and provide extended range communications.

Usage Increases

The impact of UHF repeater use is evidenced by increased activity in the 450-470 Mc UHF Business

Radio and Class A Citizens Radio Services.

A review of FCC license data for the week ending October 31, 1964 showed that the number of units licensed in this frequency range actually exceeded those in either the VHF low band (25-50 Mc) or VHF high band (150 Mc) ranges.

An analysis of license grants for this particular period revealed that 40 percent of all units licensed in the Business Radio Service were for UHF, 31 percent for VHF high band, and 29 percent for VHF low band. Some indication of the growth here is shown by comparing this information with data from earlier periods. For example, in 1960 only 8 percent and in 1962 only 16 percent of Business Radio license authorizations were in the UHF range.

It is well known that the mushrooming demand for two-way radio systems by business users is causing a tremendous pressure on all available frequencies. This situation is especially critical in the crowded

urban areas where hundreds of users compete for air time on the limited number of channels available for business use.

The pressure on frequencies is great in all classes of service, but with thousands of firms now dependent on two-way radio as a tool in a competitive business environment, the demand for frequencies in many areas has gone far beyond the limited supply and the need has reached a critical level.

A comparison of the various frequency ranges used for two-way radio systems shows that the VHF frequencies have an advantage over UHF on a cost-per-mile basis, especially where mobile to mobile communications are needed. The typical direct mobile to mobile range in low band is 15-22 miles, high band 7-10 miles, and 4-6 miles at UHF.

Extended Coverage

In our highly mobile age, more and more users are finding a need

Community Repeaters

Service-dealers are permitted to bring parties together in a sharing agreement and sell equipment to the users, charge for site rental and maintenance

for extended mobile to mobile coverage, and find an answer in a mobile relay operation. The Federal Communications Commission permits such operation for business users in the UHF (450-470 Mc) range under the Rules of the Business Radio and Class A Citizens Radio Services.

An example of the need for mobile to mobile communications is found in the construction industry where a contractor directs the activities of a number of widely separated jobs while he operates as a "manager on wheels" from his vehicle.

Without adequate mobile-to-mobile range, all calls would have to be directed to the office base station to be relayed verbally by a station operator to the other field units. The time delay and the likelihood of error inherent in this system is undesirable when on-the-spot decisions, accurately relayed, are the key to coordination of men and materials for a successful project. The popularity of mobile relay communications lies in its ability to provide instantaneous and direct contact with all units throughout a given area of operation.

Mobile Relay Planning

In planning a mobile relay system, the one most critical factor in providing extended range service is the height of the base station antenna. Therefore, a building or mountain top location is highly desirable. Where such sites are not available, tall towers must be employed to provide the needed coverage.

UHF mobile relay operation has been widespread for a number of years, especially in the western United States where mountain top sites adjacent to large metropolitan areas has provided a natural answer to coverage needs. Installations on Mount Wilson in the Los Angeles area, Mount Diablo in the San Francisco area, and Lookout Mountain near Denver, for example, have contributed to the widespread use of UHF in these key western markets. In these areas, coverage from control station to mobile, or mobile-to-mobile, of up to 100 miles has contributed to the tremendous popularity of UHF service.

The cost of repeater station equipment, site rental, and equipment maintenance, has frequently limited such systems to large firms who could justify the expense. Often, however, it is the small firms which can most profit from mobile-to-mobile service, and yet have been unable to afford such a system. An answer for the smaller firms is found in a sharing program where a common repeater is operated under a cooperative or community plan.

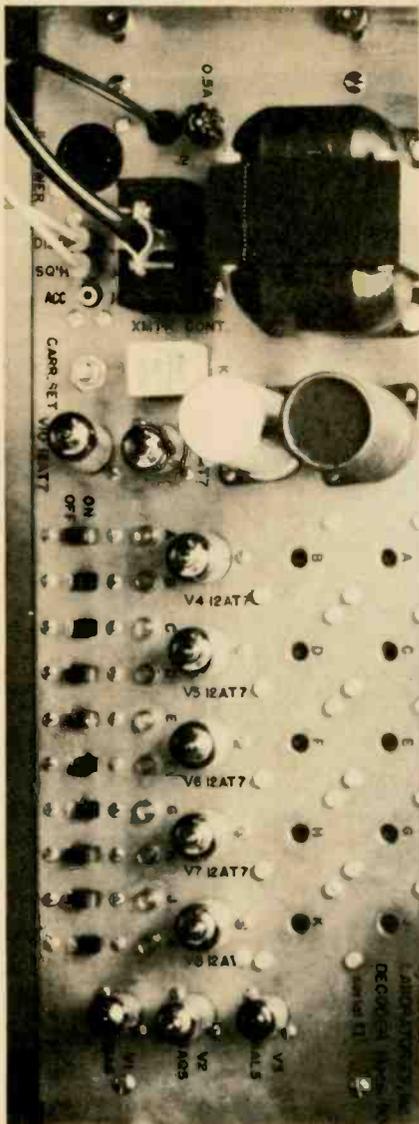
The FCC has long permitted sharing of radio station facilities. The practice of sharing base stations has been frequently used in the Public Safety Radio Service where a number of political subdivisions have found it advantageous to work on a sharing program for more economical and better communications than would be possible on an individual basis.

The cooperative use of a repeater under the Business Radio Rules

makes it possible for a number of firms to have the advantages of mobile relay type operation without the expense of their own system. In addition to the benefit of relatively low cost operation, the frequencies are used on an orderly basis rather than on a competitive basis which is usually encountered in the two-way field. From the viewpoint of public benefit, the shared systems offer greater channel efficiency and thereby meet the over-all goal of maximum using frequency spectrum utilization. Since mobile relay operation entails two frequencies rather than a single channel, it is especially important to employ the shared approach to get maximum use from available channels.

In permitting cooperative use of a repeater, the FCC does not propose that an individual directly profit from the sale of a communications service. Adequate provisions are made under FCC Rules, Part 21, for the development of a Radio Common Carrier business in which a communications service is provided for hire. In the case of the cooperative use of a base station or repeater, the FCC calls for sharing the expense on a non-profit basis and provides safeguards against violation of this principle by requiring the parties to a sharing agreement to give evidence of compliance with the non-profit intent of the agreement.

The two-way radio equipment service-dealer is permitted to bring together the parties in a sharing agreement and may sell the equipment to the users, as well as charge



Dynacoustic Laboratories' 905A tone burst ten-tone decoder.

for site rental and maintenance. He finds, therefore, an excellent opportunity to expand his business through development and encouragement of the community repeater program.

Tone Signaling

Early repeater use in the Class A Citizens Service led to situations where a mobile unit operating outside the coverage area of its own repeater would often unintentionally key another repeater using the same frequency pair, and, thereby, achieve an unexpected extension of operating range. As channel loading increased, however, it became necessary to protect each individual system from unauthorized use

through the employment of tone squelch systems. The Business Radio Rules, in fact, make it mandatory that a tone system be used so that in addition to having the proper carrier frequency, the mobile unit would have to transmit the proper tone frequency before it could work through a given repeater.

Many tone systems consist of the "tone burst" approach in which a single tone in the range of 1000 to 3000 cps, generated by a tone generator or encoder in the mobile or control station, would open the squelch in the repeater receiver and retransmit a corresponding tone to the mobile. This system works quite well in areas with minimum interference, but has the disadvantage that once keyed, the repeater will stay on as long as a carrier is present on its receive frequency.

The trend, recently, has been toward using continuous tone systems, operating in the sub-audible frequency range of 70 through 200 cps. Under the continuous tone system, a repeater is held in the repeat function for the duration of the time that a tone is present on a received signal. Under both systems, the FCC requires that provision be made to monitor the frequency before transmitting so a monitor function is provided when the mobile microphone is lifted from its hanger or when a switch is actuated on the base station microphone. Another FCC requirement calls for a three-minute timer which will automatically disable the repeater transmitter after a transmission of three minutes duration.

Tone Decoders

To satisfy the special requirements of shared systems, manufacturers have developed community repeaters which incorporate multiple tone decoders so a number of users can share the same repeater without interference from other users in the system. Both the tone burst and sub-audible tone systems are available for such applications.

In one typical community repeater, provision for up to ten tones are available. In the case of the sub-audible tone system, a single tone unit is used for the three-fold func-

tion of identifying the appropriate tone signal, keying the repeater transmitter, and generating an appropriate tone for the repeater transmitter.

A single tone reed is used in this system for each repeater sub-system. As users are added to the system, the technician merely adds a new reed to the repeater to correspond to the tone frequency selected for the new user. Provision is made for a maximum of ten different tones for a given repeater, and this will typically represent from 50 to 60 mobiles in the system. Experience has shown that this is a near saturation level. Once the repeater has reached the point where the traffic load impairs the usefulness of the system, another complete community repeater is installed.

Under the community repeater program, it is possible to go beyond normal economic considerations to provide optimum performance and system reliability. In such installations, the heart of the system is the repeater, and since a number of users are sharing the cost of this common element, it is possible to use relatively expensive accessories—highly sensitive receiver pre-amplifiers, high powered transmitter amplifiers, and high gain antennas—and yet maintain a relatively low cost for each individual user. The end result is a better and more economical system than would be otherwise possible.

Because the entire system is dependent on repeater operation, its failure would result in the loss of all communications so it is essential, therefore, for the repeater and its associated equipment to be designed for maximum reliability.

Community repeaters have resulted in better two-way communications for many users and has the additional benefit of more orderly use of a rapidly crowding radio spectrum. The future of this system has great promise and is expected to be extended soon in many areas where VHF is reaching the saturation point. From all aspects, this relatively recent innovation is filling an important place in the rapidly growing two-way radio communications field. ■



The quality goes in before the name goes on

**Choose from the complete line
built to Zenith's high quality standards!**

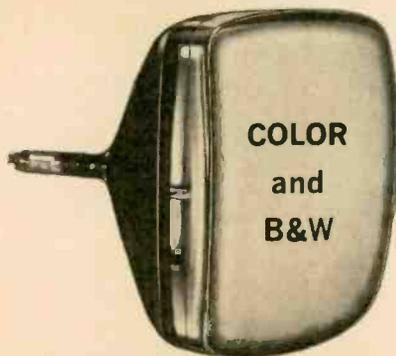
ZENITH FAMOUS QUALITY TUBES

Zenith replacement picture tubes and receiving tubes meet the famous quality standards set for Zenith "original" parts—your assurance of the

world's finest performance! Wherever you are located, there's a Zenith Distributor near you, who can supply you quickly on a day-to-day basis.

ZENITH QUALITY TELEVISION PICTURE TUBES

Complete line of more than 180 top-quality picture tubes . . . color, black-and-white, special purpose. These picture tubes have the same standard of quality that goes into Zenith television sets as original Zenith equipment.



Zenith black-and-white replacement picture tubes are made only from new parts and material except for the envelope which, prior to re-use, is inspected to the same standards as a new envelope. In color tubes the screen, aperture mask assembly and envelope are inspected and tested to meet Zenith's high quality standards prior to re-use. All electron guns are new.

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Complete line of more than 800 top-quality receiving tubes . . . made to the same quality standards as original equipment in Zenith products! More than 1,500,000 tube hours are accumulated every month by Zenith's life-testing under actual operating conditions. This insures that Zenith "Royalty Crest" tubes have greater reliability which reduces costly call-backs . . . and longer life which increases customer satisfaction!

Check the Yellow Pages for the Zenith Distributor nearest you.
Or write to Zenith Sales Corporation, Parts & Accessories Division,
5801 West Dickens Avenue, Chicago, Illinois 60639,
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Specifications subject to change without notice.

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Difficult Service Jobs Described by Readers

Horizontal Bending

A Zenith chassis 14L36, was brought into our shop accompanied by a complaint of severe horizontal bending. When we tuned in a test pattern from a local station, the pattern was twisted and the top pulled one way and the bottom the other. The bending effect was somewhat stationary, however. I replaced all tubes in the horizontal and sync sections but no improvement was indicated. We checked the horizontal dual diode with a VTVM and it turned out to be good. The waveform at the plate of the sync clipper appeared normal on the scope and the waveforms at the anodes of the horizontal diode also appeared normal. I removed the sync input from the horizontal control by disconnecting the wire that feeds the upper half of C47 (see schematic) but the bending persisted. Then I adjusted the horizontal hold control carefully but the bending wouldn't straighten out. As I figured it, all these checks localized the trouble to either the horizontal AFC stage or the oscillator. Voltage readings were made in these two stages with a VTVM but they

all checked normal. And resistance checks in this area did not lead me to conclude that anything was out of the ordinary. I then noticed, while adjusting the vertical hold control, that the horizontal sync was affected. This made me aware, for the first time, of interaction taking place between the vertical and horizontal stages. I substituted the vertical tube, 6FM7, and the trouble suddenly cleared up! I would never have suspected this tube of causing the horizontal bending in a million years. But it was the culprit as subsequent checks proved. First, I gave the tube a thorough check on the tube tester. It showed that the tube was shorted. I then checked between various pins with the VTVM. I discovered a 3M leakage between pins 3 and 4. Pin 4 has no internal connection, so the socket terminal was used as a tiepoint for C50, C44, R40 and R41 (see schematic). Pin 3 of the 6FM7 is the control grid, so apparently a portion of the vertical signal was leaking into the horizontal AFC stage. This leakage caused the severe bending. — P. L. Pierce, Jr., Morgan City, La.

No Horizontal Sync

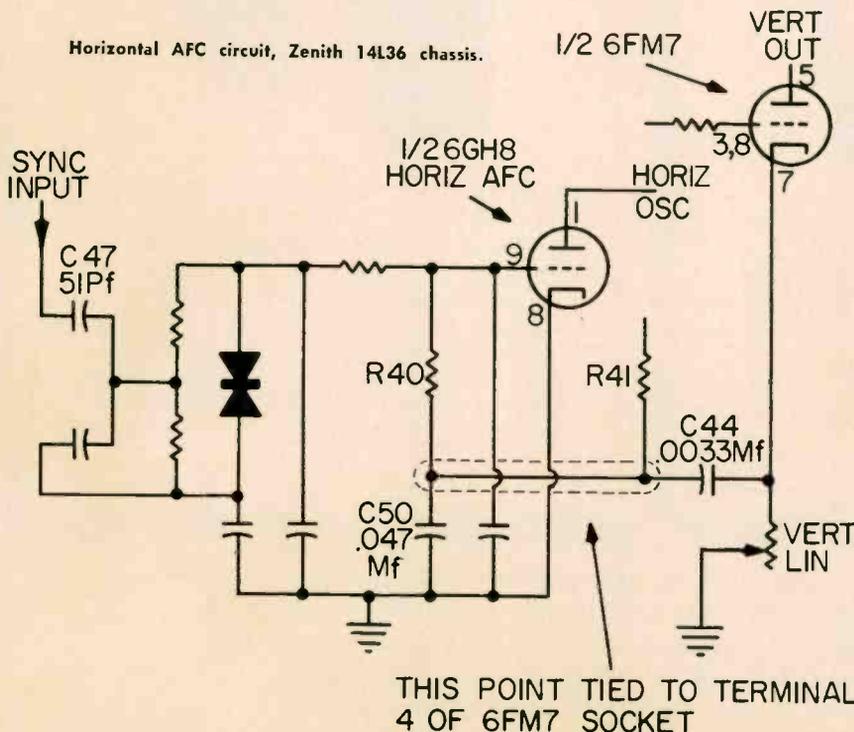
A Symphonic, 10P16 chassis, having no horizontal sync, was brought into our shop recently. After checking it on the bench for some time, our investigation showed that it would lock in at times but most of the time the picture would be out of horizontal sync.

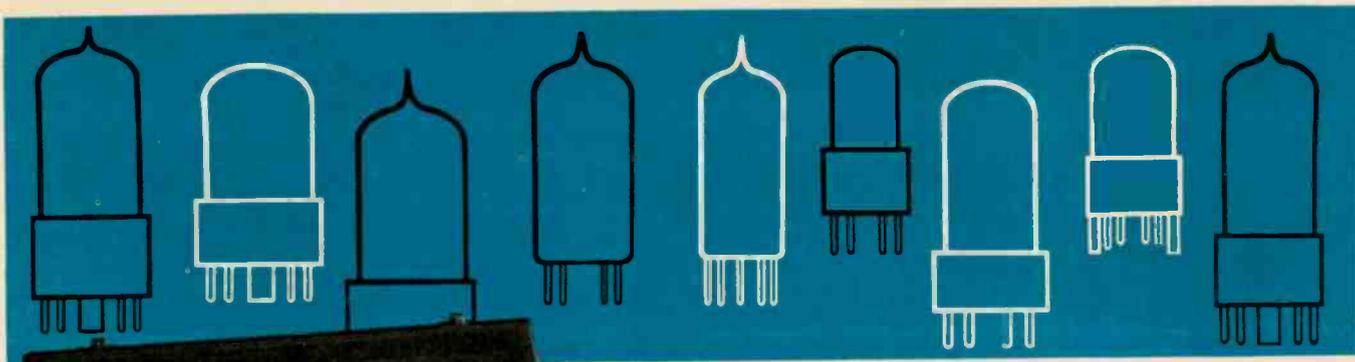
The vertical hold appeared good at all times. Tubes in the horizontal multivibrator and the sync separator sections were substituted with known-good tubes but no improvement was shown. The AFC dual diode was disconnected and a good one substituted but the condition still remained the same. All voltages in the horizontal and sync separator sections were checked with a VTVM but no unusual variations were noted at any point. The waveforms in both of these sections were also checked with the scope and they appeared to be within tolerances.

My next move called for injecting a signal from my analyzer into the sync now locked in good. The lock was good also when I injected the signal into the individual IF stages. After the analyzer was disconnected and the antenna was reconnected, the horizontal sync resumed its former poor condition. I suspected AGC trouble at this point but after connecting a bias-box in the circuit, no improvement was shown.

I now decided to substitute all tubes in the signal path. I began with the oscillator-mixer, a 5EA8, in the tuner. Then I suddenly noticed that someone had substituted a 5U8 for the 5EA8. When I removed this 5U8 from a tuner socket and replaced it with a known good 5EA8, the horizontal sync snapped in and locked perfectly. To double check, I took a known good 5U8 and substituted it for the 5EA8 — and the set lost horizontal sync again. Then it resumed normal operation, having very strong horizontal hold, when the 5EA8 was reinserted in the socket. I tried another 5EA8 — with similar good results. I then let the set "cook" for a few hours and returned it to the customer—Albert N. Williams, Cheltenham, Md.

Horizontal AFC circuit, Zenith 14L36 chassis.





*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*

You're always ahead with B&K. The new "707" gives you the famous B&K professional tube-testing speed and efficiency—plus the ability to test more color TV tubes with Gm* accuracy.

Provides multiple-socket section to quick-check most of the TV and radio tube types the *true dynamic mutual conductance way**—plus simplified switch section to check other tube types in Dyna-Jet emission circuit. Also includes provision for future new sockets.

You can quickly check all the tubes in the set, detect hard-to-locate weak tubes that need replacement... sell more tubes, save call-backs, and make more profit. *Makes test under set-operating conditions.* Checks each section of multi-section tubes separately. Checks for all shorts, grid emission, leakage, and gas. Makes quick "life" test. Exclusive adjustable grid emission test provides sensitivity to over 100 megohms. *Quickly pays for itself.*

Net, \$189⁹⁵

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New and old TV and Radio Tubes. Tests Nuvistors, Novars, 10-pin tubes, 12-pin Compactrons, European Hi-Fi tubes, Voltage Regulators, and Most Industrial types.

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NEW TUBE INFORMATION SERVICE

Keep your tube tester up-to-date. Subscribe now to tube information service, available every 3 months.

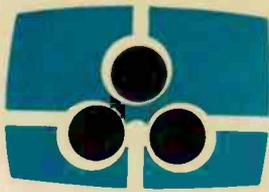


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COLORFAX

Motorola Appoints

James A. Torrence has been appointed director of color television picture tube engineering for the consumer products division of Motorola, Inc., according to S. R. Herkes, vice president and general manager of the division. Mr. Torrence was formerly assistant director of color



Torrence

TV tube engineering and is succeeded in that position by Richard Lindeman.

The new director of color TV picture tube engineering has been with the company since 1953 and first moved into color television tube research in 1962. He was promoted to chief engineer for color tubes in 1963 and in July 1964, was named assistant director of color picture tube engineering. As director of that department, he succeeds Karl H. Horn, who resigned to accept another position.

Mr. Torrence is an electrical engineering graduate of Fournier Institute of Technology.

Mr. Lindeman has been with the company since 1956 and became chief mechanical engineer for the color tube program in 1962. He is an electrical engineering graduate of the University of Michigan.

RCA Victor 1966 Color Chassis

Screen sizes in RCA's 1966 line include 21 in. models, continued production of instruments using a 25 in. color picture tube, and a table model 19 in. color television receiver.

The 21 in. color instruments use the CTC16X chassis. Various types of home entertainment instruments using the CTC16X are available, including table models, consoles and color combinations equipped for FM, FM/stereo, AM and stereo phono. Although the CTC16X is basically a continued version of last year's 21 in. chassis, a number of engineering changes and tube-type changes have been introduced.

Twenty-five in. receivers use the new CTC-17X color chassis. Generally the CTC-17X is similar in many re-

spects to the CTC17 of last year. This new color chassis, however, has additional provisions to prevent the possibility of UHF radiation interference; a transistorized circuit to provide for positive blanking of the color picture tube during vertical retrace; and added stability in the color section by using a frame-grid tube in the burst amplifier stage. The CTC17X chassis is employed in deluxe console instruments.

Instruments using the 19 in. rectangular 90 deg color picture tube employ the CTC19 color chassis. Although the CTC19 is a new chassis, the performance and service features contained in previous color chassis (especially those of last year's 25 in. chassis) are retained including: "X" and "Z" demodulation to recover R-Y, B-Y and G-Y color difference signals, simplified set-up procedures for convergence, purity and gray-scale tracking.

The CTC19 is designed to operate the 19EYP22, rectangular 90 deg CRT. The tube is a scaled-down version of the manufacturer's three-gun, shadow-mask 25-in. tube used in the CTC17 chassis.

Although the physical size and shape of the chassis is new (for accommodation of a 19 in. picture tube), the general operation of the receiver closely follows that of the 25 in. CTC17. Two "solid copper circuit" boards are used in main chassis construction. Instruments employing the CTC19 chassis uses VHF tuner KRK128.

All receivers are factory equipped for UHF operation, using the transistorized KRK120 UHF tuner. Remote control is included in some models. The three-function, all-transistor KRS28 remote receiver currently employed in black-and-white instruments is utilized.

Sound signals in CTC19 are processed by a three stage sound circuit, using a frame-grid 6JC6 as sound IF amplifier, a 6HZ6 as demodulator and a familiar 6AQ5 in the audio output circuit.

The front-end of CTC19 consists of a tuner with a nuvistor and frame-grid mixer and two IF stages using frame-grid tubes. Two video amplifiers are employed in the new color chassis. Like in the company's previous color chassis, the brightness signal is dc

coupled to the cathodes of the picture tube via green and blue drive control circuits, and a convenient service switch is included for tracking adjustments. When this switch is in the service position a fixed potential is applied to the cathodes of the picture tube and vertical sweep is collapsed.

The CTC19 features a one-stage chroma bandpass, "X" and "Z" demodulators and color-difference amplifiers to recover R-Y, B-Y and G-Y signals. The progression of chroma signals through these stages follows closely the signal flow in the CTC17.

A 6GF7 tube is used in the vertical oscillator output stage. Although a few component values have changed, the basic circuit follows closely the vertical circuits in the CTC17 color chassis. Likewise, the horizontal oscillator AFC circuit is closely related to that used in the CTC17 oscillator circuits employing a 6FQ7. A 2AV2 focus rectifier, and a 6BS3 damper are used. The Horizontal output tube is a type 6KM6. The 6BK4B shunt regulator used in the CTC19 is a further refinement of the 6BK4 family. The 3A3 is used as the high voltage rectifier tube. A 24 kv second anode voltage for the 19 in. picture tube is provided by this rectifier. The high voltage control is in the grid circuit of the shunt regulator; a 1000 Ω metering resistor appears in the cathode.

Doubles Color TV Set Output

Sylvania has doubled its color television set manufacturing capability, it is announced.

Speaking before distributors and dealers during the introduction of the company's 1966 line of television, stereo and radios, Robert J. Theis, president of Sylvania Entertainment Products Corp., said the expansion program was completed recently at its Batavia, N.Y., facility.

"Earlier this year, I said that approximately 2.2 million color receivers would be sold in 1965," according to Mr. Theis. "I believe this figure will be met and perhaps surpassed depending on picture tube production. To keep pace with this tremendous growth in color television, we have doubled our capacity to produce color sets in our Batavia plant."

Compare Color Generators

look at the rest... and you'll buy the best, new B&K model 1245

The all solid-state B&K Model 1245 Color Generator duplicates the waveforms transmitted by a color TV station.

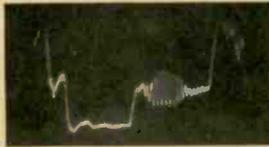
Adherence to these waveforms makes it easy to converge the color tube, check sync and make other raster adjustments... and the color generator with station quality signal will be able to sync next year's sets. Generators with compromise waveforms do not give you this obsolescence protection.

Here are oscilloscope photographs from the outputs of two typical competitive color generators, one transistorized and one tube type, and the B&K Model 1245. The detailed analysis with each photograph shows a few of the reasons why you'll save time and effort with B&K.

COLOR

CROSSHATCH

STANDARD STATION SIGNAL

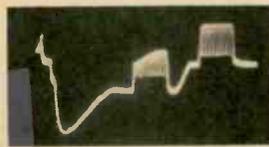


One horizontal sync pulse with its color burst.

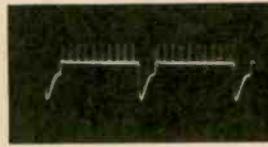


Two lines showing horizontal sync pulse with black and white TV signal.

TRANSISTORIZED B&K MODEL 1245

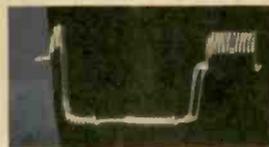


Good duplication of station-signal including back porch. If the set won't sync, the set is defective.

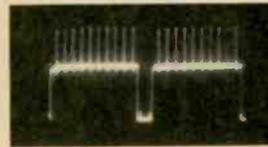


Well defined back porch on horizontal sync pulse permits accurately setting color killer and almost eliminates need to adjust brightness and contrast.

TRANSISTORIZED GENERATOR A



No back porch causes unstable color sync. Burst amplitude compression may permit sync on wrong color bar.



Square wave horizontal sync pulse with no back porch and poor dc coupling forces adjustments of brightness, contrast & fine tuning to obtain usable pattern.

GENERATOR B

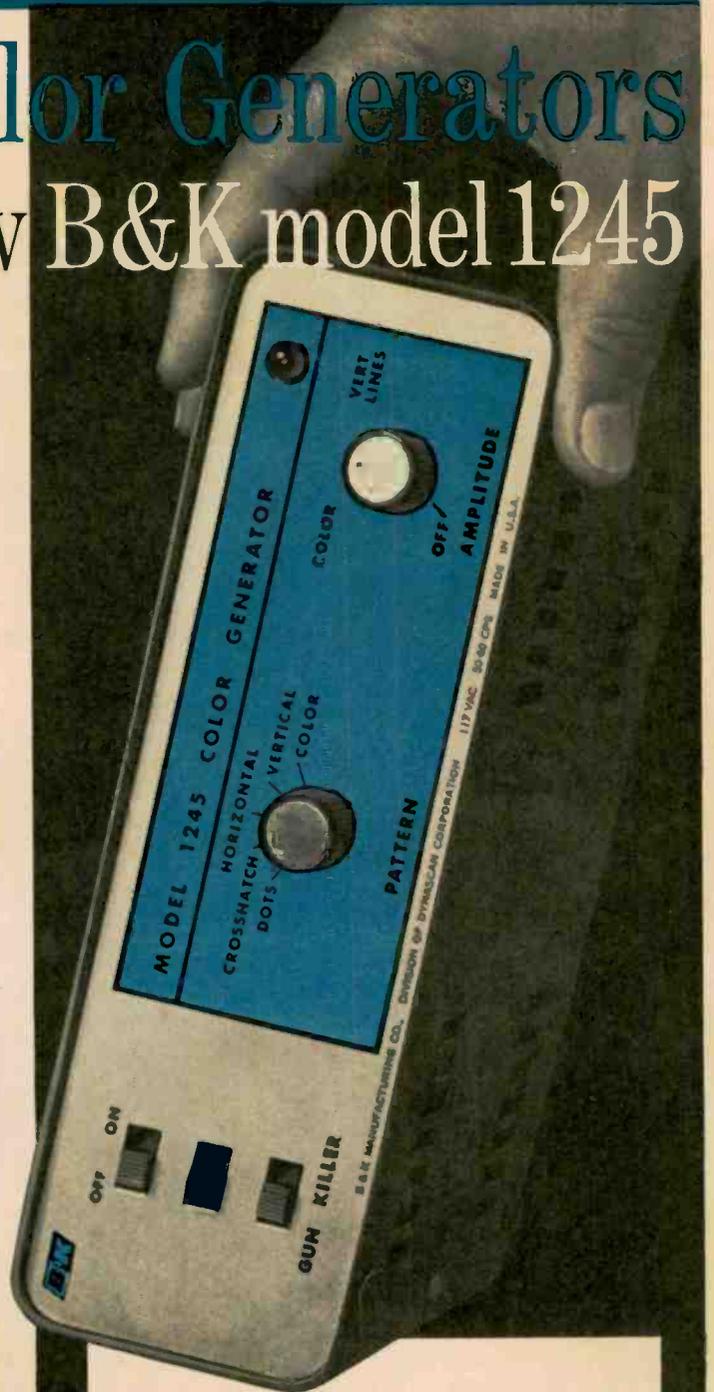


No back porch; color information on top of sync-pulse makes sync difficult on some sets.



Complete absence of any back porch necessitates readjustment of brightness, contrast and fine tuning to obtain a usable pattern.

See your B&K Distributor for a demonstration or write for Catalog AP22.



For the first time, with the no-compromise waveforms from the B&K Model 1245, it is possible to accurately set the color killer threshold control with a color generator.

The miniature size and convenience of the Model 1245 match its performance. It provides crystal-controlled keyed rainbow color bar display, and dot, crosshatch, horizontal line and vertical line patterns as well as gun killer controls that will work with any picture tube. Size only 2 7/8 x 8 1/2 x 8 7/8". Net \$134⁹⁵.



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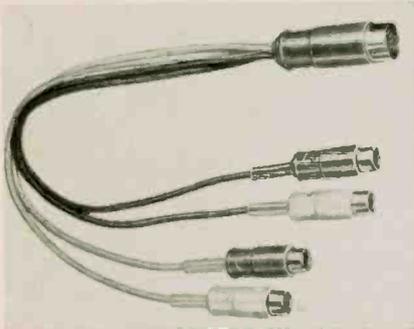
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NEW PRODUCTS

FOR MORE INFORMATION CIRCLE NEW PRODUCT NUMBERS ON POSTCARD INSIDE LAST COVER.

Stereo Adapter Cable 200

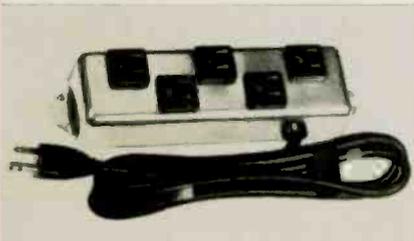
A stereo adapter cable that makes it possible to interconnect foreign built tape recorders to U.S. made microphones, headphones, amplifiers and speakers is announced. The adapter cable, model 330G, is designed



to plug directly into 5-hole sockets found on foreign built equipment. It can also be used to interconnect pre-amplifiers and crystal or ceramic high impedance cartridges to many recorders. Switchcraft.

Outlet Box 201

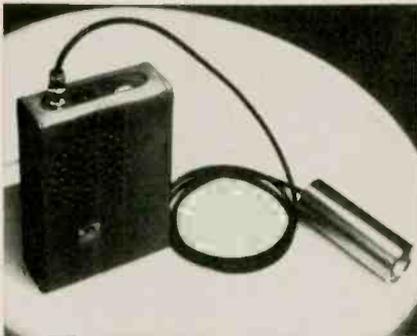
An electrical outlet box, which accepts both standard two-prong ac and safety U-ground plugs is introduced. The Model 602 unit is designed for OEM, lab, school and workshop use. Rated at 15 amp, 130 v continuous duty, the boxes have five individual



U-ground outlets and include a three-wire 6 or 15 ft neoprene cord set. The unit is housed in a steel case finished in silver gray-textured hammer-tone. Size 8 5/8 x 2 1/4 x 1 1/2 in. Waber.

Leak Detector 202

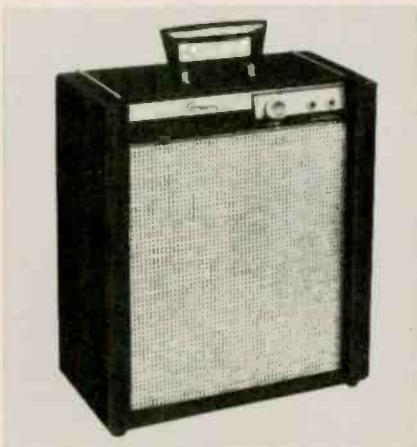
An ultrasonic detector which incorporates a small meter for making relative sound measurements as well as a standard loudspeaker is announced. According to the manufacturer, this feature is of particular value in areas of high intensity audible sound where even the accessory headset is ineffective in eliminating



outside interference for the user. A typical case would be in the vicinity of operating jet engines. Techsonics.

Amplifiers 203

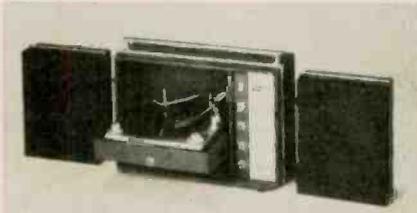
A line of portable amplifiers is announced. The Mercury 600 (illustrated) has 2 instrument inputs with a 5 w peak power output. The Gemini 700 with an 8 in. speaker is rated at



8 w peak power. The Apollo No. 800, with 30 w power output, has a 12 in. speaker. The Reverb No. 900 has 30 w power output and the Atlas 1000 features 40 w peak power, 2 channels and 2 speakers. Gregory.

Stereo Phono 204

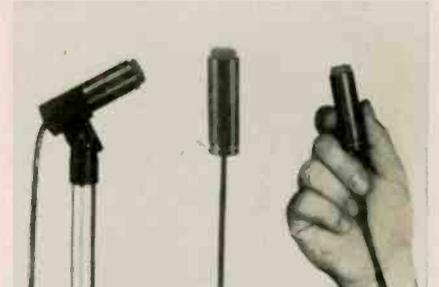
This stereo phono has a solid-state amplifier with 32 w peak power (16 w EIA), a 4-speed record changer, a ceramic cartridge, and a 6-speaker



audio system. Each remote speaker unit has one 8 in. woofer, one 4 in. and one 3 1/2 in. tweeter. A 45 rpm spindle is included. Zenith.

Microphone 205

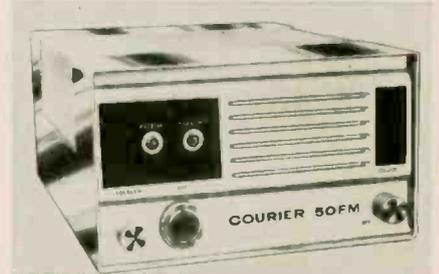
This omnidirectional, dynamic microphone is 2 5/8 x 3/4 in. It is for use



on a stand or in the hand, concealed in studios or on shooting locations, hanging over a stage or in a variety of other general applications. Shure.

Two-Way Radio 206

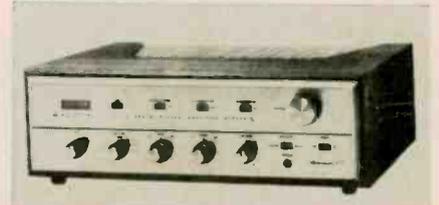
A 2-way FM business radio, designed for small business and professional men, is announced. Engineered to operate in the 25 to 50 Mc



range the Courier 50 FM offers 50 w power coverage and is available with either ac or 12 vdc power ECI.

Stereo Amplifier Kit 207

A solid state stereo amplifier kit is announced. The LK60 kit includes



front-panel stereo headset output; separate bass and treble controls for each channel; complete tape recorder input and output facilities; and ON/OFF switch for headphone listening. Scott.



B&K MODEL 970 RADIO ANALYST

SERVICE AM & FM AUTO AND TRANSISTOR RADIOS AT A PROFIT!

NEW!

Jobs that used to be unprofitable now go so quickly that you can make good money handling them! There are millions of auto radios and transistor radios in the field—portables, auto and table models, plus hi-fi and communications equipment. Instead of turning them away, you can turn them into money-makers with the B&K Model 970 Radio Analyst.

The 970 is effective because it's accurate and complete. Using the famous B&K signal injection technique, this all-in-one instrument provides the required dc power, lets you test power and signal transistors in and out of circuit; generates RF and audio signals, and includes a rugged, accurate VOM. Four functions in one compact package—with solid state reliability, B&K professional quality.

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Auto Radios—High current, low-ripple, for transistor, hybrid, and vibrator types.

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QUICK AND ACCURATE TESTING OF POWER AND SIGNAL TRANSISTORS

In-Circuit—stage by stage DC signal injection and sensitive metering of power supply current.

Out-of-Circuit—Direct Beta and Leakage meter scale readings. Easy balancing or matching.

VERSATILE SIGNAL GENERATORS

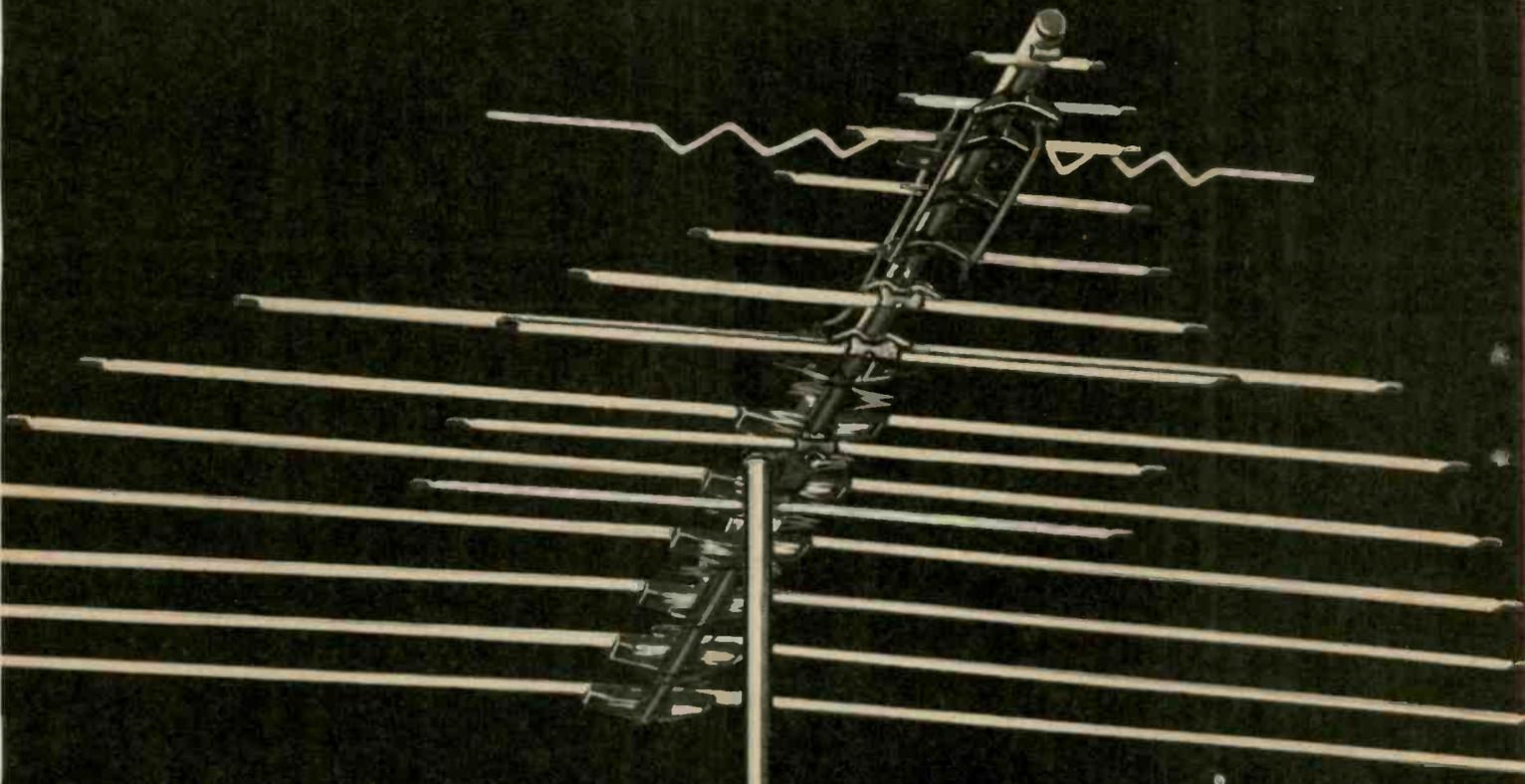
RF Generators—provide broadcast and IF frequencies for both AM and FM bands.

Audio Generator—for AM or FM modulation of the RF signals, and for troubleshooting audio circuits.

RUGGED VOM

Volt-Ohm-Millammeter—with rugged, taut band meter—provides correct ranges for easy, fast servicing of all home and auto radios, as well as transistor portables.

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HOW DID
WINEGARD
PUT
FULL SIZE
POWER IN A
1/2 SIZE ALL-BAND
(UHF-VHF-FM)
COLOR
ANTENNA?

WITH
WINEGARD
CHROMA-TEL

the new
super-compact high
gain antenna
designed specifically
for all-band UHF-VHF
Color Reception and FM

A big disadvantage of most all-band (UHF, VHF, FM) antennas is that they are larger and heavier than necessary. This is because they are really VHF antennas with UHF antennas tacked on the front end. *Chroma-Tel isn't*. It's super-compact and the

first integrated antenna designed specifically for all-band UHF-VHF color operation.

How did we reduce the size so drastically without sacrificing performance?

Two ways. First with our new *Chroma-Lens*

Director System. With this unique system, we are, for the first time, able to intermix *both* VHF and UHF directors on the same linear plane without any sacrifice of performance.

Second, with *Impedance Correlators*. These are the special phasing wires that automatically step up the impedance of Chroma-Tel's 72 ohm driven elements to 300 ohms. The correlators make sure each element has an accurate 300 ohm impedance at its given frequency. No other antennas with multiple driven elements have this! They also allow us to place the elements *only* 5 $\frac{3}{4}$ " apart instead of 10" to 14" apart as on other all-band antennas, reducing antenna length by one-half.

With the new Winegard Chroma-Tel antenna, we have eliminated *half* the bulk, *half* the wind loading, *half* the storage space, *half* the truck space, and *half* the weight ... yet still have the best working, easiest installing UHF-VHF-FM antenna ever developed!

You give your customers a neater installation that performs as well or better than any other all-band antenna on the market ... and at a much lower price.

Compare Performance. You can't find an all-channel UHF-VHF-FM antenna that will give you better results than Chroma-Tel. Look at the polar patterns. There are no side lobes with Chroma-Tel because the elements are straight ... unlike V'd elements that offer an element surface sideways to the signal, Chroma-Tel's straight ele-



Exclusive Winegard Impedance Correlators insure 300 ohm impedance on each element

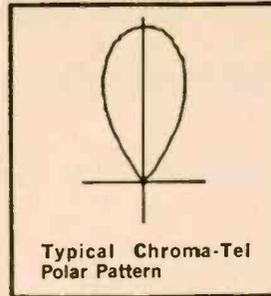
ments will not pick up ghosts from sides or back. Chroma-Tel's front-to-side ratio is practically infinite—Chroma-Tel's exceptional front-to-back ratio is up to 30 db.

Compare Construction. The Chroma-Tel is Winegard quality throughout ... from its sales-making compact 4-color box, to its weather resistant Gold Vinylized Finish, to its first quality snap-lock hardware.

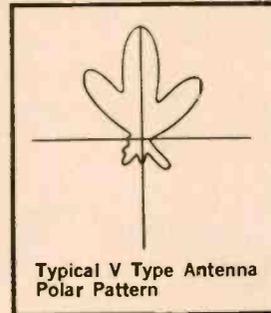
For complete information on the exciting new Winegard Chroma-Tel All-Band Antenna, ask your distributor or write for Fact-Finder #242 today.



So compact it fits in the back seat of a car



Typical Chroma-Tel Polar Pattern

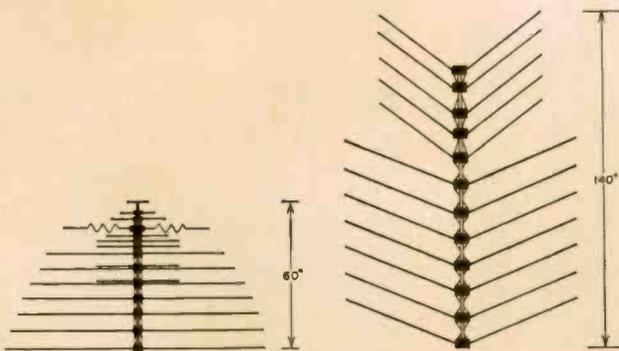


Typical V Type Antenna Polar Pattern

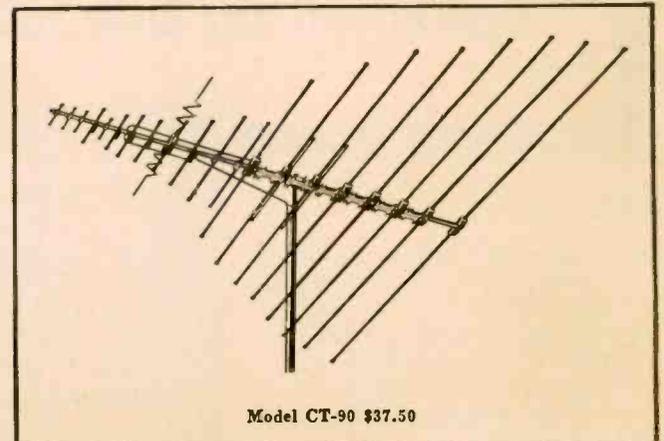


All Chroma-Tels include Winegard's model CS-283 UHF-VHF signal splitter. Splitter hangs conveniently behind TV set. Separates UHF and VHF signals coming from antenna to the two sets of terminals on your set. It's yours FREE when you buy Chroma-Tel.

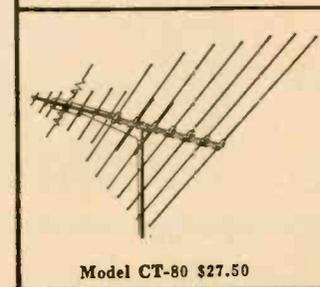
Compare Size and Price. We've illustrated the super-compact Chroma-Tel CT-80 and a comparable V type antenna. Note the difference in size, price and weight for equal or better performance. Because it's even much smaller than ordinary VHF antennas of comparable performance, it is perfect for attic installations, too!



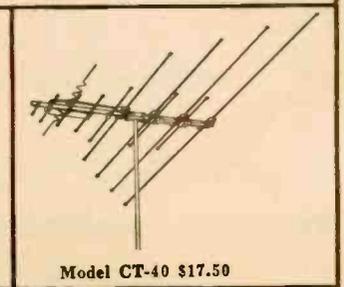
Winegard Chroma-Tel	V type (Approximate Figures)
Boom Length: 60"	140"
Total Weight: 5 lb., 1 oz.	10 lb., 3 oz.
Carton Size: .97 cu. ft. (less than 1)	5.8 cu. ft.
Number of Elements: 17	12
List Price: \$27.50	\$50.00



Model CT-90 \$37.50



Model CT-80 \$27.50



Model CT-40 \$17.50

Winegard Co.
Antenna Systems

3000 Kirkwood • Burlington, Iowa

... for more details circle 66 on postcard

NEW PRODUCTS

Asbestos Wire 208

A line of asbestos wires and cables designed for operation in high tem-



perature (above normal) environments is announced. Included in the line are power cable, apparatus cable, motor lead cable, hinge cable, boiler room

wire, rheostat wire, switchboard wire, projector and arc lamp cable. Alpha.

TV Service Manuals 209

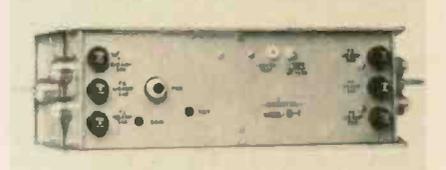
A single-set service manual system eliminates the need for purchasing



schematics and service data on other sets which are not needed. For the first time, the manufacturer claims, technicians can buy a single packaged unit which will contain authentic factory service data in complete form. Price \$0.79. Singpak.

Bridging Amplifier 210

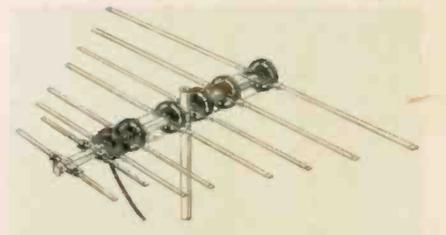
A transistorized, remotely powered outdoor bridging amplifier covering the low through high VHF band, including FM and intermediate bands is announced. The model B1 unit, the manufacturer claims, features 20 db



gain to four distribution line outputs and is designed for strand mounting. Remotely powered through the coaxial cable, the amplifier is available with electronically regulated power supply circuits for 28 v or 60 v. Entron, Inc.

Antenna 211

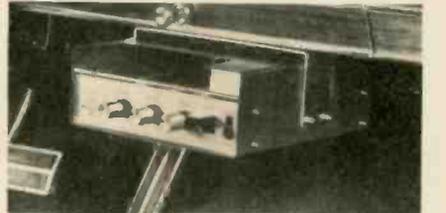
An all band antenna, pre-matched for use with 75 Ω coaxial cable, is announced. The log periodic type antenna is specially designed for home in-



stallations employing coaxial cable lead-in. No mast mounted matching transformer is needed. Jerrold Electronics Corp.

Auto Stereo 212

The Craig C502, an auto stereo set, with solid-state two-channel stereo amplifiers, dual-stereo playback heads and push-pull output is introduced.



The unit is made of steel with a brushed-aluminum face plate and is designed for mounting on any make auto. Auto Sound Division, Craig Panorama, Inc.

a lot of good dealers here ...

but room for lots more

CAN YOU QUALIFY?

- Do you have a sound knowledge of radio and/or communications equipment?
- Have you the desire to install and service this unique equipment?
- Do you have an established business reputation? Good credit rating?
- Have you a real interest in dynamic new products?
- Do you want to make really big profits?

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with the most
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City State

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dept. ET9, 56 hamilton ave., white plains, n. y.

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100% G_m TESTS . . .
*No Emission Tests,
 No Compromise!*

OBSOLESCENCE PROTECTION
*Realistic, Practical
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MULTI-SOCKET SPEED . . .
*No Compromise
 In Accuracy!*

MORE PROFIT
*Because You'll Sell
 More Tubes . . .
 Sell Them
 Honestly!*

**NEW HIGH-SENSITIVITY
 LEAKAGE AND
 GAS TESTS!**

MODEL 799

Mustang

\$199.95

From the laboratories of the world's leading tube tester manufacturer comes the model 799 "Mustang" — a completely new tube tester.

Multi-socket tube testers used to have two serious drawbacks: circuit limitations made them obsolete overnight and, at best, no more than 10% of their tests were actually mutual conductance. But the Hickok "Mustang" doesn't compromise; it delivers *honest* mutual conductance tests. And a unique circuit approach, together with an easily replaceable accessory socket panel, makes it "circuit ready" for

any possible new tube types.

A solid-state power supply gives increased accuracy and dependability. An all-transistorized gas and leakage test circuit sets a new standard of reliability for spotting "tricky" tube defects that can "chew up" your profit. You can actually read interelement leakage to 50 megohms; gas/grid leakage effects to 0.1 μ a!

We call it the "Mustang" because it uses fresh, new engineering ideas and because it gives you a real opportunity to break into new profits.

See it at your Hickok distributor or write for circular TT799.

Ask your distributor about the Hickok credit plan.

HICKOK

THE HICKOK ELECTRICAL INSTRUMENT CO.

10523 Oupont Avenue, Cleveland, Ohio 44108

Represented in Canada by Stark Electronics, Ajax, Ontario

Internationally by Hughes International, Culver City, California

NEW PRODUCTS

Multiplex Tuner Kit 213

An FM Multiplex Tuner Kit is introduced. The LT110B comes with an instruction book. The manufacturer



claims that usable sensitivity of the unit is 2.2 μV ; signal-to-noise ratio is 60 db; harmonic distortion; 0.8 percent drift, 0.02 percent; and frequency response, 20-20,000 cps ± 1 db. Capture ratio is 6.0 db; selectivity is 35 db; spurious response rejection, 80 db; and separation is better than 30 db. H. H. Scott, Inc.

Electrical Cleaner 214

A cleaning solvent for use on electric motors, generators, and electrical equipment components is announced. The solvent removes dirt, contaminin-



ants, moisture, oil and grease, the announcement said: Lectra-Clean is used for general bench cleaning, prepaint cleaning, general equipment wipe down, and in motor and component dip tanks. Corrosion Reaction Consultants.

Extend the "Talk Power" of ANY C. B. Transceiver

with **Hy-Gain's CLR2**
The most powerful all-directional base station antenna for Citizens Band...

Delivers
omni-directional power
equivalent to what you'd get
with a 12.55 watt rig!

For maximum range and greatest reliability in CB communications, Hy-Gain's CLR2 is the one all-directional non-rotating antenna that is built to do the job. It is loaded with electrical and mechanical features that clearly put it in a class all of its own. Take for example the electrically extended $\frac{5}{8}$ wavelength vertical radiator. Here we're talking basics but they're vitally important basics. In test after test conducted by every authoritative source in the electronics field, a $\frac{5}{8}$ wavelength radiator has conclusively proven to deliver a stronger signal over a greater area than either a $\frac{1}{4}$ wavelength or $\frac{1}{2}$ wavelength radiator. The chart graphically shows how power wasted in the atmosphere by $\frac{1}{4}$ wavelength and $\frac{1}{2}$ wavelength radiators is concentrated into a lower, more extended arc close to the horizon by a $\frac{5}{8}$ wavelength radiator thus providing a stronger signal over a greater area.



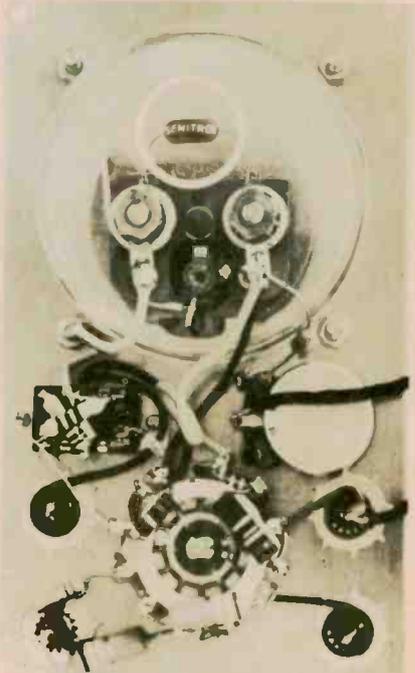
What else does the CLR2 have that makes it deliver maximum "Talk Power"? It has the original static-removing "top hat" that drastically cuts receiver noise... a moistureproof matcher that insures total electrical reliability... a unique electrical system that puts the entire antenna at DC ground for maximum static removal and lightning protection... rugged, heavy duty, all-weather construction rated to withstand winds up to 100 mph. For maximum all-directional "Talk Power" from any CB transceiver... for greatest customer satisfaction... recommend or install Hy-Gain's CLR2. Sensibly priced at \$29.95 CB Net

Available from your Hy-Gain Distributor or write
HY-GAIN ELECTRONICS CORPORATION
8567 N.E. Highway 6 - Lincoln, Nebraska 68501

... for more details circle 36 on postcard

Meter-Sentry 215

A solid-state device that protects all types of meter movements against overload damage is announced. Ex-



ternally connected directly across the meter movement terminals, the Meter-Sentry bypasses any overload currents around the instrument, thus prevents meter burnout and needle damage, the manufacturer says. Semitronics, Corp.

PA Amplifier 216

A transistorized 350 w mobile public address amplifier is announced. This amplifier is already in use by the



U.S. Government for missile range surveillance, psychological warfare, air/sea rescue, crowd control, towed cargo handling, etc. It can be operated on any battery voltage from 12 to 32 v, however, a 32 v battery is required for a full 350 w output. Current requirements are, 1 amp with no signal out, to 15 amp at full output. It can be used for sound trucks, aircrafts, helicopters, and hand pack installations and various other applications, according to the announcement. Applied Electro Mechanics, Inc.

Two-Way Radio 217

A 2-way radio for use in urban transit vehicles is announced. The unit provides contact between dispatcher and motorman and also allows communications from the dispatcher over the vehicle's public address system to the passengers. The radio locks into place at a mounting rack which is installed in the motor-



man's compartment on each end of each car. The radio is transistorized and weighs less than 12 lb with microphone. The unit operates on 24-44 vdc external source power supply, and has an RF output of 8.0 w at 32 v of primary power input, the manufacturer said. The unit contains a voltage regulator and voltage spike protection circuitry. All connections, including antenna, power, and foot switch push-to-talk, are made through a single cable, terminated with a plug, which makes convenient contact with a receptacle at the bottom of the radio. Motorola.

great profits

(small inventory)



Imagine—just 6 Sonotone® crystal cartridges replace 146 models. In microminiatures, the Sonotone Micro-Ceramic® series updates to 1965 performance almost any phonograph using a ceramic cartridge produced within the past 20 years.

Replacements in transistor phonographs? The "24T", "27T" and "35T" Micro-Ceramics are the answer. For the world's "safest cartridge," try the "21TR" with its fully retractable, hinged mounting bracket, bottoming button and Sono-Flex® stylus. Replacements in the top-end hi-fi models? The audiophile-accepted Sonotone "9T" series is your best bet. And from the standpoint of customer satisfaction, only Sonotone cartridges are equipped with the virtually indestructible Sono-Flex stylus. Now the clincher: Sonotone cartridges are direct replacements in more than 15 million phonographs in which they are original equipment.

These are just a few of the reasons you need stock fewer Sonotone cartridges than other brands—and still have the right replacement for just about every phonograph that comes into your shop. For comprehensive cartridge replacement guide, write:

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Sonotone Corp., Electronic Applications D.v., Elmsford, N. Y.
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... for more details circle 61 on postcard

NEW PRODUCTS

Soldering Kit

218

A "bubble" package format for parts distributors is used to package a line of soldering irons. Ten pack strips of bubble packaged soldering



tips and tiplests can be pegboarded, the manufacturer announced. Ungar Electric Tools.

Stereo Headphones

219

The Model HS2 stereo headphone is announced. Diaphragms with acoustic rear mesh in the driver cavity provide uniform bass to below 20 cps and high frequency range extends to 17,000 cps, the manufacturer reports.



The stereo headphones may be connected to any stereo or mono system and are equipped with eight ft input cable and standard three-conductor phone plug. Accessory phone-jack panel is also available. Jensen Mfg. Co.

Microphone

220

A dynamic lavalier microphone is introduced. The Model S-58 has a frequency response of 60-13,000 cps and output level of -60 db, the man-



ufacturer says. Impedance is combination hi or 150Ω. A 25 ft cable and lavalier assembly are also furnished, according to the firm. The Turner Microphone Co.

SCRs

221

A series of 35 amp RMS, 22 amp average, silicon controlled rectifiers is announced. The 2N681 series, the manufacturer reports, offers 12 transient peak reverse voltage ratings from 35 to 960 v, peak forward gate current of 1.2 amp, peak reverse gate voltage of 5 v, peak forward gate voltage of 10 v, peak gate power of 5 w and average gate power of 0.5 w for

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Princess

**AUTOMATIC/MANUAL
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will outperform,
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last most chang-
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twice the price!



Model #RCD-4
\$47.50



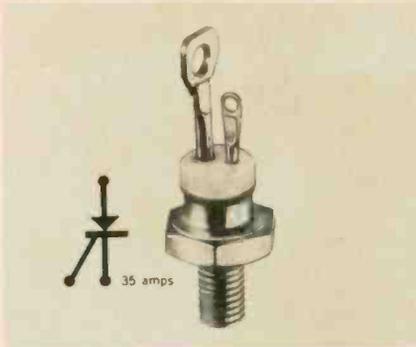
Model #RC-2
\$37.50

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RFS INDUSTRIES, INC. 102 HARBOR ROAD, PORT WASHINGTON, NEW YORK 11050
Tel. (516) 883-7575

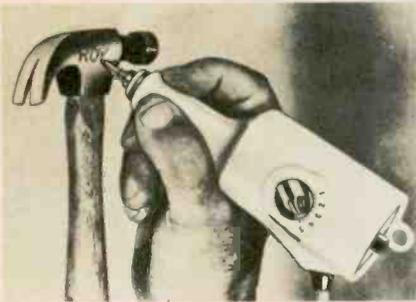
... for more details circle 53 on postcard



all units in the series. Tung-Sol Electric Inc.

Engraving Tool 222

An engraver used for engraving names or identification numbers on steel, copper, brass, silver, aluminum, glass, plastic, ceramic, wood and stone is announced. This 6 in.-long engraver weighs 7 oz. A reciprocating motor



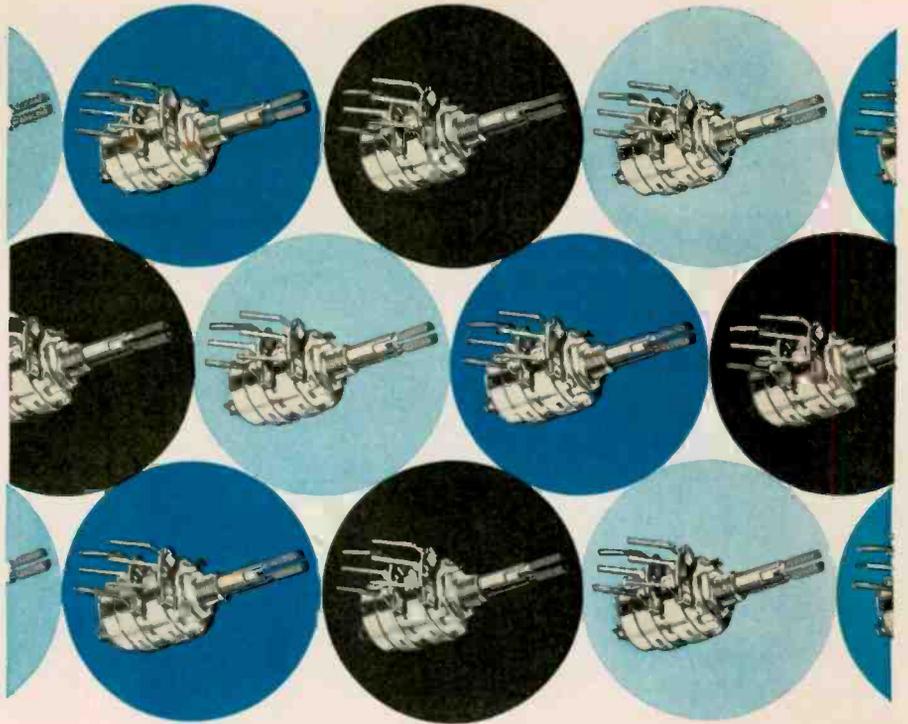
with nylon housing powers a carbide point. It is used for personalizing or coding personal property, tools, instruments and business equipment the announcement said. Meredith Separator Co.

Battery Racks 223

A wire rack designed to combine a number of popular transistor radio batteries (VS323, 9 v and VS334 1.5 v) and "D" size flashlight cells (VS 036) in 6 in. counter space is announced. RCA.



Need an Exact Replacement Control?



Your Centralab Fastatch® II Distributor Has Over

9 BILLION*

In Stock!

* With the Fastatch II system, your Centralab distributor can supply any of 9,938,500,000 different *exact replacement control* combinations. You'll see that these replacements look like the original, because they have:

- EXACT** length shafts for single, dual concentric and twin controls.
- EXACT** shaft end (round, half round, knurled, slotted, etc.)
- EXACT** mounting hardware (doghouse, twist-tab, reverse, etc.) and, of course, exact resistance and taper.

Although they look like the original, these controls will outperform the original—thanks to Centralab's patented snap-together *permanent-locking, anti-backlash* construction.

See your Centralab Fastatch II distributor whenever you need a replacement control. Whether for color or black and white TV, hi-fi, stereo, or radio, he can supply it!!

For additional information on the Fastatch II Control System, write to Centralab, Distributor Products, P. O. Box 591, Milwaukee, Wisconsin 53201, TWX: 414-731-8731. (In Canada: Centralab Canada Ltd., P. O. Box 400, Ajax, Ontario).



DIVISION OF GLOBE-UNION INC.

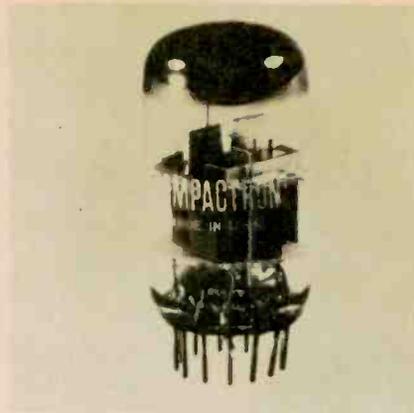
B6509

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NEW PRODUCTS

Compactron 224

A compactron which can serve as a two-stage intermediate-frequency television amplifier is introduced. The manufacturer reports that by replacing two or even three tubes in the manufacture of an IF amplifier, the compactron can save manufacturers up to 20 percent of their previous tube



cost. The 9BJ11 compactron provides high transductance and low capacitance in each section. General Electric Co.

Color CRT Tester 225

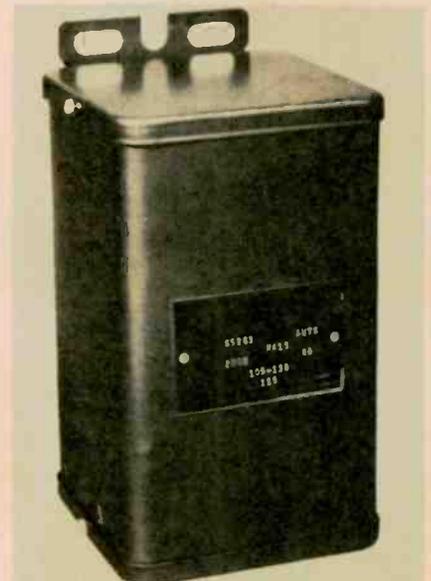
A CRT tester-rejuvenator which provides dynamic type checks of each electron gun for relative life, cutoff, contrast range, gun balance in multi-gun tubes, and other operating condi-



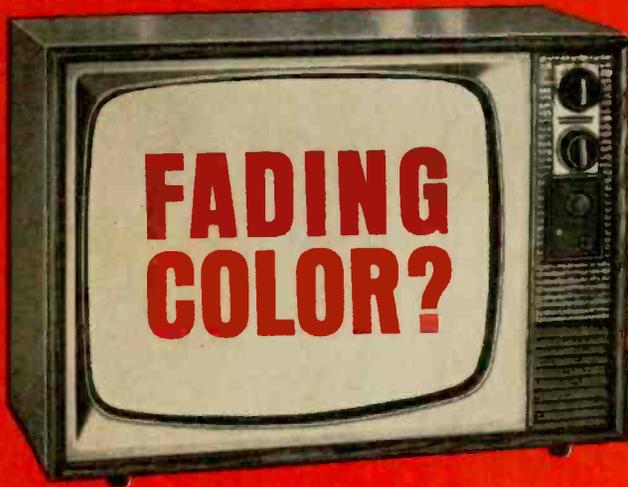
tions and defects is announced. The instrument also incorporates a voltmeter, capable of measuring up to 50,000 v. The meter has two voltage ranges—0 to 1000 and 0 to 50,000. The unit measures 9 x 12 x 5 in., and weighs 7.5 lb, according to the announcement. Amphenol.

Transformer 226

A tapped auto boost-buck transformer designed for converting the nominal output voltage of a line of constant-voltage transformers to specific load requirements is announced. The Type TA Autoformer has a range of adjustment approximately ± 15 per-



cent from 118 v nominal. Three models of the autoformer are available: 2000 v amp capacity, 4000 VA and 10,000 VA, the announcement said. Sola Electric Co.



Perk it up with Perma-Power COLOR-BRITE

Perma-Power does for color TV sets what we've done for millions of black and white CRT's: adds an extra year of useful picture tube life.

When a color tube begins to fade, COLOR-BRITE instantly brings back the lost sharpness and detail. It provides increased filament voltage to boost the electron emission and return full contrast and color quality to the 3 gun color picture tube.

COLOR-BRITE is automatic... no switching or wiring. Just plug it in. Your delighted customers will brighten up as fast as their color sets!

Model C-501, for round color tubes.

List Price \$9.75

Model C-511, for rectangular color tubes.

List Price \$9.75



COLOR-BRITE is a Hue-Brite product from Perma-Power, famous in TV service for b & w Vu-Brites and Tu-Brites.

Perma-Power COMPANY

5740 N. TRIPP AVE., CHICAGO, ILLINOIS 60646

PHONE (312) 539-7171

... for more details circle 51 on postcard

Use this check list before you install a home TV distribution system

	COAXIAL VHF	TWINLEAD* VHF	COAXIAL UHF/VHF	TWINLEAD* UHF/VHF AND UHF ONLY
Channels received	2-13	2-13	2-83	2-83 (14-83 for UHF only)
Color reception when properly installed	Excellent	Excellent	Excellent	Excellent
Cable loss: @ channel 13 for VHF only @ channel 83 for UHF/VHF	4 db (foam filled) 6 db (solid)	1.8 db/100 ft. @ Channel 13	9 db (foam filled) 13 db (solid)	5.6 db/100 ft. @ Channel 83
Loss increase when wet	Nil	Negligible	Nil	Negligible
Reception when run near or through small metal areas	Excellent	Excellent when properly installed	Excellent	Excellent when properly installed
Reception when run near or through considerable amounts of metal	Excellent	Not recommended	Excellent	Not recommended
Ease of installation	More difficult	Easy	More difficult	Easy
Extra parts required	Connectors, matching transformers	None	Connectors, matching transformers	None
Performance in strong-signal areas	Excellent	Excellent—fair**	Excellent	Excellent—fair**
Performance in weak-signal areas	Excellent	Excellent	Excellent	Excellent
Cable pickup of interference (ignition, appliances, etc.)	None***	None—slight**	None***	None—slight**

*A high quality, low-loss foam encapsulated cable type **Depends upon local conditions ***Poorly designed accessories will pickup interference.

Once you know the facts—there is one best choice for your home system—Blonder-Tongue. Whether you prefer 300 ohm or a 75 ohm coax system, Blonder-Tongue has the products you'll need. There is only one way you can protect your home TV system against obsolescence when new UHF stations come on the air—that's with a Blonder-Tongue all-channel UHF/VHF system.

Blonder-Tongue products designed for all-channel home systems include: All-channel signal amplifiers (V/U-All-2 indoor and U/Vamp-2 mast mounted); all-channel couplers (A-102-U/V two-set and A-104-UV four-set). Rounding out the all-channel concept are UHF/VHF matching transformers (Cablematch U/V set mounted; MT-283 mast-mounted) and the TF-331-U/V flush-mounted feed-thru.

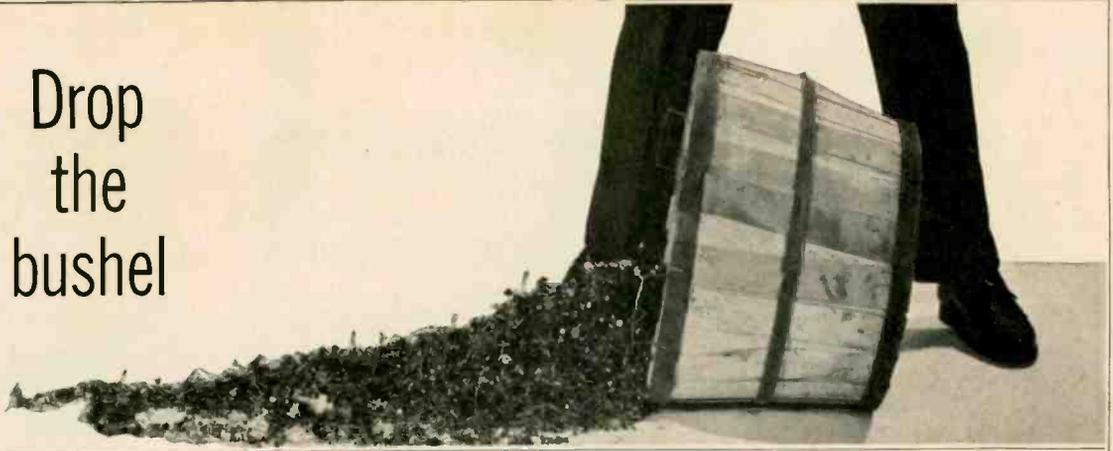
Take your pick. Blonder-Tongue makes them all—and all are "Color Approved". Buy the line with 15 years of quality leadership. Write for free booklet "How to Plan a Color-Approved Home TV System".

BLONDER-TONGUE

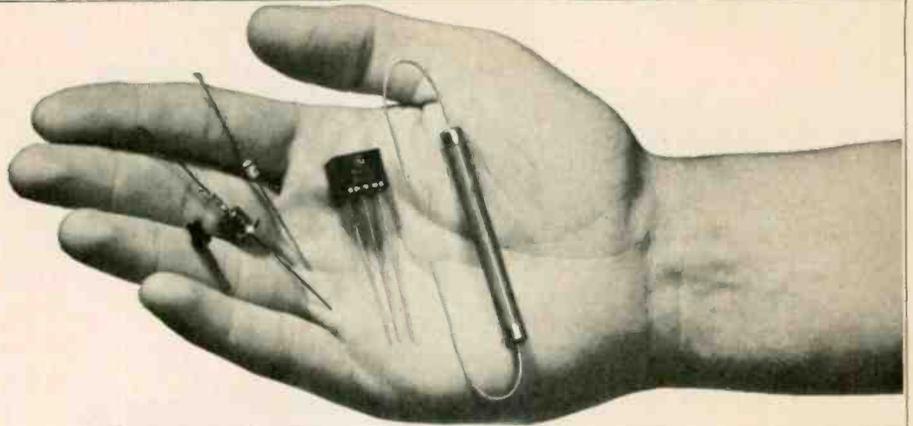
 9 Alling Street, Newark, New Jersey 07102
 home TV accessories • closed circuit TV •
 community TV • UHF converters • master TV

... for more details circle 19 on postcard

Drop
the
bushel



...and
get a
handful



You'll still fill all your replacement needs with just a few G-E Entertainment Semiconductors

A FEW WILL DO That's the whole reason behind G.E.'s universal line of entertainment semiconductors—a few will replace a whole bushel of different components.

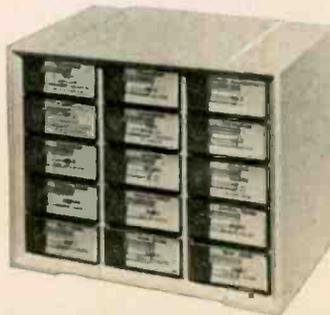
Take the handful of G-E semiconductors shown above . . . representative of G.E.'s Entertainment Semiconductor line which can fill virtually all of your daily radio, TV, and appliance replacement needs:

1. GE-10 GENERAL PURPOSE TRANSISTOR for AF amplifier-driver-output.
 2. GE-504A UNIVERSAL SILICON RECTIFIER for both black and white and color TV receivers.
 3. GE-505 GENERAL PURPOSE SILICON RECTIFIER for radio and TV power supplies, toys, light dimmers, electric tooth brushes, appliance controls, and many other circuits.
 4. 6GC1 DUAL DIODE for selenium TV discrimination diode.
 5. GE-1R1 COLOR TV RECTIFIER for color TV focus.
- G.E.'s 11 universal transistors alone will

replace over 3000 different components. Now, for those out-of-the-ordinary replacement jobs, General Electric has a complete line of back-up entertainment semiconductors (a total of 42, including 12 new additions) designed to replace literally *hundreds of components*—from *dozens* of different manufacturers.

Two new Entertainment Semiconductor Kits for fast, convenient servicing. The revised general purpose 915C Kit (shown) and the all-new color TV 916 Kit incorporate the latest new additions to G.E.'s line for all your TV service needs.

285-10



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General Electric is anxious to help you with your everyday service problems. You can help us, and earn your free HOBBY MANUAL, by recommending three new devices we can perhaps add to our line.

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COMMENTS _____

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CITY _____

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GENERAL  ELECTRIC

... for more details circle 32 on postcard

NEW PRODUCTS

Color TV Kit

230

A color TV kit, designated the GR53A, is announced. The set contains a degaussing coil to demagnetize the picture tube whenever the set is moved, and a built-in dot generator for occasional adjusting of the picture. The set has all channel reception, 2 through 83; a 26-tube, 8-diode circuit; Standard-Kollsman tuner with



push-to-tune fine tuning for individual VHF plus transistor UHF tuner; 24,000 v regulated picture power; automatic color control and gated AGC; and a 6 x 9 in. front mounted speaker. Heath Co.

Motor Speed Control

231

A solid state, speed and power controller is introduced. The SCR-1 can be used to control the speed of universal type ac dc motors such as are found in many stirrers, beaters, hand drills, sanders, saws etc. It is supplied with a 6 foot, three-wire grounded line cord. Maximum rating is 7 amp, 120 vac. It is equipped with auto-



matic circuit breaker and pilot light. Price is \$19.95. Scientific Equipment.

Lab Instrument Line

232

A line of portable instruments for lab and school use is introduced. Fifty-one standard ranges are available in 22 units for shop setups and bread-board wiring devices. The G/P series



has a 3 1/2 in. plastic meter with a knife edge pointer. The molded plastic cases measure 4 3/16 x 3 7/8 x 4 3/16 in. Triplet.

Microphone

233

A speech clipping, communications microphone, the D501K is announced. The microphone is a hand-held style with press-to-talk switch, for mobile



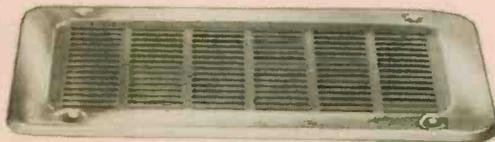
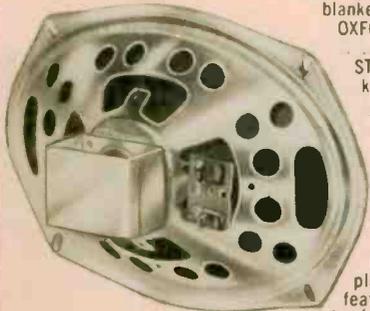
applications. It contains transistor circuitry to provide a variable amount of speech clipping. Electro-Voice, Inc.

BLANKET THE MARKET...

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FUNDAMENTALS OF TELEVISION. By Walter H. Buchsbaum, Published by John F. Rider Publisher, Inc. 291 pages, hard cover. \$9.95.

This book places emphasis on the basic fundamentals of television. Practical troubleshooting procedures are presented together with a thorough theoretical coverage of black and white and color TV. Color TV theory and procedures are worked in along with a well written informational presentation on monochrome TV. The author begins with a complete review of how a TV picture is formed, how it is broken down for transmission and how the information is transmitted. He describes how the color information is integrated into the existing black and white frequency spectrum. Coverage is then extended to the receiver and individual circuitry and principles are described. Helpful servicing information is woven into the text as the reader progresses. One chapter gives complete coverage of both black and white and color receiver alignment. The book is recom-

mended reading for either students or professional technicians. It presents highly technical information in easy-to-understand form for the student and offers the expert a chance to brush up on his monochrome theory and learn more about color principles.

MOST-OFTEN NEEDED 1965 RADIO DIAGRAMS. Published by Supreme Publications, Highland Park, Ill. 192 pages, soft cover. \$2.50.

This volume contains schematics, servicing information and alignment procedures for a great many current radio sets. Many transistor and tube radios are covered along with combinations, stereo, FM and multiplex units. The information contained in the manual is furnished by the manufacturer and most popular brands are covered. The data is presented in easy-to-read form and the book will be an aid to technicians who do a lot of radio work.

MODERN ELECTRONIC VOLTMETERS. By Sol D. Prensky. Published by John F. Rider, Publisher, Inc. 224 pages, soft cover. \$4.95.

Designed as an aid to greater professional competence, this book will

give the reader a thorough understanding of electronic voltmeters. It briefly reviews fundamental principles, covers specific instruments and delves at length into well-established service test procedures. Fifteen chapters cover basic principles of electronic voltmeters, diode voltmeters, elementary dc VTVMs, general-purpose ac/dc VTVMs, using the VTVM, transistor voltmeters, dc testing, ac testing, RF testing, high-sensitivity ac voltmeters, high-sensitivity dc voltmeters, electronic microammeters and galvanometers, potentiometric voltmeters and recorders, digital voltmeters and specialized applications. A bibliography is provided for those who would like to extend their studies in this area. The text is well illustrated with schematics, drawings and photos. It is highly recommended to professional technicians in all phases of electronics.

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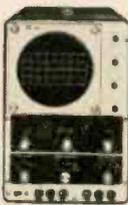
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NEW LITERATURE

Audio Products 300

This 14-page catalog describes a line of audio equipment and replacement parts. Many types of cartridges, tonearms and needles are listed. Also included are specifications on a series of ceramic microphones and a selection of speaker systems. Sonotone Corp.

Contour Charts 301

This four-page bulletin contains contour charts for two column type speakers. Instructions on how to use these charts for speaker system layout are also presented. Jensen Mfg. Co.

Coaxial Installation 302

The advantages of using coaxial cable for home antenna lead-in are stressed in this four-page brochure. A line of antennas and kits necessary to make a 75 Ω installation are described. Jerrold Electronics.

Commercial Antennas 303

Electrical and mechanical specifications of a line of mobile and base station antennas for use on the commercial radio frequencies are contained in this data sheet. Master Mobile Mounts.

Electrician's Tools 304

A line of electricians' wiring tools is described in a six-page booklet. Complete specifications and application information are included for an assortment of tools for wire fishing and pulling, wire and cable stripping, and circuit testing. Ideal Industries, Inc.

Sound Systems 305

Amplifiers and sound systems for commercial and industrial application are described in a 20-page booklet. Specifications for a line of public address amplifiers and accessories are given. A short description of what is required of a PA system is included. Harman Kardon.

Church Microphones 306

A four-page brochure describes a line of microphones and accessories designed for church and synagogue installations. Information and suggestions on how to use these microphones is also provided. The Turner Microphone Co.

Phono Needles 307

A 32-page catalog gives data on more than 600 phonograph needles.

The catalog also contains retail price listings as well as cross references to other brands of needles. Jensen Industries.

Electronic Kits 308

This 36-page catalog contains numerous electronic kits. Hi Fi/stereo components, test and measuring instruments, CB transceivers, ham gear and educational training aids are described. EICO Electronic Instrument Co., Inc.

Soldering Iron 309

A pencil type soldering iron is described on this data sheet. Ratings and specifications are also given. Weller Electric Corp.

Solid State Components 310

A replacement line consisting of 9 transistors, 12 silicon rectifiers, 4 silicon diodes and 3 dual diodes is cross referenced in this six-page brochure, I.E.H. Mfg. Co., Inc.

Tools 311

This 12-page brochure contains specifications of a line of tools used in maintaining telephones, relays, central office equipment, precision instruments, and business machines. Jonard Industries Corp.

Antenna Displays 312

This brochure describes a series of communication antenna displays. A number of antenna accessories are also listed. The Antenna Specialists Co.

Power Tools 313

A line of power tools are listed in this 20-page catalog. Drills, circular saws, jig saws, sanders and lawn and garden tools are included. A selection of accessories for these tools are displayed. Prices, specifications and applications are given. Skil Corp.

Wrench 314

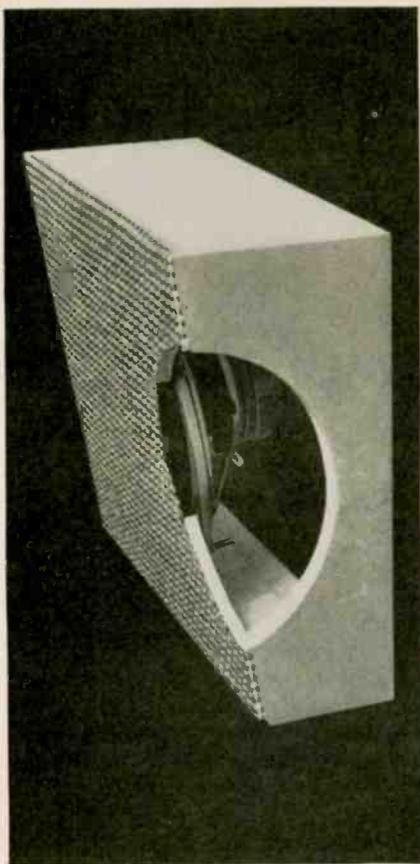
An adjustable grip wrench is described in a data sheet. Specifications and application of the tool are given. G. and G. Tool Co.

Antennas 315

A line of antennas for commercial applications such as CATV, translator, MA-TV and ETV is described in this six-page catalog. Both VHF and UHF antennas are included. Taco.

Indoor Antennas 316

This 12-page brochure describes a line of indoor antennas. Specifications and outstanding features are included. A large photo of each antenna is displayed. Channel Master Corp.



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Test Equipment 317

This ten-page catalog contains specification on a line of test equipment used for TV/Radio, industrial electronic and electrical applications. Many accessories and adaptors for the equipment are included. VOMs, VTVMs, Scopes, other types of meters and some specialized equipment. Simpson Electric Co.

Tuner-Amplifier 318

A solid state tuner-amplifier is described in this data sheet. Specifications, features and dimensions are included. V-M Corp.

Electron Tubes 319

A numerical index, descriptions and basic specifications of a line of electron tubes are contained in a 26-page catalog. The publication can serve as a reference guide for designers as well as for replacement tubes. Ampex Electronic Corp.

Replacement Coils 320

Specifications and prices of a line of coils and components are contained in a 160-page catalog. A cross reference section listing exact replacement for many brands of TV sets and radios is included. J. W. Miller Co.

Relays 321

A line of sealed relays are described in this 22 page catalog. Features, description, applications, ratings, specifications and pricing information are listed for each type of relay. G-E.

Soldering Aids 322

A line of soldering aids are described in this four page brochure. Test adapters, tweezers and filament scissors are also covered. The folder illustrates and gives prices on the tools. Beatech.

Antennas 323

This technical bulletin describes technical and mechanical changes made in the line of CB antennas. Antenna Specialists.

Test Accessories 324

A 28 page catalog lists molded patch cords, cable assemblies, molded test leads, connecting leads, socket savers and test socket adapters. Photographs, specifications, dimensions, schematics, operating ranges and prices are listed on all items. Pomona.

Stereo Tape Recorder 325

Specifications and features for a stereo tape recorder are given in this bulletin. Rheem Mfg. Co.

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NEW LITERATURE

Lamps

326

This 24 page catalog contains electrical and physical characteristics of a line of miniature, subminiature and sealed beam lamps. The book contains base diagrams, filament designs and bulb outlines. Tung-Sol.

Relays

328

The revised edition of this catalog contains pertinent data and prices on a line of relays. It describes solid state time delay, sensitive, polarized and general purpose relays. Potter and Brumfield.

Miniature Power Tools

327

An eight page catalog illustrates a line of bench and hang-up type tools.

Voltage Regulators

329

This eight page catalog gives features and characteristics for a line of

voltage regulators. A description on how the regulators operate and a circuit diagram is included. Sola.

Speaker System

330

This four page brochure describes a pair of Hi Fi speakers. It also contains physical and electrical specifications. Sonotone.

Finger Wrenches

331

This brochure describes a line of specialized finger-tip wrenches for use in holding nuts in inaccessible places. Three sets of wrenches are listed. Ames.

Voltage Regulators

332

A line of automatic voltage regulators are listed in this 24 page bulletin. Ratings and specifications of these industrial type regulators are included in the bulletin. Superior.

RECORD CHANGER . . .

Continued from page 70

from an audio signal generator through the input and also from stage to stage. If you have one audio channel that is good and the other is defective, use a 0.01 μ f capacitor in series with a probe and alligator clip. Clip the capacitor lead to the good amplifier input and play a record through the defective side. Stage by stage can be checked with this system. Poor balancing is the result of lower gain in one side of the stereo amplifying section.

Intermittent audio is the most difficult trouble to find. These intermittent troubles are generally bad soldered joints on a printed board, intermittent coupling capacitors and intermittent tubes.

A defective volume control will sometimes become intermittent. In the front end of the amplifier sections 60 cps hum can easily be picked up and amplified. Be sure to cut all leads as short as possible on new components and make good soldered ground connections.

The amplifier section is not a lot different than the amplifier in a radio or TV set. A few additional features exist in the stereo amplifier. They all have the same troubles. A good example of this is shown in Fig. 3. The 35C5 audio output tube shorted and burned the cathode resistor R16, screen dropping resistor R24, and the two 15 Ω resistors in series with the selenium rectifier. The rectifier plates were pitted and burned black in spots.

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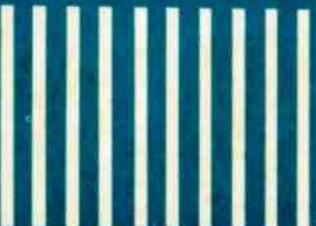
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These parts were replaced and the set was back in operation again.

Speakers

Most speaker troubles can be easily located. It is always best to replace a defective speaker with a good name-brand item. If the cone is torn or holes poked into it you will notice it right away with a stereo Hi Fi unit. A mushy or distorted sound is generally a dropped cone (cone is resting on the center pole piece). "Blatting" or vibration on certain notes will usually indicate a torn spider or bad cone paper. Generally, a large 10 or 12 in. speaker is used for the low range and a 4 or 6 in. for the middle range and approximately a 3 in. speaker for the high frequency end.

Since some stereo speakers are quite costly, it is always best to figure an estimate and call the customer about the charges. Be sure to check the requirements of a new speaker according to the cost, brand name, frequency response and correct impedance matching. ■

ONE MAN . . .

Continued from page 62

it on stub mast. (I use a safety belt of 2½ in. cotton webbing so I may work with both hands.) Actually, you have better footing on the ladder than you have on the pitched roof. Now proceed with lifting and locking the same as for ground mounted mast.

Suppose you need to put the antenna up another 10 ft? Generally speaking, the higher the antenna the better the signal. Telescoping masts are available up to 70 ft but this is too much for one man. For a 50 footer, assemble just as you would a 40 footer but on first time up leave the top section telescoped. Tie the second set of wires in place with just a little slack, now lower the mast, pull out top section and elevate to full height. The second wires will hold the mast from drooping while you tie the upper ones.

You can use this trick on a 40-ft mast and put it up in near gale winds by getting ready and lifting it during a lull.

Suppose you have a tough location or a customer who wants the best. You can obtain triangular crank-up telescoping towers which

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you can handle alone up to 100 ft.

These towers require a small poured concrete base (See Fig. 3) and anchors should be set in concrete also. I use 3- or 4-in. pipe set 4 ft in the ground and standing about 6 ft above ground. A hinge base mount is bolted to the concrete base.

To erect one of these towers by yourself, you'll need a light block and tackle with about 100 ft of rope. Use an anchor post or even your truck to pull against. When the tower is in vertical position, tie lower guys securely. Use your long ladder (the tower sections are 20 ft instead of 10, as with the tubular mast) and assemble as you did the roof mounted pole.

Once again, if you put it up, you'll probably have to service or move it. So don't fudge! ■

PROLIFIC SERVICE . . .

Continued from page 65

capacitor, we recognize immediately that we must have the correct capacity, and the voltage rating must be equal to the original or higher. Here again, is a critical application where operating ambient must be taken into consideration in selecting the proper replacement. The original capacitor was a mica. In addition to observing the temperature characteristics of the mica in making a replacement substitution, we must also select a capacitor having a low dissipation factor. The horizontal oscillator circuit, of which this is a part, operates in excess of 15,000 cps. Dissipation factor is a function of frequency; and therefore, the dielectric material used can play an important role. The material itself must have a low power factor rating. A ceramic would fill the requirement here if it has low "K" construction and is temperature compensated.

Another capacitor that would work in the application satisfactorily is polystyrene. Polystyrene is a member of the plastic family. It has the highest IR (insulation resistance), however, of all the materials commonly used and has very low dielectric absorption.

This article will be concluded next month and will contain further valuable information on capacitor replacements. ■



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NEWS OF THE INDUSTRY

Zenith Ships Million TV Sets

Zenith Radio Corp. announces that it has set new all-time TV industry records with the production and shipment of more than one million TV sets during the first six months of 1965. Joseph S. Wright, president, said that the company produced and sold "its one millionth TV receiver over a month earlier than it did last year to achieve these new TV unit production and shipment records, the greatest for any company in our industry's history." Leonard C. Truesdell, president of the company's sales division stated: "Zenith expects to sell more than two million TV sets in 1965, and become the first TV receiver manufacturer to attain and exceed this figure in a single year. This will be the manufacturer's seventh consecutive million-plus TV set sales year."

Oxford Transducer Expands

Oxford Transducer Corp. has taken over new and enlarged quarters at 3911 South Michigan Ave., Chicago. According to executives of the firm, the move was made to increase manufacturing and warehousing facilities. Oxford manufactures a line of speakers for public address, high fidelity, replacement use, special purpose applications, inter-com, automotive, plus a line of auto speaker rear seat kits.

Jerrold Educational TV

Jerrold Electronics educational television (ETV) systems are being installed in 110 schools throughout the state of Delaware, under a contract awarded by the Delaware Educational Television Board. Classrooms in each of the schools will be equipped with television outlets connected to a closed-circuit cable system and master antenna. Educational television programs will be distributed through each school via the system. The Diamond State Telephone Co. will transmit instructional programs to the schools, via microwave and cable, from a central studio in Dover, Delaware. All systems should be in operation for the fall school term.

Channel 47 Advertising Revenue

Channel 47's (WNJU-TV) gross advertising revenue is expected to hit \$1.5 million at the end of its first year of operation, and possibly \$2.5 million at the end of the second, discloses Edwin Cooperstein, president and general manager of the station. He said those figures are based on Channel 47's highly successful Charter Rate Plan, which closed when the station went on the air May 16 with nearly \$500,000 contracted for by national and local advertisers. The Plan provided for rebates to advertisers who signed for a minimum of 52 weeks prior to Channel 47's debut as the first commercial UHF outlet in Metropolitan New York, and first new television station in the tri-state area in 16 years. With studios in The Mosque Theatre Building, Newark, New Jersey, Channel 47 transmits from the Empire State Building, Newark, New Jersey, Channel 47 transmits from the Empire State Building in color and black-and-white to New York, New Jersey and Connecticut with a power of over 500,000 w. The station signs on at 4 p.m. each day, and broadcasts well past midnight.

SEPTEMBER 1965

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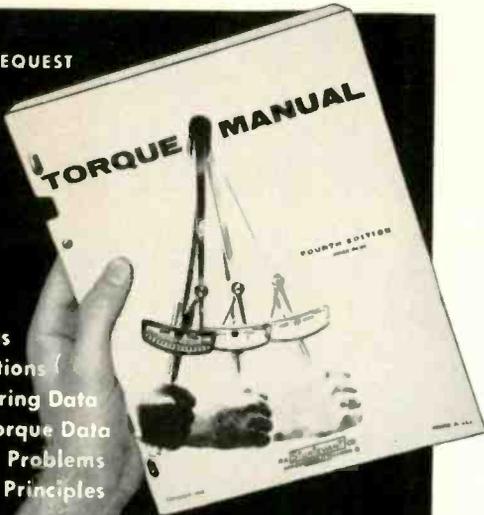
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NEWS OF THE INDUSTRY

Fanon Appoints Sales Rep

Murray Trotiner, vice president in charge of sales for Fanon Electronics, announces the appointment of three new sales representative organizations to the electronic distribution market. The company manufactures intercom, PA audio and citizens band transceiver equipment. The state of Florida will be covered by Winfield Electronic Sales Co., 66 N.E. 125th St., No. Miami, Fla. Indiana and Kentucky have been assigned to Courier Sales, 2070 East 54th St., Indianapolis, Ind. For the mountain states of Utah, Colorado, Wyoming and the eastern portions of Montana and Idaho, Koether & Cox, 1325 So. Inca St., Denver, Colorado, have been designated territorial representatives.

Belden Earnings

Belden Mfg. Co. announces that its earnings for the first half of 1965 increased 32.24% over the same period last year, while sales rose 26.35%. Net income for the six months period ending June 30, 1965, was \$1,402,474, equal to \$1.72 a share compared with \$1,060,521 or \$1.31 a share last year. The earnings for the period set a new high in the company's 63 year history. Sales for the period also climbed to a new high to \$25,126,902, compared with \$19,887,139 last year. Net profit on sales billed for the first half was 5.58% compared to 5.33% for the corresponding period last year.

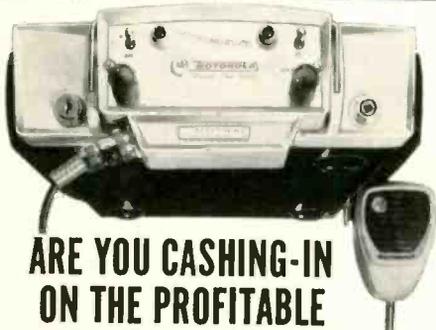
Standard Kollsman Earnings

Standard Kollsman Industries Inc. reports increased earnings of \$1,441,964, or 64 cents per share, for the first half of 1965, compared with a loss of \$925,057 for the same period last year. Consolidated net sales rose to \$43,755,403 for the six months, from \$38,546,209 in the comparable 1964 period, it was announced by John B. Huarisa, president. For the second quarter of this year, sales and earnings are \$23,806,682 and \$802,422, respectively, up from sales of \$20,104,008 and a loss of \$526,515 in the 1964 quarter.

RCA Sales and Earnings

Profits and sales of the Radio Corporation of America rose to all-time record levels during the second quarter and first half of 1965, Chairman David Sarnoff and President Elmer W. Engstrom announced today.

Second-quarter and first-half dollar earnings increased by 18 percent and 17 percent, respectively, over last year's levels. The quarter was the 17th consecutive three-month period in which profits improved over the comparable quarter of the preceding year. New all-time sales records were set for a month, a quarter, and a half-year. June sales volume of \$186,000,000 was the highest for any single month in the company's 45-year history. It exceeded by \$17 million the previous monthly record set in October 1962. Profits after taxes in the second quarter were \$18,900,000, as against \$16,000,000 in the same period last year. For the first half, after-tax profits were \$43,900,000, compared to last year's first-half record of \$37,600,000. Earnings per share of common stock rose to 32 cents in the second quarter, 19 percent higher than the 27 cents in the comparable period last year. For the first



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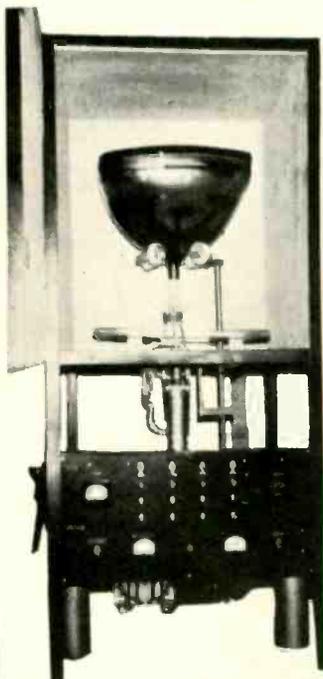
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half, earnings per share were 75 cents, or 19 percent higher than in the first six months last year. The percentage increase in per-share earnings was greater than in dollar earnings because the manufacturer recently retired 78 percent of its outstanding first preferred stock. Since holders of preferred stock have first call on earnings, the reduction in the outstanding shares increased the proportion of earnings remaining for common stock. Sales in the first six months were \$963,900,000, setting a new mark for any half year. The previous high was \$913,300,000 in the second half of 1964. Second quarter sales were \$488,400,000, an all-time record for any quarter. The best previous quarterly total was \$486,200,000 in the fourth quarter of 1962. In comparison with the same periods last year, the gains in sales volume were 12 percent for the second quarter and 7 percent for the first half.

IRC Reports Earnings

International Resistance Company again established new highs in its second reporting period this year, resulting in the largest sales and net profit figures for the first 25 weeks of any year in the company's history. The company's net through June 27, 1965, increased 87 percent over the comparable 1964 period, on sales that gained 29 percent. Net profit amounted to \$1.12 per share for the 25 weeks this year, compared with 60 cents a year ago and exceeded the \$1.05 earned in the full year of 1963. Per share figures are based on 1,491,862 shares currently outstanding. For the period ended June 27, 1965, profit totaled \$1,675,316 compared with \$896,028 for the 25 weeks ending June 21, 1964. Sales amounted to \$18,464,021 this half-year and \$14,321,496 a year ago.

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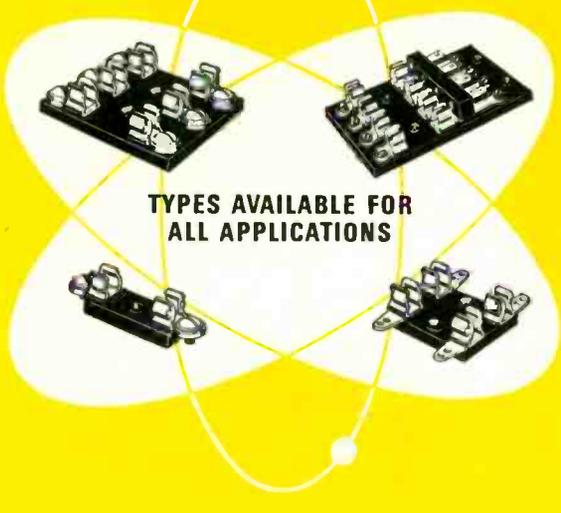
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NEWS OF THE INDUSTRY

NAB Supports FCC Proposal

The National Association of Broadcasters endorses the Federal Communications Commission's proposal to reserve UHF channels 70 to 83 for exclusive use by community-type, low-power television stations. The rule, proposed by the Commission last month, is designed to meet the needs of medium and small communities for local commercial and educational TV operation. It would limit the maximum effective radiated power to 10 kw and the maximum antenna height to 300 ft above average terrain. In a filing by NAB General Counsel Douglas A. Anello and Attorney Gordon C. Coffman, NAB said it "always has supported the Commission in its quest for ways to provide the maximum, efficient use of the available spectrum and agrees that a need exists for relatively low-powered television stations designed to serve medium and small size communities.

Jerrold Names Sales Manager

Tom Shea has been named sales manager of the distributor sales division of Jerrold Electronics, Sanford Berlin, manager of the distributor sales division, announced.

Mr. Shea assumes sales responsibility for all products which are sold through distributors, including TV and FM reception aids, TV/FM distribution systems for home, commercial and educational use, and the entire consumer line. In this capacity, Mr. Shea will direct activities of the distributor sales organization, including regional sales managers, manufacturers representatives, and the company's nationwide distributor roster. Prior to joining the company, Mr. Shea was associated with Blonder-Tongue Laboratories, Newark, N.J., for 11 years. Most recently, he served as product manager, responsible for national sales of closed circuit television systems and master antenna television systems. Previously, he was eastern regional manager, responsible for both consumer products and systems sales volume in the eastern United States.

Sylvania Appoints Distributor

The appointment of General Appliance Corporation, Salt Lake City, Utah, as a franchised distributor for the entertainment products division of Sylvania Electric Products Inc. is announced. Robert J. Theis, president of the division, said the distributor will be responsible for the distribution of his company's complete line of television, high fidelity stereophonic instruments and radios in 34 counties in Idaho, 29 in Utah, 12 in Nevada, five in Wyoming and two in Oregon.

Texas Instruments Sales

Texas Instruments is reporting to its shareholders that second quarter and first half sales and earnings were higher than for any prior three or six months reporting period.

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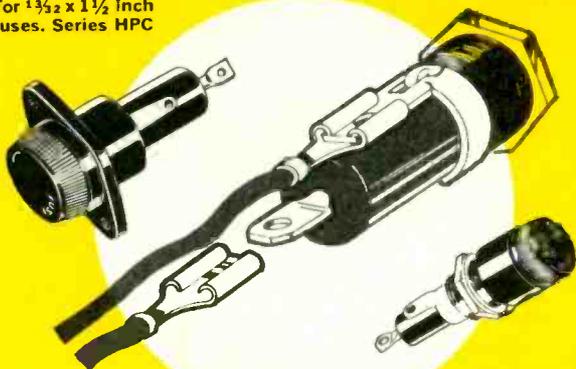
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Corporation are being distributed to company distributors and dealers. Officials said the checks are in payment of the first group of some 50,000 claims expected to be filed under its program to speed up refunds of the excise tax on distributors' and dealers' floor stocks, on the effective date of the tax repeal, June 22. The company has earmarked more than \$12 million to cover the program. When the Excise Tax Reduction Act of 1965 was signed into law, the company announced to distributors and retailers that it would help them retain their capital position by making advance payments on validated claims at the earliest possible date — well in advance of the time when excise tax refunds from the government would be likely. The manufacturer had previously shipped out complete instructions to enable distributors and their dealers to take immediate inventories and prepare refund claims. To speed up payments, a special staff was set up to check claims and prepare them for computer processing, and will add additional people as the work load increases.

Vidaire Appoints

George Miller, president of Vidaire Electronics Mfg. Corp., announces the appointment of the Newhope Corporation as their sales representatives in the metropolitan New York-northern New Jersey territory. The company manufactures a line of television, radio, audio accessories and replacement components and is also the sole marketer for all BSR products through the electronic parts distributor. It also markets a line of replacement phonograph cartridges, 45 rpm spindle adapters and center post spindles.

Fuseholders of Unquestioned High Quality

Second quarter sales were up 24% and earnings per share up 16% over comparable results in 1964. Sales billed were \$106,394,000 for the second quarter and \$198,004,000 for the first six months of 1965, the shareholders report states. Net profit after taxes was \$5,562,000 for the second quarter and \$10,541,000 for the first six months of 1965. Earnings per common share were \$1.10 for the second quarter and \$2.08 for the first six months of 1965 on 5,050,704 shares outstanding. These compare with 95 cents and \$1.67 for the respective periods of 1964. Shareholders were informed that total backlog had increased to an all-time high of \$198 million from \$178 million at the end of the first quarter. It was \$148 million at year-end.

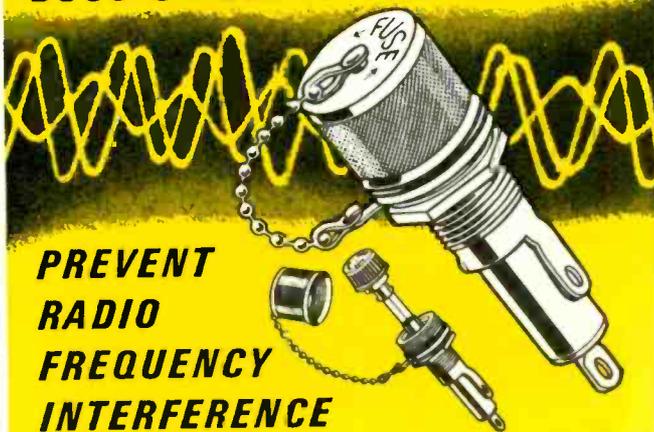
ITT Acquires Avis, Inc.

International Telephone and Telegraph Corp. announces the completion of the acquisition of the assets of Avis, Inc., by a new subsidiary — ITT Avis Inc. Shareholders of Avis — the nation's second largest vehicle renting and leasing concern — approved the acquisition on May 20. The acquisition previously had been approved by the boards of directors of both companies. The vehicle renting and leasing concern employs about 2500 persons in its offices located throughout the United States as well as abroad, offering truck-rentals and car-leasing services in addition to its car-rental operations.

Zenith Mails Tax Refunds

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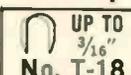
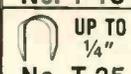
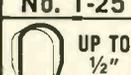


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