APRIL, 1963 35 CENTS

PF REPORTER

including Electronic Servicing

SPECIAL ANTENNA SECTION

Sizing Up Antennas

How to Strip and Solder Cables

Spotting Antenna Failures Quickly

Installing Communications Antennas

Stock Guide for TV Tubes

Symfact

Beauty
TO UHF CONVERTERS

The Model "A", the only UHF converter you can show and sell with pride. Designer styled in beige and tan to blend with today's decor . . . to harmonize with modern TV cabinet design. Standard waited . . . and tested, analyzed, and re-tested until they could bring you the quality instrument you and your customers have a right to expect from the leading manufacturer of tuners. As a result, you now have a converter which is beautiful, *profitable, and dependable.*

PERFORMANCE YOU CAN SEE

New low-noise, shielded tuner permits fine tuning for all 83 UHF channels. Functions perfectly with color or black and white sets. Two simple controls: one for VHF, UHF, and "off" . . . the other for channel selection and fine tuning. The "SK" installs in about a minute with just a screwdriver.

POWER IN PROMOTIONAL SUPPORT

With a first order of 12 units or more, Standard supplies 3 newspaper ad mats . . . 3 radio spot scripts . . . materials for a powerful TV spot . . . 2-color catalog sheets . . . a giant (3′ x 6′) 2-color window banner . . . a counter card . . . as many pre-printed jumbo post cards as you can use PLUS hard hitting ads in TV Guide.

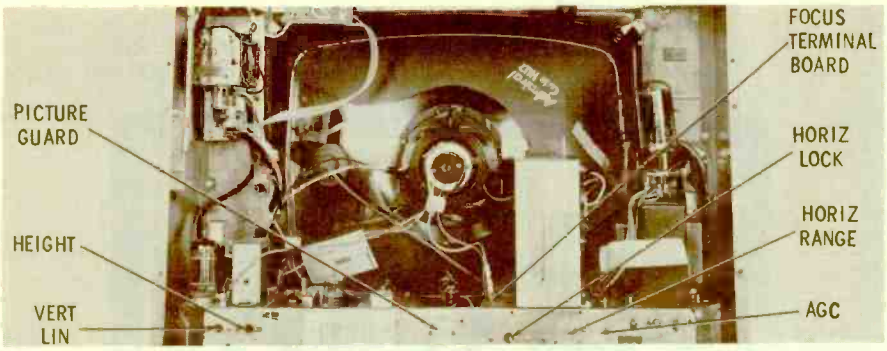
Feature this exciting counter-top display carton

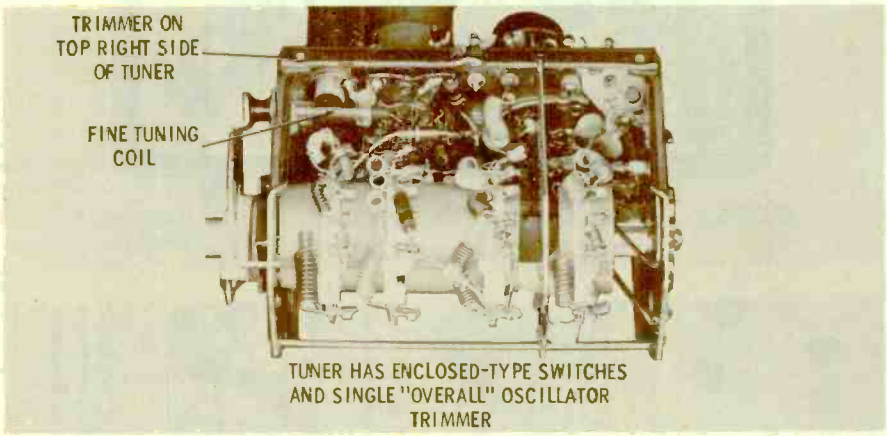
Contact your Standard representative . . . or write

standard kollsman INDUSTRIES, INC.

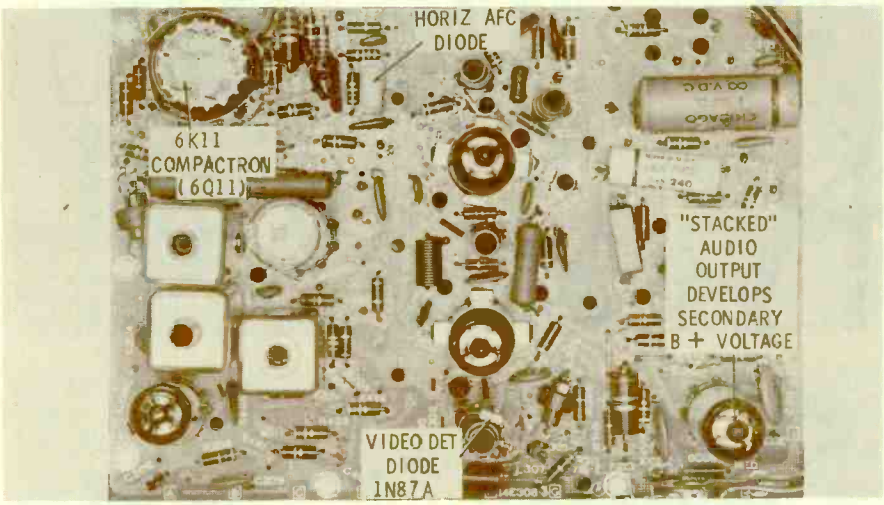
Formerly Standard Coil Products Co., Inc., Melrose Park, Illinois / WORLD'S LARGEST MANUFACTURER OF TELEVISION TUNERS

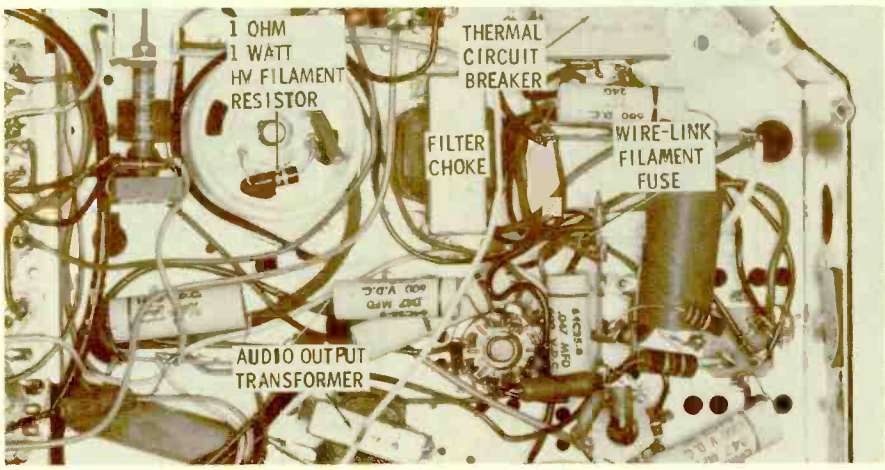
Admiral

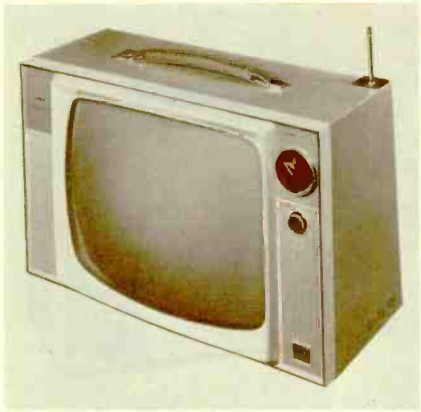




TUNER HAS ENCLOSED-TYPE SWITCHES AND SINGLE "OVERALL" OSCILLATOR TRIMMER







Admiral
Model 93F16
Chassis 16F3B

Included in Admiral's '63 TV line is the 19" portable shown here. An enclosed-switch tuner is used in this manually tuned receiver, and it has only one "overall" oscillator adjustment (a trimmer) for all channels. This trimmer, located on top of the tuner near the front, should be adjusted only on the highest channel. (You may have to compromise the setting to obtain the best fine-tuning range on both high and low channels.) Other portables, using a similar chassis and a turret tuner, are available with remote control; some models come equipped for UHF reception.

The tubes in the tuner are a 6FS5 *shadow-grid* RF amplifier and a 6FG7 mixer-oscillator. A 6BZ6 and a 6DK6 function as IF amplifiers, and a 1N87A is used as the video detector. The detector diode is mounted above the chassis, on the terminals of the last IF transformer (see photo). The common-cathode dual diode used for horizontal AFC plugs into a socket on the printed-circuit board.

A 6K11 compactron, used in last year's line, again fills the AGC keying-noise limiter-sync separator functions. (In some chassis you may find a directly interchangeable 6Q11.) The 6CU5 audio output tube is wired in a stacked B+ circuit, to develop a secondary B+ voltage of approximately 140 volts. A 5U4 is the low-voltage rectifier, and a thermal circuit breaker provides protection for its circuit. A wire-link fuse (see photo for location) protects the parallel tube filaments.

One of three different focus potentials —boost voltage, 265 volts B+, or ground —can be selected for the 114° picture tube, a 19XP4. A terminal board on the top side of the chassis makes focus adjustment easy; you merely slip the connector (from pin 4 of the CRT) over the wanted terminal.

Operating controls—channel selector, fine tuning, and on-off-volume—are located on the front of the cabinet. The vertical linearity, height, PICTURE GUARD (sync stability), horizontal lock, horizontal range, and AGC controls are all mounted on the rear apron of the chassis. The contrast, brightness, and vertical hold controls are accessible at the side of the cabinet.

PF REPORTER, for April, 1963, Vol. 13, No. 4. PF REPORTER is published monthly by Howard W. Sams & Co., Ins., 4300 W. 62nd St., Indianapolis 6, Indiana. Second-class postage paid at Indianapolis, Indiana. 1, 2 & 3 year subscription price: U.S.A., its possessions, and Canada: $4.00, $7.00, $9.00. All other countries: $5.00, $9.00, $12.00. Current single issues 35c each back issues 50c each.

Panasonic by Matsushita
Model AN-14

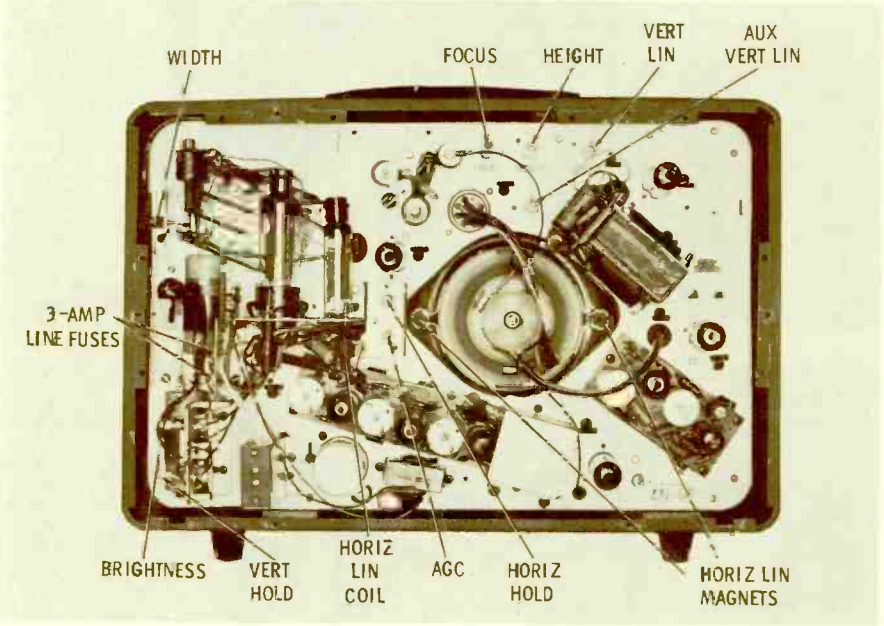
The portable TV shown here is one of the newest imports to appear this year. The set comes equipped with a built-in rabbit-ear antenna, and has an earphone socket for private listening.

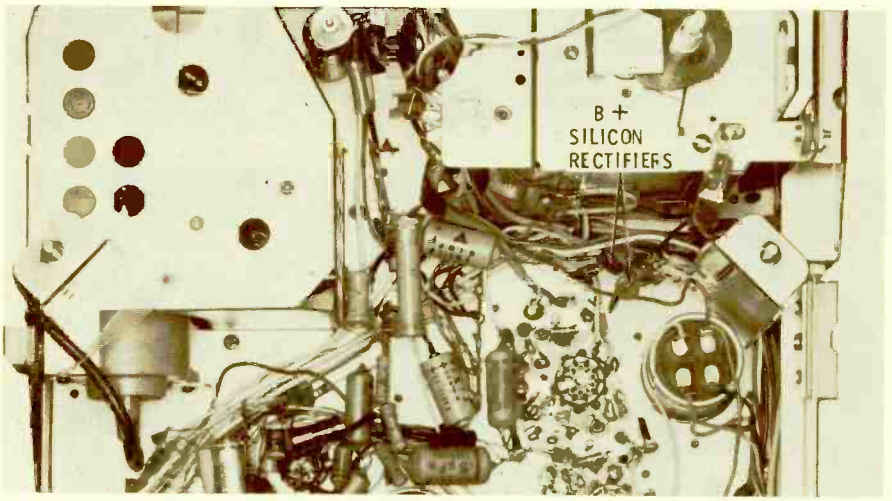
The circuits in this set are hand-wired, except for those on two small printed-circuit boards. On one of the boards are mounted the components for the IF stages; the other contains portions of the sound circuits.

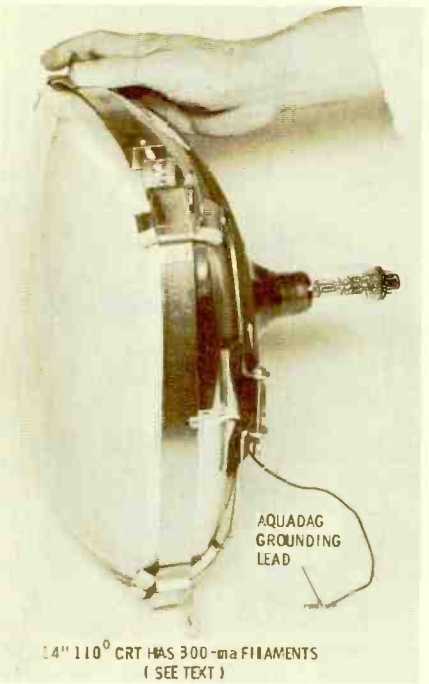
The chassis is a transformerless type, and B+ voltage is developed by two silicon rectifiers, wired as a full-wave voltage doubler. Overload protection for the receiver is provided by two 3-amp fuses —one in series with each side of the AC line. The filament wiring is uncommon, using a series-parallel arrangement with two separate 300-ma strings. An 8-ohm, 20-watt dropping resistor is common to both strings, and each of the strings also has its own separate 82-ohm, 20-watt dropping resistor.

An array of unfamiliar tubes is used in this set. One of the strings uses such unusual numbers as: 18GV8/PCL85 vertical blocking oscillator-output; 9A8/PCF80 horizontal oscillator-AFC; 25E5/PL36 horizontal output; and 30AE3/PY88 damper. The other string uses a 7DJ8/PCC88, RF amplifier; 9A8/PCF80 mixer-oscillator; 6BX6/EF80 first IF amplifier; 6BX6/EF80 second IF amplifier; 6BX6/EF80 third IF amplifier; 9A8/PCF80 sound IF-sync limiter; 16A8/PCL82 audio output-sync separator; two familiar types (12BY7A video output and 6DT6 audio detector); and a special-type AW36-91 picture tube. Since the 14" picture tube, a 114° type, draws a filament current of only 300 ma, a normal 600-ma test CRT cannot be used with this receiver. (A special adapter is available from at least one manufacturer for using a standard test CRT with this type of filament circuit).

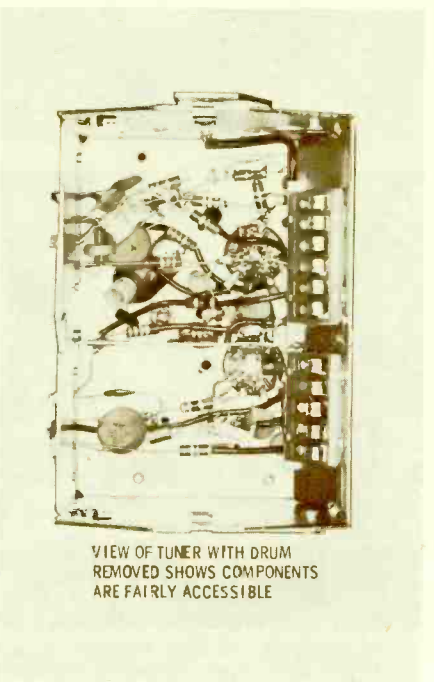
An unusual control arrangement is used in the vertical circuit of this set; there are two separate controls for vertical linearity, and a third control for adjusting vertical height. The extra linearity control adjusts the shape of the feedback waveform coupled back from the vertical output stage to the vertical blocking oscillator. You must use all three of these controls to obtain proper vertical sweep and linearity.





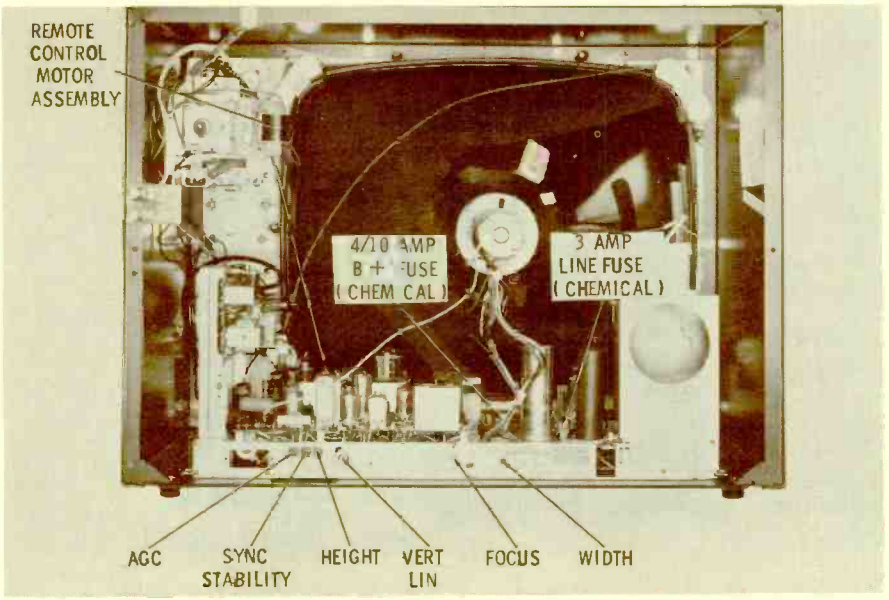


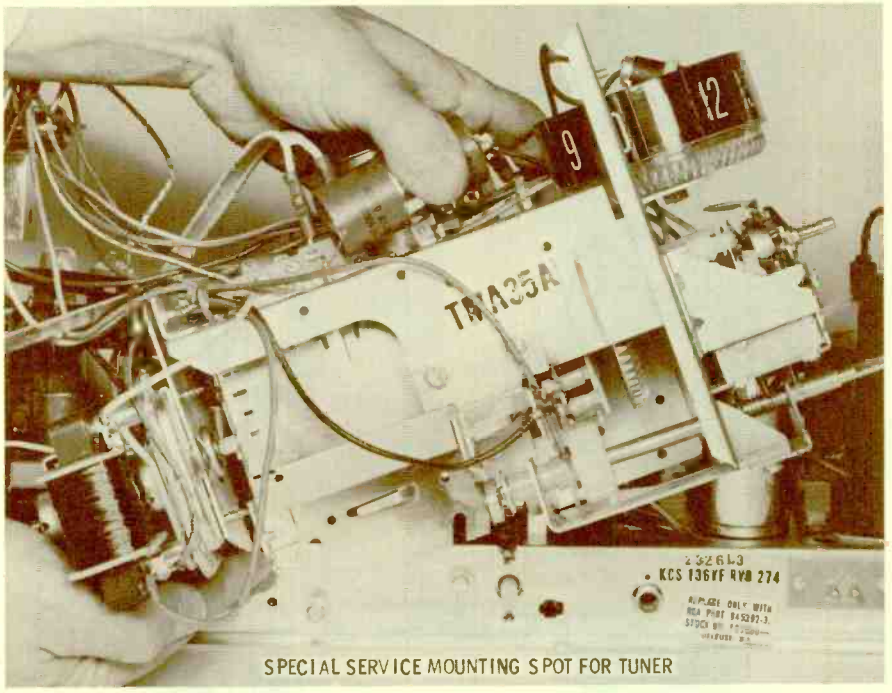
14" 110° CRT HAS 300-ma FILAMENTS (SEE TEXT)



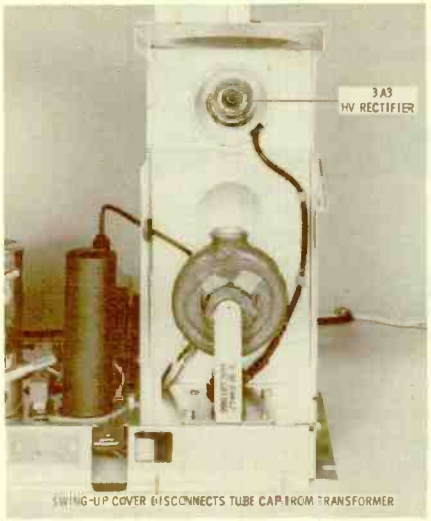
VIEW OF TUNER WITH DRUM REMOVED SHOWS COMPONENTS ARE FAIRLY ACCESSIBLE

RCA

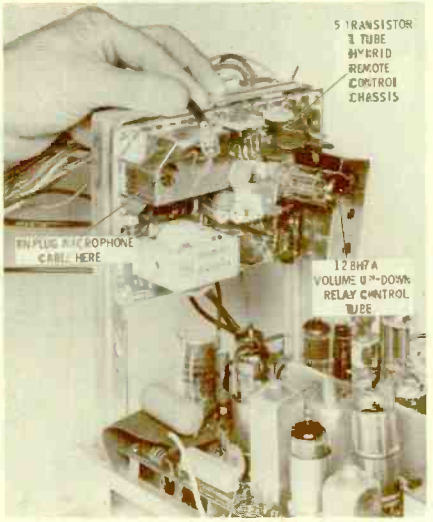


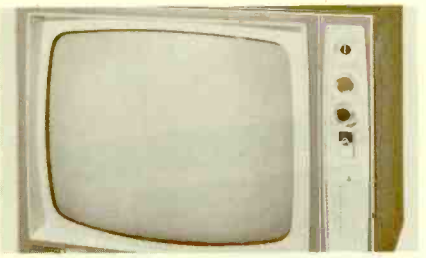


SPECIAL SERVICE MOUNTING SPOT FOR TUNER



SWING-UP COVER DISCONNECTS TUBE CAP FROM TRANSFORMER





RCA
Model 233-B-605RS
TV Chassis KCS136YA
Remote Control Chassis KRS26A

This model is representative of the 23" TV's introduced by RCA in '63; all use a "warmed-over" version of last year's horizontally mounted chassis. The table model shown here comes equipped for remote operation of the channel selector and volume controls; remotely controlled tuner rotation is in one direction only, but the volume can be either raised or lowered. The remote chassis is a "hybrid" type, using five transistors and one relay-control tube (a 12BH7A); the tube actuates the relay that controls the volume-control motors.

Two 1N3194 silicon diodes, new to this line of sets, are the low-voltage rectifiers; they are mounted—by soldering—on the top side of the chassis, and can be replaced without removing the chassis from the cabinet.

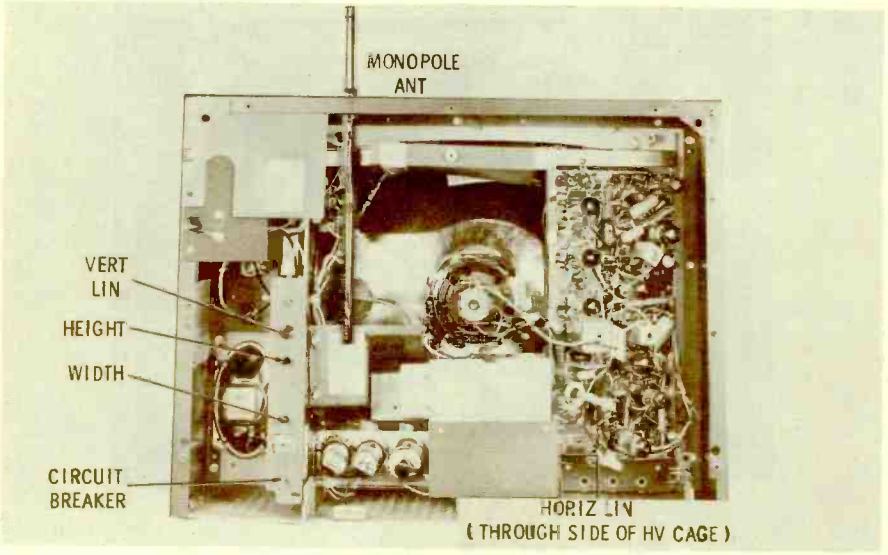
Two plug-in chemical fuses—a 3-amp line fuse and a 4/10-amp B+ fuse—are the main protective devices (see the photo for their exact location). The filament circuits are protected by two #28 wire-link fuses.

The switch-type tuner has a 6CW4 nuvistor RF amplifier and a 6EA8 mixer-oscillator. The tuner is mounted separately from the main chassis; as depicted in one of the photos, the main chassis has a handy arrangement for temporarily mounting the tuner during transportation and servicing operations.

A 6BZ6, a 6GM6, and a 6EW6 are used in the first, second, and third IF stages, respectively. The pentode section of a 6HF8 functions in the single video output stage; the triode section of this tube serves as the sound IF amplifier. AGC voltage is developed by a 6GY6 pentode, and the video detector is a crystal diode.

Among the major components in the horizontal circuits are: soldered-in AFC dual diode (a common-cathode unit), 6CG7 (alternate 6FQ7) oscillator, 6GW6 output, 3A3 high-voltage rectifier, and (new this year) a 6AY3 novar damper.

The vertical circuit is similar to other recent RCA designs, using a 6EM7 in a combined vertical multivibrator-output stage. Also carried over is a 6AV6 sync-separator stage; the diode section of the 6AV6 provides the cathode-return path for the first triode section of the 6EM7, for more precise vertical-sync action. (A defective 6AV6 in this set could easily cause loss of vertical sweep.) Other tubes are the 6GX6 audio detector (first introduced last year) and the "old standby" 6AQ5A audio output. A 92° bonded 23BKP4 picture tube is used in this receiver.



Sylvania Model 19T09 Series Chassis 563-4

A monopole antenna and a 114° bonded 19AFP4 picture tube are two features of the portable TV shown here. The switch-type tuner uses a *triode* 2GW5 RF amplifier and a 5EA8 mixer-oscillator. If you need to readjust the oscillator slugs, you must first remove the tuner control panel. Only three oscillator adjustments are used in this tuner (one each for channels 13, 9, and 6); you should adjust them in that order.

This transformerless receiver has a single printed-circuit board, upon which most of the tubes and other circuit components are mounted. The underside of the board is clear of obstructions, making soldering operations relatively easy.

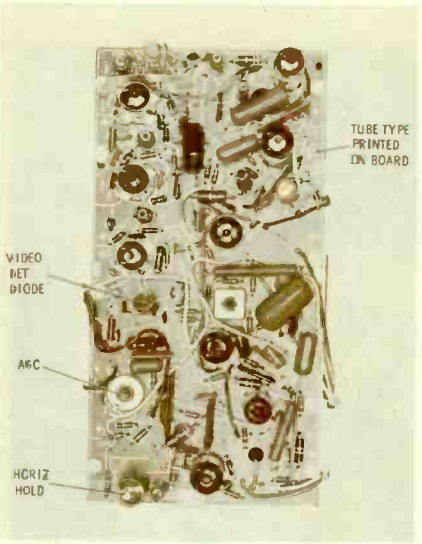
If you ever have to replace the video-detector diode, you'll find it under a snap-off shield on the printed board; the photo shows its exact location.

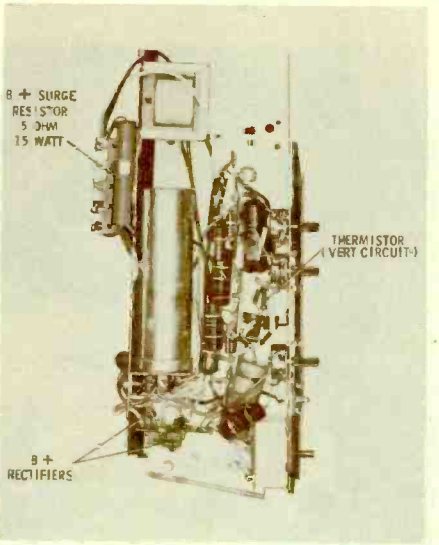
B+ in this chassis is developed by two silicon rectifiers, wired as a voltage doubler. A fusible wire in the AC input circuit and a circuit breaker in the B+ circuit are the protective devices used in this set; a 5-ohm, 15-watt resistor prevents line-voltage surges from damaging the silicon rectifiers.

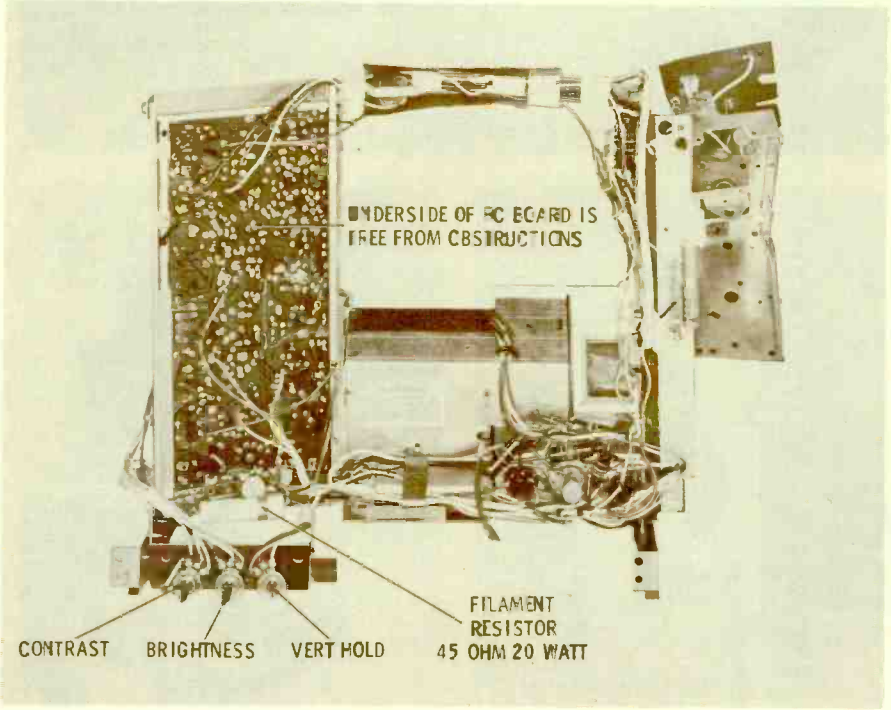
Operating knobs located on the front of the set include the channel selector, fine tuning, contrast, brightness, vertical hold, volume, and on-off controls. Adjustments for vertical linearity, height, width, AGC, horizontal hold (a coil), and horizontal linearity extend from the rear of the chassis.

Some of the tubes used in this receiver —and their functions—are as follows: three 4GM6 IF amplifiers; 8ET7 video output-horizontal AFC; 10EG7 vertical multivibrator-output; 5BR8A AGC-sound IF amplifier; 3CS6 noise limiter-sync separator. The tube complement of the horizontal circuit includes a 6FQ7 (alternate 6CG7) horizontal oscillator, 12DQ6A horizontal output, 12AX4GTB damper, and 1G3GT (1B3GT alternate) high-voltage rectifier.

Make sure you use normal "hot-chassis" servicing precautions when working on this set, since chassis ground is connected to one side of the power line.







See PHOTOFACT Set 545, Folder 1

See PHOTOFACT Set 545, Folder 1

Mfr: DuMont **Chassis No.** 120602A

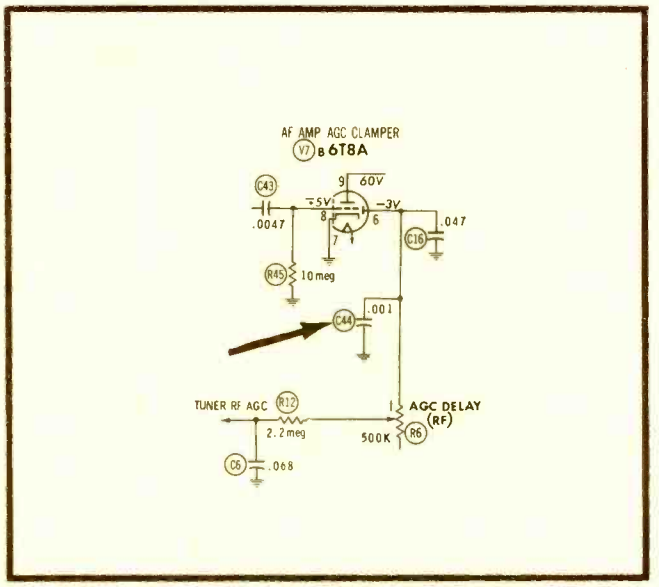
Card No: DU 120602A-1

Section Affected: Pix.

Symptoms: Weak picture due to excessively high AGC; RF-IF bias voltage too negative for signal being received.

Cause: Leaky AGC-clamper bypass capacitor.

What To Do: Replace C44 (.01 mfd).



Mfr: DuMont **Chassis No.** 120602A

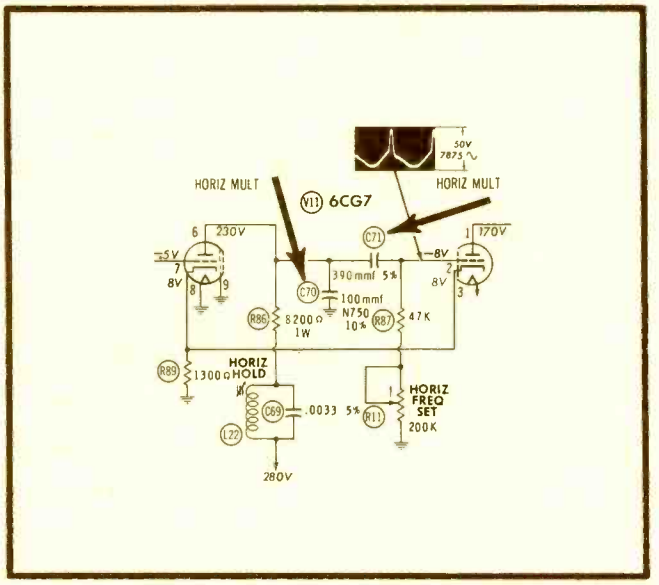
Card No: DU 120602A-2

Section Affected: Sync.

Symptoms: Horizontal jitter.

Cause: Defective capacitors in horizontal multivibrator circuit.

What To Do: Replace C71 (390 mmf) and C70 (100 mmf, N750).



Mfr: DuMont **Chassis No.** 120602A

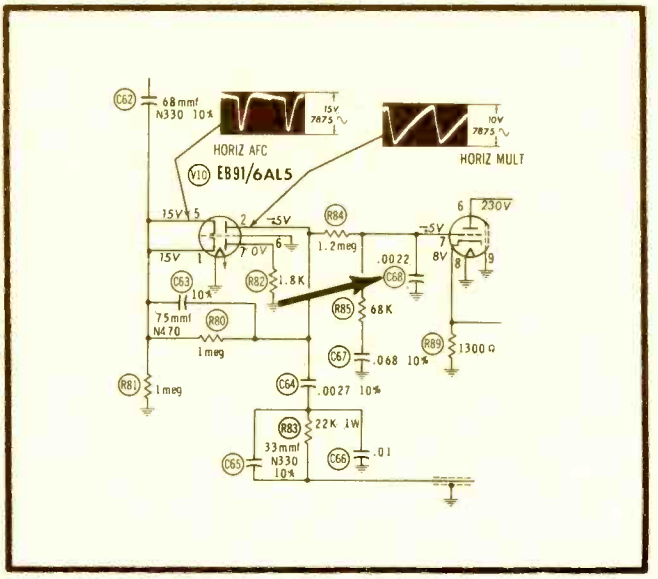
Card No: DU 120602A-3

Section Affected: Sync.

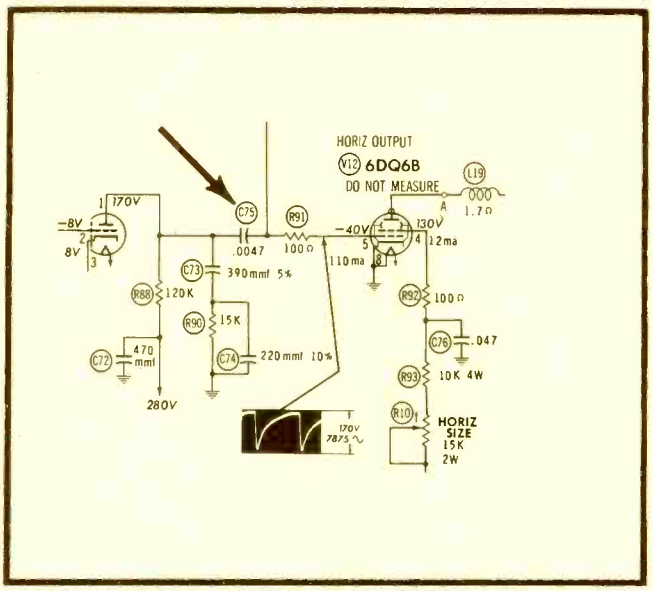
Symptoms: Horizontal drift after warmup.

Cause: Defective bypass capacitor at input grid (pin 7) of horizontal multivibrator.

What To Do: Replace C68 (.0022 mfd).



See PHOTOFACT Set 545, Folder 1



See PHOTOFACT Set 545, Folder 1

Mfr: DuMont **Chassis No.** 120602A

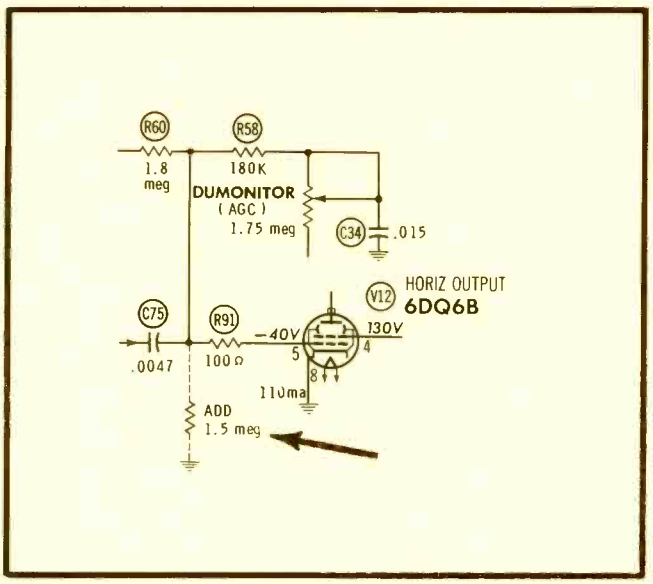
Card No: DU 120602A-4

Section Affected: Sync.

Symptoms: Horizontal jitter.

Cause: Leaky coupling capacitor between horizontal multivibrator and grid of horizontal output tube. Positive voltage, or insufficient negative voltage, on grid (pin 5) of V12 (6DQ6B).

What To Do: Replace C75 (.0047 mfd).



Mfr: DuMont **Chassis No.** 120602A

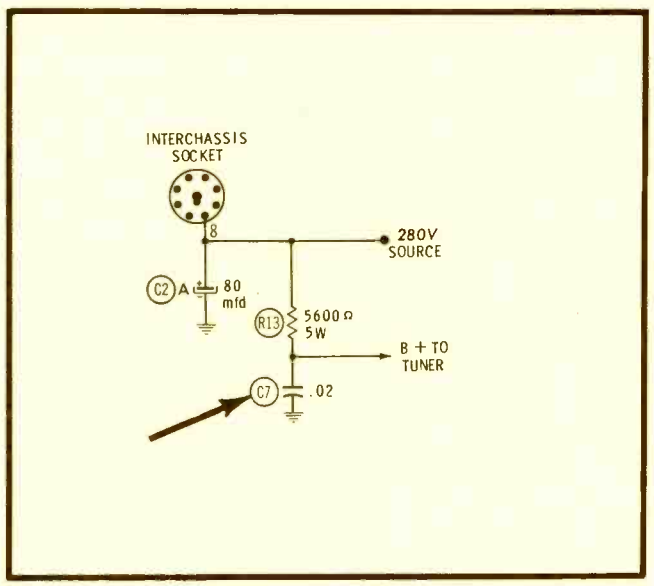
Card No: DU 120602A-5

Section Affected: Raster.

Symptoms: Horizontal drive line.

Cause: Incorrect operation of horizontal output tube as result of returning grid to ground through AGC system.

What To Do: Add a 1.5-meg resistor from grid of horizontal output tube V12 (6DQ6B) to chassis. *Note:* Chassis coded Triangle D already have this change.



Mfr: DuMont **Chassis No.** 120602A

Card No: DU 120602A-6

Section Affected: Pix and sound.

Symptoms: Raster normal, but no picture or sound.

Cause: Shorted bypass capacitor on B+ line to tuner.

What To Do: Replace C7 (.02 mfd).

See PHOTOFACT Set 524, Folder 2

See PHOTOFACT Set 524, Folder 2

Mfr: Zenith **Chassis No.** 16F28

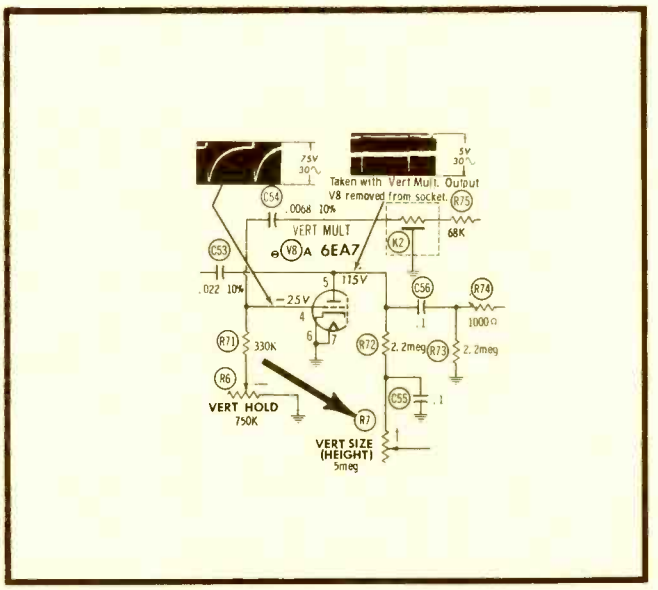
Card No: ZE 16F28-1

Section Affected: Raster.

Symptoms: Flashes and streaks on screen.

Cause: Arcing in vertical size control.

What To Do: Replace R7 (5 meg).



Mfr: Zenith **Chassis No.** 16F28

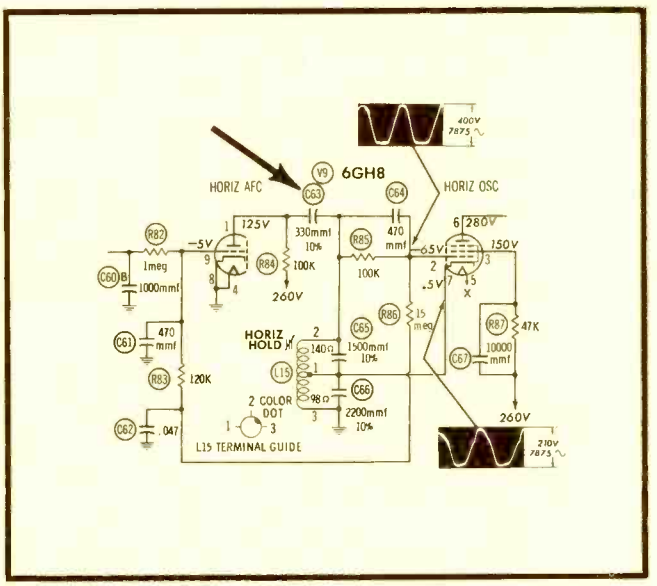
Card No: ZE 16F28-2

Section Affected: Sync and raster.

Symptoms: Picture drifts out of horizontal sync; receiver then loses high voltage and raster. Control grid (pin 2) of V9 (6GH8) becomes positive.

Cause: Shorted coupling capacitor between horizontal AFC and oscillator.

What To Do: Replace C63 (330 mmf).



Mfr: Zenith **Chassis No.** 16F28

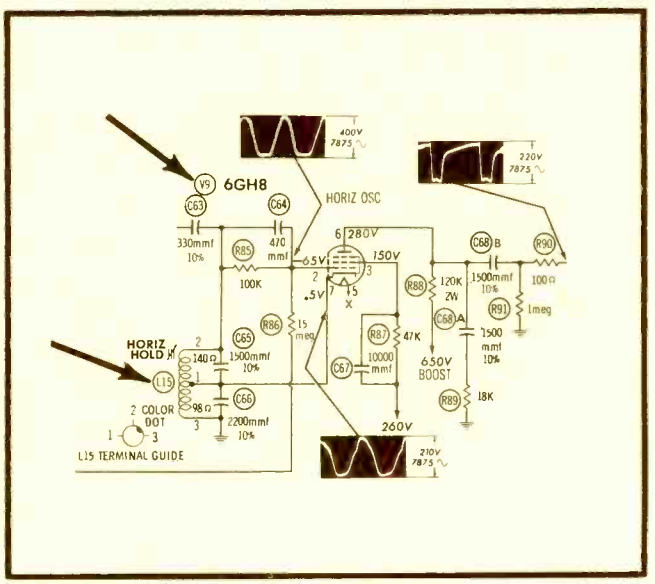
Card No: ZE 16F28-3

Section Affected: Raster.

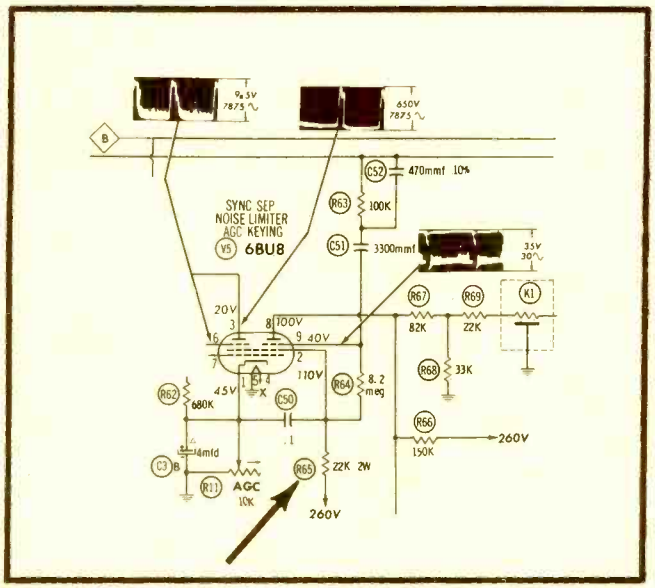
Symptoms: No raster.

Cause: Shorted turns in horizontal oscillator coil.

What To Do: Replace L15. Since trouble is most likely due to defective V9 (6GH8), also replace this tube.



See PHOTOFACT Set 524, Folder 2



See PHOTOFACT Set 524, Folder 2

Mfr: Zenith **Chassis No.** 16F28

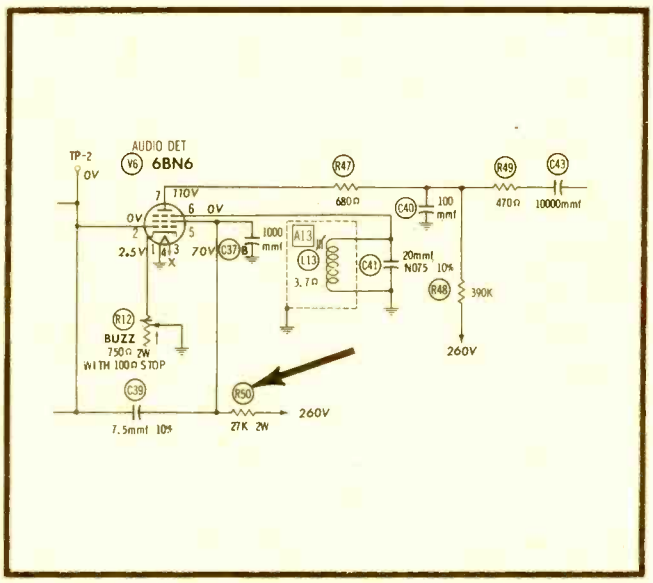
Card No: ZE 16F28-4

Section Affected: Pix.

Symptoms: Video overload. Reduced voltage on screen grid (pin 2) of V5 (6BU8).

Cause: Screen resistor increases in value.

What To Do: Replace R65 (22K—2W).



Mfr: Zenith **Chassis No.** 16F28

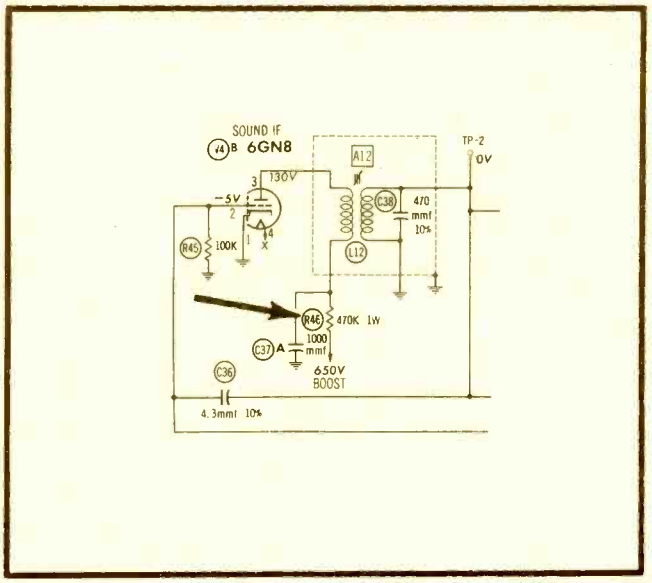
Card No: ZE 16F28-5

Section Affected: Sound.

Symptoms: Sound cuts out after short period of operation.

Cause: Screen resistor in audio detector stage increases in value.

What To Do: Replace R50 (27K—2W).



Mfr: Zenith **Chassis No.** 16F28

Card No: ZE 16F28-6

Section Affected: Sound.

Symptoms: Weak sound. Lower than normal voltage at plate (pin 3) of V4B (6GN8).

Cause: Plate resistor in sound IF stage has increased in value.

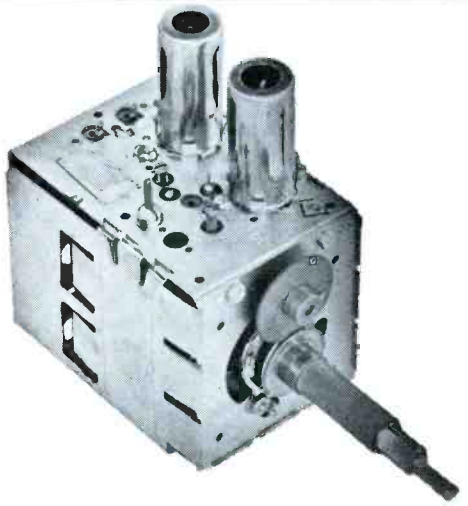
What To Do: Replace R46 (470K—1W).

Prices effective January 1, 1963

Tarzian offers FAST, DEPENDABLE TUNER REPAIR SERVICE (ALL MAKES)

ONLY $9.50 INCLUDING

ALL PARTS (except tubes) and LABOR



24-HOUR SERVICE 1-YEAR WARRANTY

It just makes sense that a manufacturer of tuners should be better-qualified, better-equipped to offer the most dependable tuner repair and overhaul service.

Sarkes Tarzian, Inc. pioneer in the tuner business, maintains two complete, well-equipped Factory Service Centers—assisted by Engineering personnel—and staffed by specialized technicians who handle ONLY tuner repairs on ALL makes and models.

Tarzian-made tuners received one day will be repaired and shipped out the next. Allow a little more time for service on other than Tarzian-made tuners.

Tarzian offers a 12-month guarantee against defective workmanship and parts failure due to normal usage. And, compare our cost of $9.50 and $15 for UV combinations. There is absolutely no additional, hidden charge, for ANY parts except tubes. You pay shipping costs. Replacements on tuners beyond practical repair are available at low cost.

Ⓣ Tarzian-made tuners are identified by this stamping. When inquiring about service on other tuners, always give TV make, chassis and Model number. All tuners repaired on approved, open accounts. Check with your local distributor for Sarkes Tarzian replacement tuners, replacement parts, or repair service.

TWO SERVICE CENTERS TO SERVE YOU BETTER

See your distributor, or use the address nearest you for fast factory repair service

537 South Walnut St.
Bloomington, Indiana
Tel: 332-6055

10654 Magnolia Blvd.
North Hollywood, Calif.
Tel: 769-2720

SARKES TARZIAN, INC.

Bloomington, Indiana

MANUFACTURERS OF TUNERS . . . SEMICONDUCTORS . . . AIR TRIMMERS . . . FM RADIOS . . . AM/FM RADIOS . . . AUDIO TAPE . . . BROADCAST EQUIPMENT

publisher
Howard W. Sams

general manager
Mal Parks, Jr.

editor
Verne M. Ray

managing editor
Forest H. Belt

ass't. managing editor
Thomas A. Lesh

associate editors
George F. Corne, Jr.
Fred G. Biesecker

consulting editors
William E. Burke
Joe A. Groves
C. P. Oliphant

production manager
Robert N. Rippy

circulation fulfillment
Pat Tidd, Mgr.
Katherine Krise, Ass't.
Cora La Von Willard, Ass't.

art directors
Dick Lovell
Robert W. Reed

advertising & editorial assistants
Gladys Bauer
Georgeanna Caldwell
Clare Hult
Ellie Rother

photography
Paul Cornelius, Jr.

advertising sales offices
John Grace, advertising sales manager

midwestern
Hugh Wallace
PF REPORTER
4300 West 62nd Street,
Indianapolis 6, Ind.
AXminster 1-3100

eastern
Charles Horner
Howard W. Sams & Co., Inc.
3 West 57th Street,
New York, N. Y.
MUrray Hill 8-6350

western
The Maurice A. Kimball Co., Inc.
2550 Beverly Blvd., Los Angeles 57, Calif.
DUnkirk 3-6178; and 580 Market Street,
Room 400, San Francisco 4, Calif. EXbrook 2-3365

Address all correspondence to PF REPORTER, 4300 W. 62nd Street, Indianapolis 6, Indiana

Subscription Prices: 1 year—$4.00, 2 years—$7.00, 3 years—$9.00, in the U.S.A., its possessions and Canada. All other foreign countries: 1 year—$5.00, 2 years—$9.00, 3 years—$12.00. Single copy 35c; back copies 50c

Indexed in Lectrodex.
Printed by the Waldemar Press Div. of Howard W. Sams & Co., Inc.

PF REPORTER

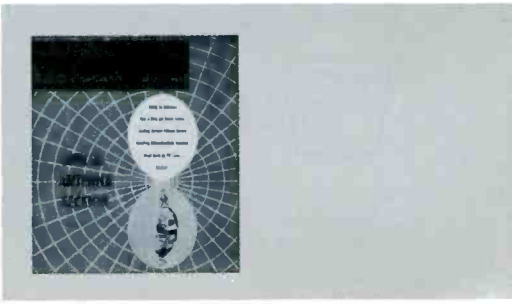
including Electronic Servicing

VOLUME 13, No. 4 *APRIL, 1963*

CONTENTS

ABOUT THE COVER

To many technicians, the expression "antenna response" calls to mind a polar pattern like the one on our cover; but these words can have another meaning, related to success in making customers more antenna-conscious. The special articles in this issue will help you obtain better "antenna response."



New Heavy Duty RFI Suppression Kit For Mobile Radio

RADIO HAMS, fleet owners, and CB operators can now enjoy clearer, more readable, less tiring mobile communications at longer effective ranges.

Sprague's new Type SK-1 SUPPRESSIKIT provides effective R-F Interference suppression—at moderate cost—up through 400 megacycles. Designed for easy installation on automobile, truck, or boat engines with either 6-volt or 12-volt generators, the Suppressikit makes possible high frequency interference control by means of Sprague's new, extended range, Thru-pass™ capacitors.

The components in the SK-1 Suppressikit are neatly marked and packaged, complete with easy-to-follow installation instructions. All capacitors are especially designed for quick, simple installation.

The generator capacitor is a heavy-duty unit rated at 60 amperes, and will operate at temperatures to 125°C (257°F). This means you'll have no trouble with an SK-1 installation in the terrific temperatures found "under the hood" on a hot summer's day. There's no chance of generator failures from capacitor "short outs," as with general purpose capacitors. The Thru-pass capacitors for use on voltage regulators are also rated at a full 60 amperes.

The Deluxe Suppressikit is furnished complete with an 8-foot shielded lead on the generator capacitor which can be trimmed to necessary length for any car or small truck, preventing R-F radiation from armature and field leads.

Containing only 5 easy-to-install capacitors, the Deluxe Suppressikit is a well-engineered kit. The net price is a little higher than that of many thrown-together kits, but it saves you so much time and aggravation it's well worth the slight extra cost.

For additional information on the Type SK-1 Suppressikit, see your Sprague Electronic Parts Distributor.

68-341 R3

Sprague TWIST-LOK® Capacitors give you 2 tremendous advantages over all other twist-prong electrolytics

1

The right size, the right rating, for EVERY replacement job

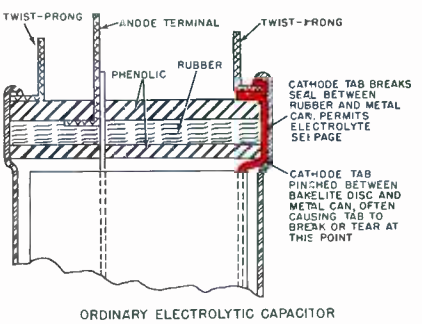
No need to compromise or improvise...the TWIST™-LOK Line includes over 1690 different capacitors . . . It's the industry's most complete selection of twist-prong type capacitors, bar none!

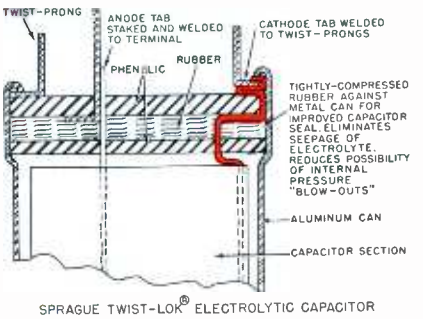
2

Exclusive, improved cover design for greater dependability

Type TVL Twist-Lok Capacitors are now more dependable than ever! Sprague's new cover design provides a truly leak-proof seal and permits capacitors to withstand higher ripple currents.

Compare internal construction of TWIST-LOK to ordinary 'Lytic!





Get your copy of Sprague's comprehensive Electrolytic Capacitor Replacement Manual K-106 from any Sprague Distributor, or write to Sprague Products Company, 105 Marshall St., North Adams, Mass.

WORLD'S LARGEST MANUFACTURER OF CAPACITORS

SPRAGUE®
THE MARK OF RELIABILITY

For window-size blow-ups of this message, send 10¢ to Sprague Products Co., 105 Marshall St., North Adams, Mass., to cover handling and mailing costs.

HOW TO BE SURE OF GOOD TV SERVICE...

1. Beware the Service "Bargain." If you shop around for cut-rate prices or extra-liberal service contracts, you're *asking* for trouble. A "something-for-nothing" offer usually means cut-rate parts and sub-standard service methods. The *reputable service dealer* spends years in study and training—thousands of dollars on test equipment, tools, and service manuals—countless hours in keeping up-to-date on new developments and service techniques. Because of this heavy investment, he can't *afford* to offer "bargains."

2. Rely on a Fully Qualified Independent Service Dealer. Well known and highly regarded by your friends and neighbors, his professional training and experience have made him a real technical expert. He takes pride in his work. He wants to stay in business. And he stakes his reputation and his future on satisfying *you*. So he'll use only component parts of the highest quality and latest design—plus his thorough knowledge and keen skills—to do the job right. Depend on him; he can't *afford* to let you down!

Your TV set provides you with a wealth of entertainment. Keep it in the best repair . . . at lowest cost . . . by calling your local TV-RADIO Service Dealer at the first sign of trouble!

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

YOUR INDEPENDENT TV-RADIO SERVICE DEALER

65-342 R1

TUBE TESTER 88, $69.50 NET—locates all tube faults quickly, accurately with patented Seco grid circuit test that checks tubes 11 ways—also cathode emission test.

DELUXE POWER SUPPLY RPS-5, $69.50 NET—transistorized zener-regulated circuit maintains constant voltage over wide load fluctuation without overshoot—up to 30 V DC and 150 ma.

REGULATED TRANSISTORIZED SUPPLY RPS-2, $26.95 NET—constant voltage—adjustable 0-25 V. Bias tap—0-100 ma.

TRANSMITTER TESTER 510B, $48.95 NET—reads both positive and negative modulation peaks on 0-120% scale—also RF output in 0-5 watts and 0-400 ma. For Handy-Talkies too!

REGULATED TRANSISTORIZED SUPPLY RPS-4, $36.95 NET—constant voltage—meter ranges 0-1.5, 0-15 and 0-30 V DC—reads load in 0-30 and 0-150 ma. Taps for simultaneous biasing.

TRANSISTOR AND TUNNEL DIODE ANALYZER 250, $74.50 NET—complete transistor lab in one compact unit—even has VOM! Analyzes semi-conductors in or out of circuit—no set-up data needed.

ANTENNA TESTER 520A, $49.95 NET—reads Forward Power and Reflected Power directly in watts! Antenna efficiency reads in: SWR from 1:1 to 8:1, per cent, or GOOD-POOR. For 50 ohm coax.

New Look in Test Equipment

The look is bold, professional, functional. Handsome black cases, lustrous brushed aluminum panels, wide easy-to-read meters—"matched set" appearance and quality. It comes to you now from Seco. See the "New Look" display of Seco test equipment at your electronic distributor's and at the May Parts Show in Chicago. Look for the red velvet!

SECO ELECTRONICS, INC. 1221 South Clover Drive, Minneapolis 20, Minnesota
Subsidiary of Di-Acro Corporation, Lake City, Minnesota

SYLVANIA DECLARES
through

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

A DIVIDEND
Participating Distributors...

REWARD FOR DEALERS WHO RECOGNIZE VALUE: . . . popular, fast-moving Sylvania receiving tubes with every SILVER SCREEN 85® picture tube you buy—regardless of size—during Sylvania's Spring Savathon!

This is actually a *double* dividend. First, you get bonus tubes at no cost—which will move quickly in your servicing business. Then comes the even more valuable dividend of additional satisfied customers—because of the inherent quality of Sylvania picture tubes and receiving tubes. For you, this means fewer profit-stealing callbacks when you stay with Sylvania.

Dealers know: the only good business is dealing with quality. And Sylvania dealers know that only quality comes from Sylvania. We think it's the only way to do business, and this dividend is our way of thanking you for the confidence you have shown. But hurry, this is a limited-time offer, available only through Sylvania Distributors who are participating in the Spring Savathon promotion.

LOOK FOR THIS DISPLAY at your Distributor's—and get bonus quality receiving tubes with every quality Sylvania picture tube you buy during the Spring Savathon!

SYLVANIA

SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS

GENERAL SYSTEM

LETTERS TO THE EDITOR

Dear Editor:

I've been a subscriber for some time now. I don't know how you do it, but time after time, just when I'm about to pull out my hair and swear off TV servicing, along comes my PF REPORTER with just the information I need to finish a tough job. Your articles are wonderful.

CHARLES KUCERA
Exeter, Neb.

One of our public services — helping prevent baldness!—Ed.

Dear Editor:

Your October issue was terrific. I'm an old-timer in TV, and your PF REPORTER has been my correspondence school. And it's been so effective I can turn out work as fast as many young squirts.

BASCOM TV SERVICE
Campbell, Calif.

We write for "squirts" of all ages.—Ed.

Dear Editor:

As a long-time subscriber to PF REPORTER, I'd like to know if you can tell me what past issue contained information on electronic flash guns. In addition, do you know of any other sources of this information?

PAUL BATTAT
New York, N. Y.

"Servicing Electronic Photoflash Equipment" appeared in the February, 1961 issue. Also, Chapter 4 of the Sams book "Servicing Unique Electronic Apparatus" is full of information on flash guns; copies are available from your local parts distributor.—Ed.

Dear Editor:

I was first introduced to PF REPORTER several years ago, while stationed at Walter Reed Army Medical Center. I was just starting in electronics and can't tell you how much the magazine helped me during those days. Since leaving the Center, I've not been getting copies regularly; and, because I'm teaching electronics servicing now to servicemen from all over the world, I'd like to be sure of receiving each issue. So, will you please send a subscription blank as soon as possible?

S/SGT. CHESTER A. ATWOOD
Huntsville, Ala.

Such loyalty can't go unrewarded! A subscription blank is on its way.—Ed.

EVERYTHING IS

A-OK--GO!

PHILCO STAR BRIGHT 20/20 PICTURE TUBES

Starlight, STAR BRIGHT . . . here's the finest tube you'll see tonight! Philco Star Bright 20/20 Picture Tubes are not exactly intended to sail through space to the moon, but we couldn't be more particular about how they are made if our lives depended on them.

Everything that goes into* a Philco Star Bright 20/20 Picture Tube is new! That means you need only open the carton . . . and install. Everything will be A-OK . . . no need to worry about checking, testing . . . or callbacks, either. Each Philco Star Bright 20/20 Picture Tube gets the same careful attention that we at Philco give to everything we make or sell . . . whether it is Philco equipment that rides the rockets to the moon . . . or Philco Star Bright 20/20 Picture Tubes to help you make more satisfied customers for your business.

PHILCO
Long Life Tested
Receiving Tubes

A complete line of receiving tubes and numbers, manufactured under exacting quality standards, thoroughly tested and inspected. And each one bears the name PHILCO . . . a name your customers know and trust.

DEPEND ON YOUR PHILCO DISTRIBUTOR . . . Your one stop shopping center for all your tubes, parts and accessories.

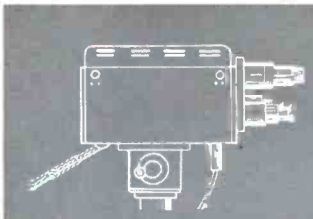
PHILCO MODERN COPPER ENGRAVED CIRCUITS
—for Simplified Service

PHILCO Factory-Supervised Service®

PARTS & SERVICE OPERATIONS

PHILCO®

A SUBSIDIARY OF *Ford Motor Company*



The Electronic Scanner

Education on the Move

This mobile education van will soon be bringing lectures, demonstrations, and film programs on modern farming techniques to the rural areas of East Pakistan. The mobile unit is equipped with sound equipment manufactured by **Bogen Communications Division** of Lear Siegler, Inc., and includes a 50-watt universal mobile amplifier specially designed for the unit. Other equipment includes a tape recorder, a 16-mm projector, and associated instruments. Similar audio-visual mobile units, equipped with Bogen sound systems, are in use in 64 other countries throughout the world.

Upswing in Sales

Hugh Robertson, chairman of **Zenith Radio Corp.,** and Joseph S. Wright, company president, recently tabbed color television as responsible for new records in earnings and sales. To sustain the trend, the company's expansion program includes construction of 750,000 square feet of additional manufacturing, warehousing, and office space located on 28 acres of land immediately south of Zenith's present plant in Chicago. The production section of the new plant was occupied in March; final completion is scheduled for August.

Technirama '63

The nationwide "Technirama" meetings, being conducted by **Philco,** are striving to better inform independent servicemen in advanced techniques. Mr. Ray E. Nugent, manager of the Parts and Service Operation—also in charge of Technirama—reports that enthusiasm for these meetings is snowballing. At a recent session held at the John M. Otter Co. of Philadelphia, Mr. Nugent counted 450 service technicians in attendance — a record for such meetings. Technirama centers around aligning stereo-FM sets, and servicing modern copper-engraved circuit boards and color circuits. A color sound movie shows the processes involved in producing Philco's circuit boards. According to Mr. Nugent, Technirama is not a one-shot project; it will be making stops all over the country, to bring up-to-date servicing information to the independent serviceman.—P.S. Free coffee and sandwiches are served at the meetings.

Quality Award

The U.S. Army Electronics Materiel Agency, recently awarded a certificate to **Tung-Sol Electric, Inc.** The award was for "the completeness of the manufacturing processes, and quality controls in the manufacture of electron tubes." This is the third such award received by the firm; both the Chatham Electronics and Semiconductor divisions received similar awards in 1961. In presenting the company with the certificate (displayed in the Bloomfield Plant), Brigadier General Allen T. Stanwix-Hay stated: "It is with great pleasure we award you (this certificate) and express our sincere appreciation in recognition of your achievement."

Looks Good At the Finish

Chairman David Sarnoff and president Elmer W. Engstrom, of **RCA,** recently reported that sales and profits during 1962 were the highest since the company was founded in 1919. They pointed to color television and electronic data processing as the principal elements that contributed to increased business. The sale of color sets doubled over those during 1961, as did the production of color CRT's. Another bit of news was the final successful operation of the orbited Relay satellite, designed and built by the firm. The communications satellite, after a successful launching, at first appeared to be a failure. But, it overcame initial operating difficulties, and transmitted television pictures between the United States and Europe, as originally intended.

Millions of Fusibles

Mr. Henry Workman, president of **Workman Electronic Products, Inc.,** is shown receiving the ten millionth F80 fusible resistor produced by the firm. Mr. George Bartole, department foreman, presents the "prized" fusible, which left the assembly line early this year.

Hi-Fi Seminars

Consumer orientation sessions, called "Citation Seminars," are attracting national attention, according to Mr. Leon Kuby, sales manager for **Harman-Kardon, Inc.** It's estimated that at least 2,000 persons attended the trial seminars held last November in the New York area. The theme of the meetings is to give prospective hi-fi buyers a look into the development of the "Citation A" solid-state stereo preamplifier recently introduced by the firm. Steward Hegeman, design engineer for the firm, has appeared in person at the sessions to explain transistor technology, and to answer questions on hi-fi.

Twice the Space

Mr. Norman A. Ackerman, president of **Perma-Power Co.,** recently announced construction of a new plant for his company. The one-story building will approximately double their operating space. Complete manufacturing, warehousing, and office facilities will be housed under one roof. The move to new quarters is expected to take place in April.

512—The Key Number

If any combination of numbers in your life make "512," be sure you contact **Jensen Industries.** A unique search is being carried on by this firm, to tie in with their promotional activities at the May Parts Show. The "theme" centers around the number "512." So, if you have 512 wives, or were born 5/12/12, or if there's a 512 in your Social Security number, get in touch with them. You can guess what room number they'll have in the Conrad Hilton this May!

New Electronics Plant

Construction is progressing on a new 40,000-square-foot plant for **Centralab Electronics,** Division of Globe-Union, Inc. Mr. W. S. Parsons, president, announced the new facility will be used for manufacturing and research. The new plant will be located at Lafayette, Indiana, in the McClure Industrial Park. This site was selected partly because of the opportunity for development and research activities with Purdue University. Target date for occupancy of the new building is July; total employment is expected to reach 200. Centralab also operates plants in Ajax, Canada, Fort Dodge, Iowa, and Cleveland, Ohio, in addition to four plants in Milwaukee and a couple in Menomonee Falls, Wisconsin.

SENCORE
SIMPLIFIES COLOR SERVICING

NEW! CA122
COLOR CIRCUIT ANALYZER

A simple approach to a complex problem

Here is an instrument that is designed to eliminate the guesswork in color TV servicing. A complete analyzer that provides all required test patterns and signals for testing from the tuner to the tri-color tube. Additional analyzing signals for injection at each stage including audio, video and sync, brings to life a truly portable and practical TV analyzer for on the spot service; virtually obsoleting other analyzers with the advent of color. Sencore's simplified approach requires no knowledge of I, Q, R-Y, B-Y, G-Y or other hard to remember formulas. The CA122 generates every signal normally received from the TV station plus convergence and color test patterns.

The CA122 offers more for less money:

TEN STANDARD COLOR BARS: The type and phase that is fast becoming the standard of the industry. Crystal controlled keyed bars, (RCA type) as explained in most service literature, offer a complete gamut of colors for every color circuit test.

WHITE DOTS: New stabilized dots, a must for convergence, are created by new Sencore counting circuits.

CROSS HATCH PATTERN: A basic requirement for fast CRT convergence.

VERTICAL AND HORIZONTAL BARS: An added feature to speed up convergence, not found on many other color generators.

SHADING BARS: Determines the ability of the video amplifier to produce shades (Y Signal) and to make color temperature adjustments. An important feature missing on other generators.

COLOR GUN INTERRUPTOR: For fast purity and convergence checks without upsetting color controls. Insures proper operation of tri-color guns, preventing wasted time in trouble shooting circuits when CRT is at fault.

A must for color . . .

a money maker for black and white TV servicing

ANALYZING SIGNALS: RF and IF signals modulated with any of the above patterns for injection into grid circuits from antenna to detector. IF attenuator is pre-set for minimum signal for each IF stage to produce pattern on CRT thus providing a check on individual stage gain. Sync and video, plus or minus from 0 to 30 volts peak to peak, have separate peak to peak calibrated controls for quick checks on all video and sync circuits. Crystal controlled 4.5 mc and 900 cycles audio simplify trouble shooting of audio circuits.

NEW ILLUMINATED PATTERN INDICATOR: A Sencore first, offering a rotating color film that exhibits the actual color patterns as they appear on color TV receivers. Locks in with pattern selector control.

You'll pay more for other color generators only.

Dealer Net **187.50**

NEW! PS120 PROFESSIONAL
WIDE BAND OSCILLOSCOPE

A portable wide band 3 inch oscilloscope for fast, on-the-spot testing. An all new simplified design brings new meaning to the word portability . . . it's as easy to operate and carry as a VTVM. Though compact in size, the PS120 is powerful in performance: Vertical amplifier frequency response of 4 MC flat, only 3 DB down at 7.5 MC and usable to 12 MC, equips the technician for every color servicing job and the engineer with a scope for field and production line testing. AC coupled, with a low frequency response of 20 cycles insure accurate low frequency measurements without vertical bounce. Sensitive single band vertical amplifier; sensitivity of .035 volts RMS for one inch deflection saves band switching and guessing. Horizontal sweep frequency range of 15 cycles to 150 KC and sync range from 15 cycles to 8 MC (usable to 12 MC) results in positive "locking" on all signals. New exclusive Sencore features are direct reading peak-to-peak volts —no interpretation; dual controls to simplify tuning; lead compartment to conceal test leads, jacks and seldom used switches. Rear tilt adjustment angles scope "just right" for easy viewing on bench or production line.

Size: 7"w x 9"h x 11¼"d. Weight: 12 lbs.

Dealer Net **124.50**
(with low cap. probe)

Kit **74.50**

A must for servicing color TV in the home . . . lowest priced broad band scope. All hand wired — all American made

SENCORE

SIMPLIFIES SWEEP CIRCUIT TROUBLE SHOOTING

SS117
SWEEP CIRCUIT ANALYZER

For Color and Monochrome Testing

A professional trouble shooter that helps you methodically walk the trouble out of "tough-dog" sweep circuits in monochrome and color receivers. The SS117 provides a positive but simple push button test on all circuits indicated in the block diagrams. These time-consuming circuits are checked step-by-step with tried and proven signal injection and substitution methods. All checks can be made from the top of the chassis or from under the chassis when it is removed from the cabinet.

TV horizontal oscillator check is made by substituting a universal oscillator known to be good. Horizontal output check consists of a cathode current and screen voltage test. The TV horizontal yoke is checked by substituting a universal yoke from the SS117 and viewing brightness or restoration of 2nd anode voltage. Horizontal flyback is checked dynamically in circuit by measuring the power transfer to the yoke when TV is turned on. TV horizontal sync can be used to control the SS117 horizontal oscillator, providing a positive check on sync from the video amplifier to the TV oscillator. Vertical circuits are tested by simple signal injection from vertical yoke to oscillator for full height on CRT. The SS117 with the CA122 Color Analyzer provides a complete TV analyzer for virtually every stage in monochrome or color receivers.

External checks for AC, DC, peak to peak voltage readings and DC current in the upper right hand corner save using a separate VTVM. Accurate 2nd anode measurements up to 30,000 volts are made with a sensitive 300 microamp meter and the attached high voltage probe. AC outlets, all steel construction and mirror in the cover makes every servicing job easier.

Size: 10¼" x 9¼" x 3½". Wt. 10 lbs.

Dealer Net **89.50**

The SS117 checks them all

FREE—A 33 RPM half hour permanent record packed with every unit explains each test.

FOR FASTER MORE ACCURATE TUBE TESTING

TC114 MIGHTY MITE
TUBE CHECKER

This is the famous Mighty Mite, acclaimed by over 25,000 servicemen, maintenance men and engineers as "the best they've ever used." A complete tube tester that is smaller than a portable typewriter yet finds tubes that testers costing hundreds of dollars miss, thus selling more tubes and reducing call backs. A real money maker for the serviceman and a trusty companion for engineers, maintenance men and experimenters. The Mighty Mite has been acclaimed from coast to coast as the real answer for the man on the go. Even though the Mighty Mite weighs less than 8 pounds, new circuitry by Sencore enables you to use a meter to check grid leakage as high as 100 megohms and gas conditions that cause as little as one half microamp of grid current to flow. Thus, too, it checks for cathode current at operating levels and shorts or leakage up to 120,000 ohms between all elements. And it does all this by merely setting four controls labeled A, B, C, & D with new type easy grip knobs. Check these plus Sencore features... Meter glows in dark for easy reading behind TV set... The new Mighty Mite has large size Speedy-Setup Tube Chart inside of cover—cuts setup time for even faster servicing. New stick proof D' Arsonval meter will not burn out even with shorted tube... Rugged, all steel carrying case and easy grip handle.

The improved Mighty Mite will test virtually every radio and TV tube that you encounter, nearly 2000 in all, including foreign, five star, auto radio tubes plus the new Compactrons, Novars, Nuvistors and 10 pin tubes. Has larger, easy-to-read type set-up booklet for faster testing.

Size: 10¼" x 9¼" x 3½". Weight: 8 lbs.

Dealer Net **74.50**

Fast, Accurate . . . never lets you down

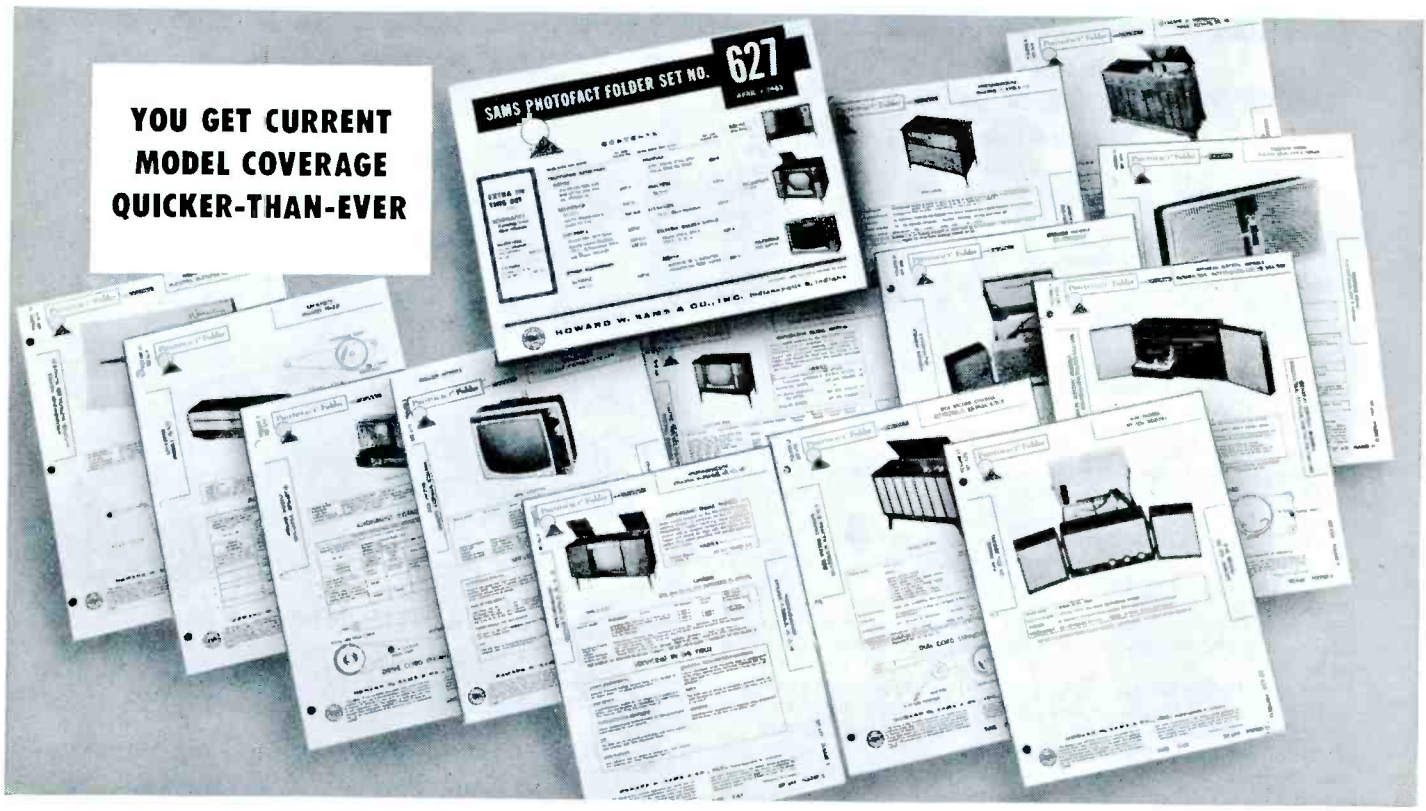
A must for color

TM116 TUBE TESTER MODERNIZING PANEL

New tube adapter for testing Compactrons, Novars, Nuvistors and 10 pin tubes in any tube tester except cardomatic types. Plugs into octal socket of your tube tester enabling you to test these new tubes in the same manner that your tester checks conventional tubes. Tube set-up chart included with each adapter.

Dealer Net **24.95**

NOW! PHOTOFACT®—BETTER THAN EVER—



Now! More TV Coverage in Every PHOTOFACT Set

More coverage of the type of equipment you service most!

- MORE **TV** COVERAGE
- MORE **AC-DC** COVERAGE
- MORE **AM-FM** COVERAGE
- MORE **HI-FI** COMBINATIONS
- MORE **RECORD CHANGER** COVERAGE
- MORE **PHONOGRAPH** COVERAGE

SEND COUPON

UP-TO-THE-MINUTE COVERAGE KEEPS YOU AHEAD

Here it is—beginning with April releases—quicker service data coverage for more of the kind of equipment you most frequently repair. And it's the same famous PHOTOFACT time-saving, troubleshooting help—*everything* you need to earn more daily. You get: Exclusive Standard Notation Schematics packed with all the service details you need; full photo coverage of all chassis views; complete replacement parts lists, tube placement diagrams; actual waveform photos; CircuiTrace® for printed boards; alternate tuner data; terminal identification and connections; disassembly instructions; field servicing notes; dial cord stringing diagrams—plus dozens of other great features. Take the *right* step to time-saving, profit-building servicing—see your Sams Distributor for details on an Easy-Buy PHOTOFACT Library and Standing Order Subscription—or send coupon today!

HOWARD W. SAMS & CO., INC.

Howard W. Sams & Co., Inc., Dept. 7-D3A
4300 W. 62nd St., Indianapolis 6, Indiana

☐ Enter my Photofact Standing Order Subscription
☐ Send full information on money-saving Easy-Buy Plan

My Distributor is:_____

Shop Name_____

Attn._____

Address_____

City_____ Zone____ State_____

SAVE 30¢ PER SET!

SIGN UP TODAY FOR A MONEY-SAVING PHOTOFACT STANDING ORDER SUBSCRIPTION!

With a Standing Order Subscription to receive PHOTOFACT regularly each month as issued, you pay only $1.95 per Set instead of the regular $2.25 price. You save 30¢ per Set—and you keep right up with the rapidly-increasing current model output! You enjoy the same 30¢ per Set savings when you purchase an Easy-Buy PHOTOFACT Library. Take advantage of substantial savings—sign up for a Standing Order Subscription or Easy-Buy Library with your Sams Distributor, or send coupon now for full details.

SAVE WITH A STANDING ORDER SUBSCRIPTION!

WITH ALL THE DATA COVERAGE YOU WANT!

NEW PHOTOFACT SERIES FOR SPECIALIZED SERVICING

Here's timely service data coverage on specialized equipment—complete, uniform, authoritative PHOTOFACT service data now available only in handy bound-volume form. Take advantage of our money-saving Standing Order Subscription offer for any of the Specialized PHOTOFACT Series described below.

New Auto Radio Series

Six to eight of these bound volumes issued each year, to bring you complete PHOTOFACT service data coverage of Auto Radios. Each volume covers 40-50 popular late models. Regular price per volume, $2.95—**only $2.65 when purchased on a Standing Order Subscription—you save 30¢ per volume!**

New Transistor Radio Series

Twelve to fifteen of these volumes issued each year—complete PHOTOFACT coverage of Transistor Radios. Each volume covers 40-50 popular late models. Regular price per volume, $2.95—**only $2.65 when purchased on a Standing Order Subscription—you save 30¢ per volume!**

New Tape Recorder Series

Two volumes issued yearly, to bring you complete PHOTOFACT coverage of all important, late model Tape Recorders. Regular price per volume, $4.95—**only $4.65 when purchased on a Standing Order Subscription—you save 30¢ per volume!**

New CB Radio Series

Two to three volumes issued yearly—complete PHOTOFACT coverage of all popular CB Radio models. Regular price per volume, $2.95—**only $2.65 when purchased on a Standing Order Subscription—you save 30¢ per volume!**

SEND COUPON

SAVE 30¢ PER VOLUME

SIGN UP TODAY FOR A STANDING ORDER SUBSCRIPTION TO THE PHOTOFACT SPECIALIZED SERIES

With a Standing Order Subscription to receive the new PHOTOFACT Specialized Series of your choice as issued, you pay only $2.65 for the Auto Radio, Transistor Radio and CB Radio Series, instead of the regular $2.95 price; only $4.65 for the Tape Recorder Series, instead of the regular $4.95 price! Get the world's finest specialized servicing data and enjoy extra savings with a Standing Order Subscription. Sign up with your Sams Distributor, or send coupon now.

SAVE WITH A STANDING ORDER SUBSCRIPTION!

HOWARD W. SAMS & CO., INC.

Howard W. Sams & Co., Inc., Dept. 7-D3B
4300 W. 62nd St., Indianapolis 6, Indiana

Enter my Standing Order Subscription for the following:

☐ Auto Radio Series ☐ CB Radio Series
☐ Transistor Radio Series ☐ Tape Recorder Series

My Distributor is:_____

Shop Name_____

Attn._____

Address_____

City_____ Zone____ State____

Smoothing Business Peaks and Slumps

Ever take your business-activity "temperature"? It's easy to do, and very rewarding because it reveals an important aspect of your TV service business: the peaks and slumps.

Business slumps are frustrating periods shared by most TV service shops. Sometimes there are too many service calls to handle; at other times, too few to keep you busy. Either extreme can be unprofitable. By charting your activities, however, you can learn to predict these periods with amazing accuracy . . . and plan how to alter their course.

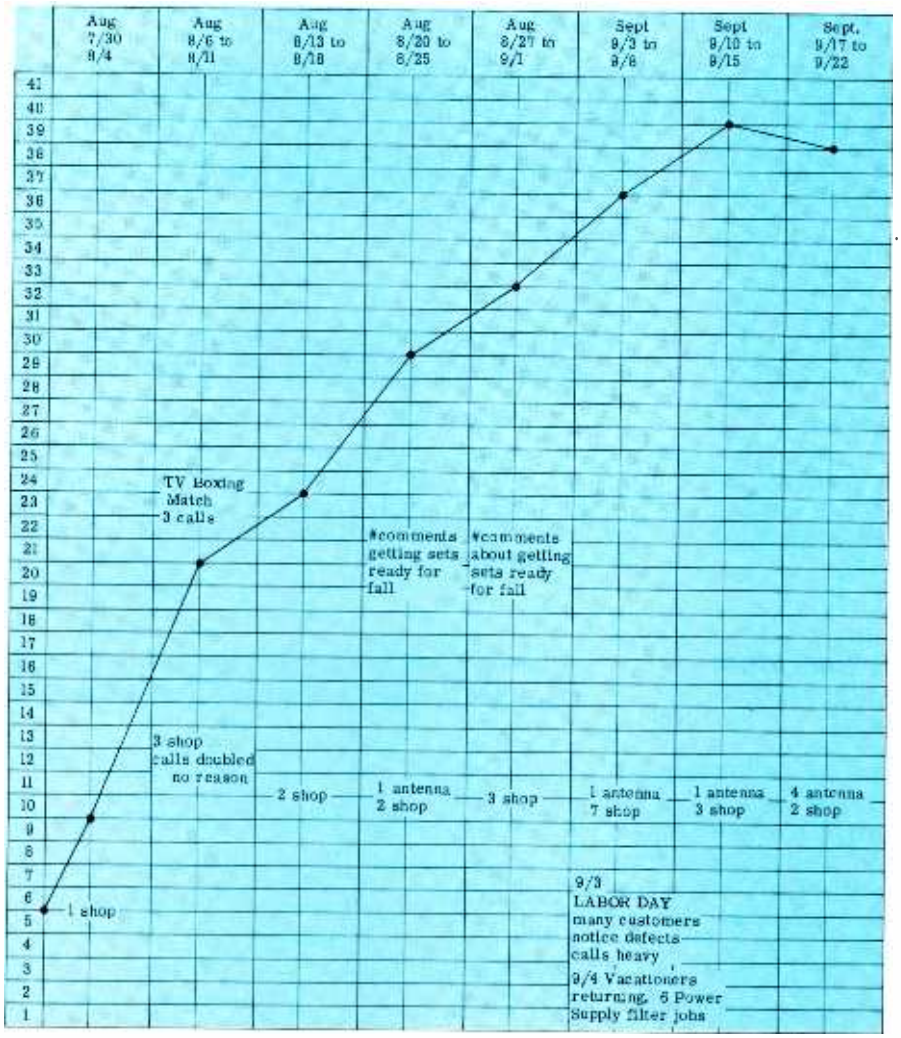
Activity Chart

The "activity chart" may be a notebook in which the number of service calls made each week is listed, or it can be an actual chart on standard graph paper—see Table I. The idea is to illustrate your business activity in a dramatic, visual manner. Either method will achieve the same result—a business-activity log for an entire year, pinpointing your problem periods and giving you an opportunity to do something about them in advance.

Simply list the number of service calls made each day or each week on your chart. To make the records most meaningful, some work must be "weighted" to consider additional service time. For example, pulling a TV set into the shop, repairing it at the bench, and returning it could be weighted as the equivalent of three house calls; also, an antenna installation might be weighted as two house calls.

Be sure to indicate the dates of all holidays, including legal holidays, religious holidays, and even local celebrations. Experience has shown that much TV service activity (and inactivity) can be directly related to these events.

1962 Business Activity Chart



Capitalizing on Peaks

Many times during the year, TV servicemen experience unusually heavy work loads. Service calls seem to converge into a brief time period when there just aren't enough working hours in a day to meet all repair requests. Happily, repair *income* during this period is maximum. But have you ever considered the *profits* you may have lost?

How many customers have refused to wait a day or two for repairs? These calls are irretrievable! You might receive future service requests from these impatient customers, but you've certainly lost their immediate business. Further, you've given another repair shop a golden opportunity to acquire a new cus-

• *Please turn to page 92*

Find it and Fix it in ½ the time!

EASILY SOLVES "TOUGH DOGS"... INTERMITTENTS ... ANY TV TROUBLE

B&K MODEL 1076 TELEVISION ANALYST

BLACK & WHITE AND COLOR

By Easy Point-to-Point Signal Injection, You see the Trouble on the TV Screen and Correct it—Twice as Fast and Easy!

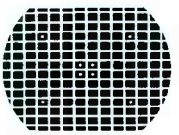
Simplified technique stops lost hours never recovered on **"tough dogs", intermittents,** and **general TV trouble-shooting.** This one instrument, with its complete, accurate diagnosis, enables any serviceman to cut servicing time in half . . . service more TV sets in less time . . . satisfy more customers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

With the Analyst, you inject your own TV signals at any time, at any point, while you watch the generated test pattern on the picture tube of the television set itself. This makes it quick and easy to *isolate, pinpoint, and correct* TV trouble *in any stage throughout the video, audio, r.f., i.f., sync and sweep sections* of black & white and color television sets—*including intermittents.* No external scope or waveform interpretation is needed. Checks any and all circuits—solves any performance problem. Gives you today's most valuable instrument in TV servicing—*proved by thousands of professional servicemen everywhere.*

Available on Budget Terms. As low as $30.00 down.

Net, $329.95

SIMPLIFIES COLOR TV SERVICING, TOO



Enables you to troubleshoot and signal trace color circuits in color TV sets, or facilitate installation.

Generates white dot, crosshatch and color bar patterns on the TV screen for color TV convergence adjustments.

Generates full color rainbow display and color bar pattern to test color sync circuits, check range of hue control, align color demodulators. Demonstrates to customers correct color values.

Time-Saving, Money-Making Instruments Used by Professional Servicemen Everywhere

Model 960 Transistor Radio Analyst

Model 360 V O Matic Automatic VOM

Model 375 Dynamatic Automatic VTVM

Model 700 Dyna-Quik Tube Tester

Model 440 CRT Rejuvenator Tester

See Your B&K Distributor or Write for Catalog AP20-R

B & K MANUFACTURING CO.

Division of DYNASCAN CORPORATION

1801 W. BELLE PLAINE AVE. • CHICAGO 13, ILL.

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

Export: Empire Exporters, 253 Broadway, New York 7, U.S.A.

READ HOW TO MEASURE HV RECTIFIER FILAMENT VOLTAGE

. . . complete information on how to build a measuring device at low cost; how to use it.

G-E HORIZONTAL PHASE DETECTOR discussed; BENCH NOTES . . . helpful hints from your fellow Service Dealers; SERVICE NOTES on television and radio.

GET YOUR COPY FREE FROM YOUR G-E TUBE DISTRIBUTOR

Techni-talk is now available only from your General Electric tube Distributor. *Techni-talk* is loaded with electronic data, news of electronic developments, schematics and other information to make TV, radio, hi-fi servicing more profitable for you. Pick up a copy at his store and ask him to add your name to his mailing list to receive *Techni-talk* regularly.

ANOTHER ACCENT ON VALUE FROM G-E *ELECTRONICS* DISTRIBUTORS

Get a complete set of *Techni-talk* back issues in a handsome three-ring binder for only $8.50 or send 10¢ in coin for this latest issue. Fill out coupon and mail to: GENERAL ELECTRIC COMPANY, Dept. B, 3800 N. Milwaukee Ave., Chicago 41, Illinois.

Progress Is Our Most Important Product

GENERAL ELECTRIC

ORDER COUPON

Please send:

_____ETR-3560 Latest issue of *Techni-talk*. (Enclose 10¢ in coin.)

_____ETR-3567 Complete set of *Techni-talk* back issues in tabbed three-ring binder. (Enclosed is check or money order for $8.50 payable to General Electric Company.)

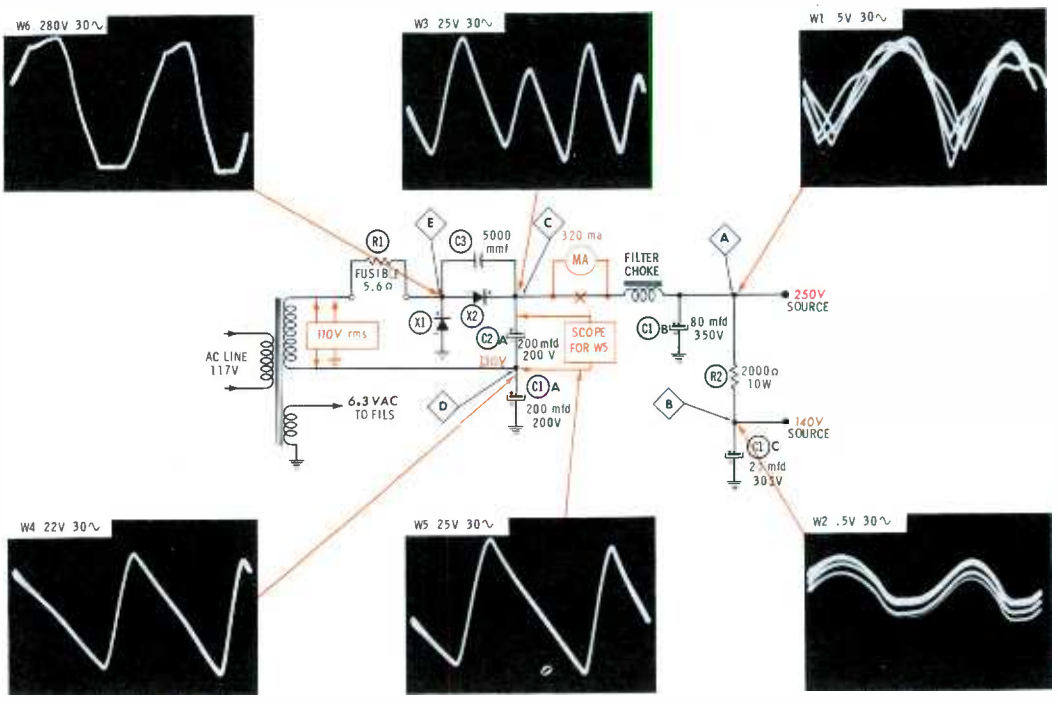
*Name*_____

*Street and No.*_____

*City*_____ *Zone*___ *State*_____

Full-Wave Doubler

Using Silicon Rectifiers



DC AND AC VOLTAGES taken with VTVM, and current with VOM, on inactive channel.

WAVEFORMS taken with wide-band scope; filament voltage used for external sync.

Normal Operation

Power transformer provides line isolation, but no AC-voltage step-up. Silicon rectifiers conduct alternately on successive half-cycles of input voltage, as in common half-wave doubler circuit; but voltage-doubling action is different. Current path on one half-cycle is through X1 to ground, and back to transformer through C1A—charging capacitor so top plate is positive. When X2 conducts on next half-cycle, it similarly charges C2A. After initial charging surge, rectifiers conduct only enough to replenish charge on capacitors. B+ source voltage is developed across C2A and C1A in series. If there were no load on power supply, this voltage would equal full peak-to-peak value of AC input. Charging and discharging of capacitors causes fluctuation in voltage at point C on every half-cycle of AC input; thus, ripple frequency seen in W3 is 120 cps (same as in 5U4 supply). Result of filtering by choke and C1B is W1. Fusible resistor R1 can stand any momentary surge, but burns open if excessive current load is placed on transformer for prolonged period. (Transformer is customarily, but not always, used with full-wave doubler.)

Operating Variations

A DC reading here will vary 2 volts for every 1-volt change in AC line input. W1 contains both power-supply ripple and vertical-sweep energy; if these are out of phase, waveform will continually change shape. Unstable waveform (shown) is normal when no station is tuned in.

C DC voltage is 5 volts higher than at point A, because of voltage drop across choke. B+ current is usually measured at input side of choke. It decreases by 20-30 ma on strong stations, since picture-signal stages develop considerable bias and draw less plate and screen current. If horizontal sweep system (heaviest single load on B+) is disabled, current falls to 220 ma, and voltage rises to 280 volts at point C. Alternate peaks of W3 may be unequal in size; this merely indicates difference in efficiency of X1-C1A and X2-C2A (not necessarily a defect).

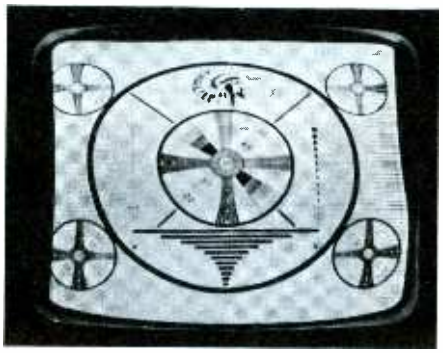
D W4 and W5 show waveshape and amplitude of AC voltages across the individual capacitors C1A and C2A; slight inequality may be normal.

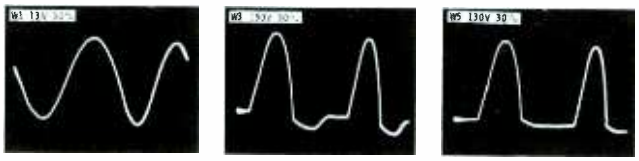
SYMPTOM 1

Slight Loss of Height and Width

Good Video and Audio

C2A Decreased in Value





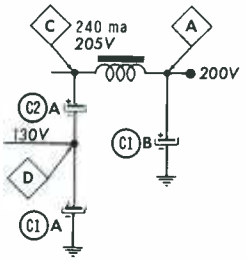
Waveform Analysis

Large ripple waveform W1 gives first inkling of filter trouble. W3 shows even greater distortion, directing attention toward voltage doubler. Positive sine-wave peak in W3 is almost complete half-cycle of AC input; this indicates one of doubler capacitors is not holding normal charge, although associated rectifier is conducting. Checking waveforms across individual capacitors helps pinpoint trouble. W4 is nearly normal, clearing C1A of suspicion; however, rectified but unfiltered sine wave in W5 is clear sign of trouble in C2A.

Symptom Analysis

Reduction in both horizontal and vertical sweep is usually first effect noted when B+ is low. Line voltage should be checked before set is serviced for this trouble. Deterioration in brightness, contrast, and focus can hardly be detected unless other marginal defects have caused reduction in efficiency of circuits.

Voltage and Component Analysis



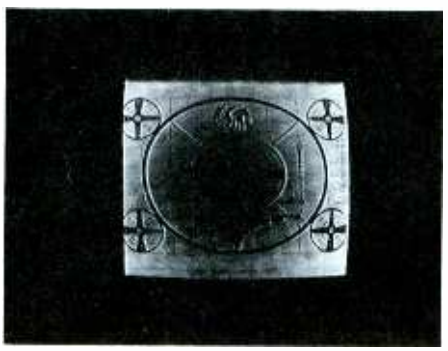
B+ source voltage at point A is only 200 volts, but AC voltage across transformer secondary is normal; therefore, fault is definitely in B+ supply. Any suspicion of overload on B+ circuit is dispelled by measuring current at point C: only 240 ma. DC reading at point D is normal 130 volts, while that at point C is only 75 volts higher (205 volts above ground). This trouble usually develops slowly as electrolytic capacitor ages and dries out; malfunction involves increase in power factor as well as loss of capacitance.

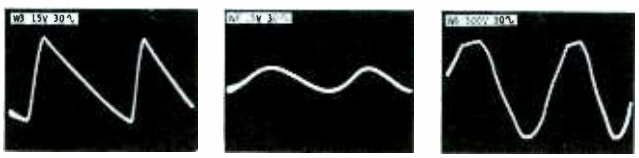
SYMPTOM 2

Raster Size Half of Normal

Low Brightness

X1 Open





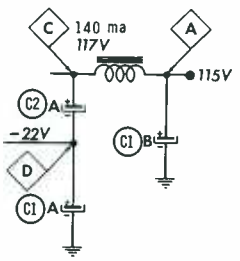
Waveform Analysis

B+ ripple waveforms W1 and W2 both appear normal. Definite clue is present in W3, though: Frequency of sawtooth ripple is only 60 instead of 120 cps, and amplitude is considerably below normal. Virtual absence of W4 is additional evidence that one leg of doubler is not functioning. W6 also contains hint of trouble, in rounded negative peaks; these should be clipped off by conduction of X1. If X2 were open, same symptoms would occur; however, W4 would be identical to W3, and *positive* peaks of W6 would be rounded.

Symptom Analysis

This small picture is most likely to be observed on a nearly new set that has sufficient reserve capability to produce light on screen at greatly reduced supply voltage. As a rule, older or less efficient receivers will simply develop a "sound — no raster" condition, with trace of high voltage present.

Voltage and Component Analysis



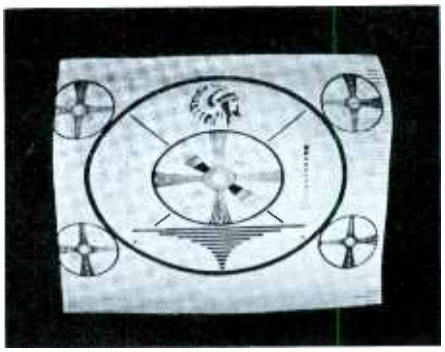
Source voltage at point A is only 115 volts, and proportional reductions are noted at points B and C. Current drain is likewise cut approximately in half—to 140 ma. *Negative* 22-volt reading at point D is useful clue. If trouble were in X2, all readings would be almost same as described here, except for slightly higher than normal indication (140 volts) at point D. For quick in-circuit test of rectifier, place ohmmeter probes across it in first one direction and then the other. Upscale drift in both readings means open rectifier.

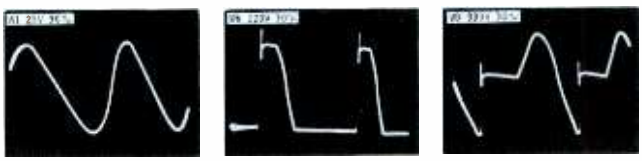
SYMPTOM 3

Moderate Decrease in Raster Area

Raster Sides Bowed

C1A Open





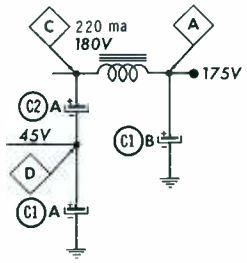
Waveform Analysis

High amplitude of W1 is definite sign of rectifier or filter trouble. W3, W4, and W5 are all identical, and have extraordinary amplitude and shape. Analysis of W6 helps explain conditions responsible for distortion of other waveforms. Positive pips denote conduction periods of X2; during rest of cycle, X1 conducts and clamps point E at ground. Entire peak-to-peak value of AC input voltage then appears between point C and ground, except when X2 is biased into conduction on negative peaks (note overshoot and flat spot in W3).

Symptom Analysis

As in Symptom 1, reduced raster size at normal line voltage is basic indication of B+ fault. Secondary symptoms will vary according to condition and design characteristics of receiver circuits. In example shown, width is evidently being varied by 60-cps ripple in B+ fed to horizontal circuit.

Voltage and Component Analysis



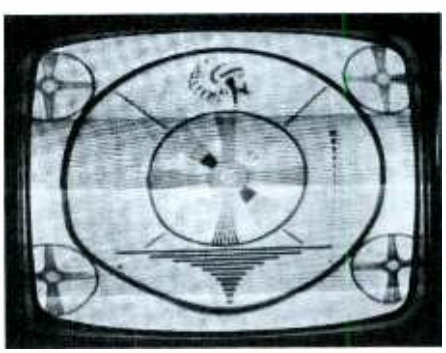
High and low B+ source voltages are both at fairly low levels—175 and 100 volts at points A and B, respectively. Short in load circuitry is not responsible; current through choke is only 220 ma. Positive 45 volts (average value of W6) appears at points D and E. DC voltage developed across C2A is close to normal 130 volts—evidence this capacitor is being charged in usual fashion when X2 conducts. Adding this voltage to the 45 volts at point D gives total average DC output of 180 volts between point C and ground.

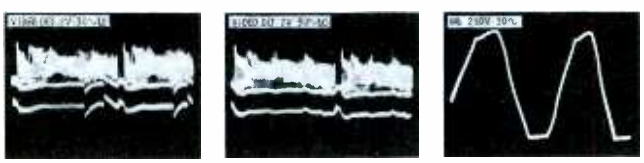
SYMPTOM 4

Faint Horizontal Bar in Picture

May Drift Up or Down

C3 Open





Waveform Analysis

Small portions of video-detector output waveform are displaced up or down when bars are present, proving front-end stages are involved in trouble. Preliminary tests usually rule out external interference, and next step is to scope receiver circuits for possible source of interfering pulses. B+ supply is a major suspect; waveform check in this area turns up clue in W6. Peaks of this waveform, clipped by conduction of rectifiers, have same width and frequency as "jogs" in video signal. Radiation of W6 into tuner is suspected.

Symptom Analysis

Shadowy bar is about 3" wide, has sharp edges, and may be either lighter or darker than background. Second bar may also be seen. Condition appears only under certain signal conditions—sometimes only on strong channels. Trouble looks like interference, most likely involving 60-cps source.

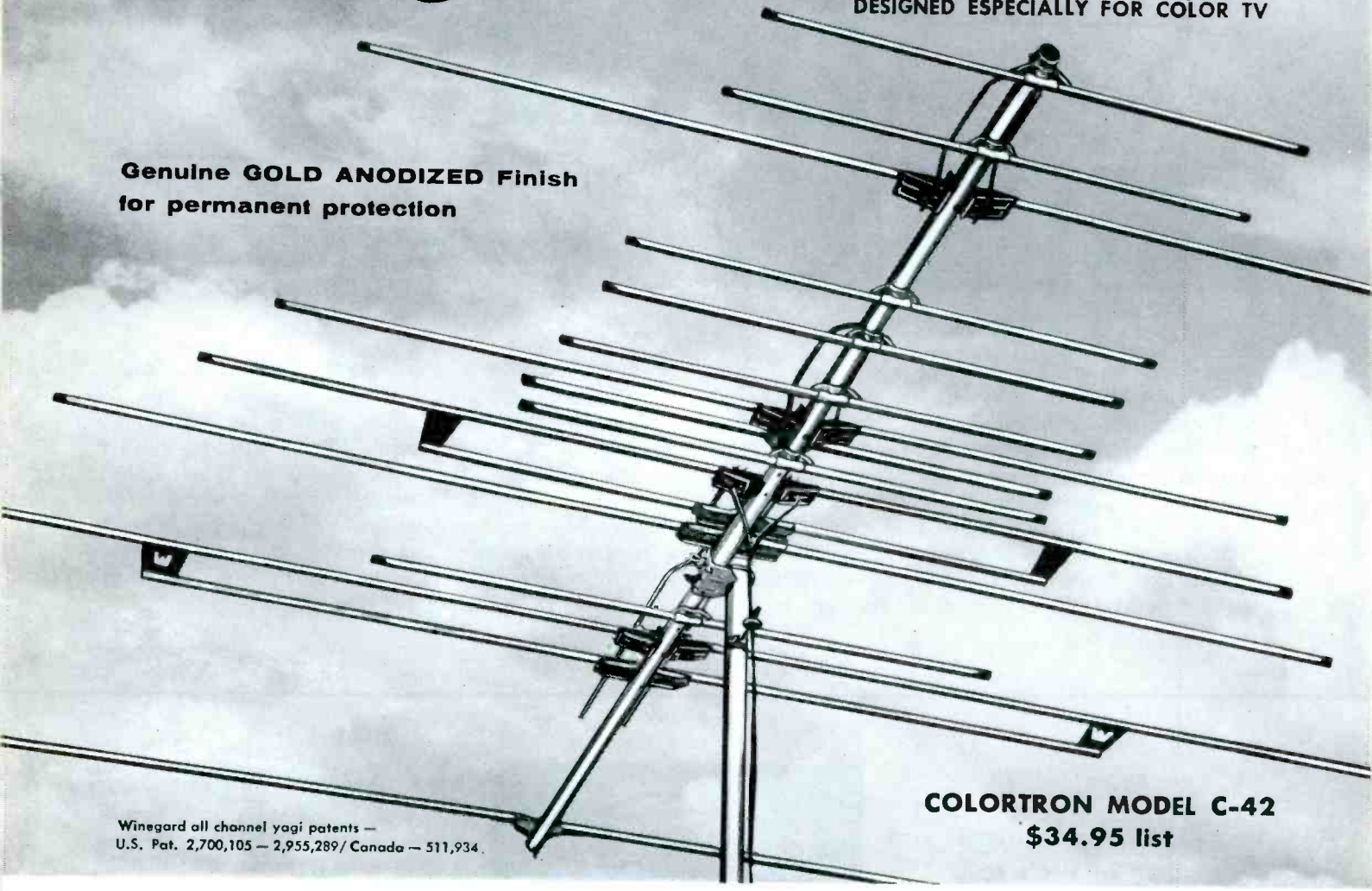
Voltage and Component Analysis

NO VOLTAGE CLUES

DC voltages give no hint of trouble, which has following cause: As a silicon rectifier conducts, faint arcing characteristically occurs at its PN junction. One consequence is weak RF radiation, which may be picked up by front-end circuits. Capacitors like C3 are commonly wired across rectifiers, as pulse and arc suppressors. Open capacitor may or may not make bars appear; other factors such as positioning of B+ and antenna leads can affect radiation pickup. Several thin horizontal lines may appear instead of solid bar.

WHY THE *Winegard* COLORTRON

DESIGNED ESPECIALLY FOR COLOR TV



Genuine GOLD ANODIZED Finish for permanent protection

Winegard all channel yagi patents — U.S. Pat. 2,700,105 — 2,955,289/ Canada — 511,934

COLORTRON MODEL C-42
$34.95 list

The world's BEST performing VHF all channel TV antenna, size for size and dollar for dollar, is the Winegard Colortron. The Colortron is more nearly perfect than any other all channel antenna made. It is the only all channel antenna you can buy that carries a factory written guarantee of best performance.

HERE'S WHY COLORTRON IS BEST

1. A perfect all channel, high gain TV antenna would have the following characteristics:

—the sensitivity of a well-engineered cut channel yagi of equal physical length on each of the 12 channels.

—sharp directivity. A single frontal lobe and absolutely no pick-up of signal from back or sides on any channel.

—it would have an exact 300 ohm non-reactive impedance on every VHF channel 2 through 13.

2. There are several basic designs for high gain, all channel TV antennas. For practical reasons, only two of these are used today.

Ⓐ The *all channel yagi* that incorporates only 2 driven elements—but *many* directors. This design was invented by John R. Winegard in 1954. Until then, the high efficiency of the yagi was limited to single channel antennas.

Ⓑ The all channel antenna that incorporates a *multiplicity of driven elements* in a single plane. These are *End-Fire* arrays.

This basic design was first used for TV in 1952. Some end-fire antennas are called "log periodic".

IT IS A SCIENTIFIC FACT that a single ½ wave director element* will absorb 4 times more signal energy from a TV wave than a ½ wave driven element**. Because of this indisputable fact, the Winegard Colortron all channel yagi uses multiple *directors* to get its gain—*not* multiple driven elements.

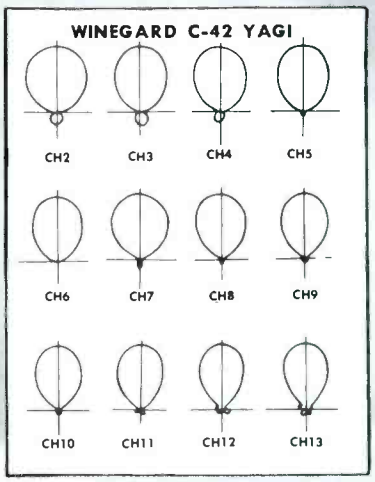
To obtain a near perfect impedance match across the entire VHF TV band, it takes only two driven elements. More than two driven elements will not improve the match any more than extra wheels would improve a car. The only purpose of driven elements on a TV antenna is to transfer the signal energy to the line.

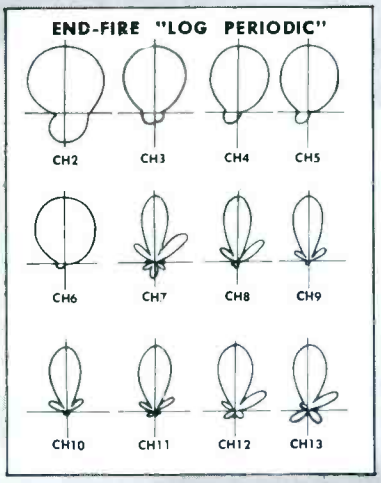
As every antenna engineer knows, a well-engineered cut-to-channel *yagi* (with but *one* driven element and *many* directors) is superior to any other design when peak performance is desired on a single channel. The same fact holds true for best results in all channel reception . . . the yagi design is the most efficient, sensitive ever created on a size for size basis.

*Directors are elements connected electromagnetically (not by means of phasing lines) to the driven elements.

**Driven elements are connected together with phasing lines and the transmission line is attached to these elements.

Antenna is World's BEST





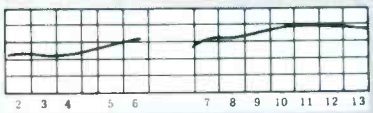
COMPARE POLAR PATTERNS

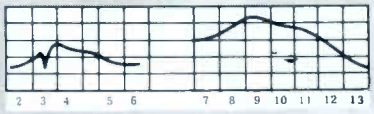
WINEGARD C-42 YAGI. Polar patterns from Polar coordinate Recorder Speedomax Type G.

NOTE uniform directivity patterns and high uniform front-to-back ratio on all channels. NOTE absence of spurious lobes and total absence of side pick-up.

END-FIRE "LOG PERIODIC" model comparable with C-42. Polar patterns taken from same recorder.

NOTE large variation between directivity from channel to channel. NOTE reduced front-to-back ratio from C-42. NOTE spurious lobes (especially on high band) which pick up interference. Also has undesirable side pick-up on low band.





COMPARE FREQUENCY RESPONSE CURVES

WINEGARD C-42 YAGI shows consistent sensitivity across all channels. No roll-off on ends of bands, no suck-outs to ruin color reception.

END-FIRE "LOG PERIODIC" (in same price range) shows varying sensitivity across the bands. Peaks in middle of bands with sharp roll-offs on ends. Serious suck-out in middle of channel 3.

PERFECT PARTNER TO THE COLORTRON ANTENNA . . . THE TWIN NUVISTOR COLORTRON AMPLIFIER

Winegard's revolutionary new circuit, employing 2 nuvistors, enables the Colortron to overcome the service problems and limitations of other antenna amplifiers. Colortron will not oscillate, overload or cross modulate because it takes up to 400,000 microvolts of signal input. This is 20 times better than any single transistor amplifier.

The Colorton amplifier will deliver clean, clear, color pictures or black and white, sharp and bright without smear. It can be used with any good TV antenna but will deliver unsurpassed reception when used with a Colortron antenna.

Nothing on the amplifier is exposed to the elements—even the terminals are protected. A rubber boot over the twin-lead keeps moisture out. Colortron comes complete with an all AC power supply with built-in 2 set coupler. Colortron model AP-200N 300 ohm input and output $39.95 list. Model AP-275 300 ohm input 75 ohm output $44.95 list.

NOW WHAT ARE THE BASIC DIFFERENCES BETWEEN THESE TWO TYPES OF ALL CHANNEL ANTENNAS?

One big difference is in SENSITIVITY. The Winegard Colortron patented yagi with multiple *directors* has far more ability to absorb signal power from a TV wave than multiple driven element antennas. In fact, *all* fringe-type antennas with multiple driven elements have *one or more* directors out front. Why add directors if the multiple driven elements are supposed to be so efficient? The reason is obvious . . . directors are added to get the gain they can't get with extra driven elements.

Another big difference is in DIRECTIVITY. The Winegard Colortron patented yagi has far better directivity characteristics than multiple driven element antennas and the *directivity pattern is essentially the same on every channel.* The Colortron has *no* signal pick-up from the sides (as you can see above). It offers no receiving surface to side signals and has no complex phasing problems to cause extra pick-up lobes. It has *minimum* pick-up from the back.

On the other hand, multiple driven element antennas have large side lobes because the driven elements are always out of phase at some frequencies in the TV band—particularly on the high band.

The Winegard Colortron excels, too, by having the *best 300-ohm match in the industry*—an average VSWR of better than 1.5 to 1 across both bands.

In addition to its performance superiority, the Winegard Colortron has the finest quality construction and *permanent gold* anodizing for weather protection. A personal examination of a Colortron tells this quality story far better than words.

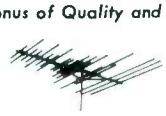
(The polar patterns and frequency response curves above have been illustrated to give you a basis of comparison between Winegard's popular Colortron Mod. C-42 and a highly advertised multiple driven element antenna which we have tested (along with other models in this line.) Constant testing of *all* new outdoor TV antennas proves to our satisfaction that no other design equals or excels the Winegard Colortron in quality or performance. We are so positive of this performance superiority that we put a written guarantee on it.

For technical data sheets write today!

Nationally advertised month after month. ADVERTISED IN LIFE

There's an Extra Bonus of Quality and Performance in Every Winegard Product

COLORTRON ANTENNA Model C-44—Gold Anodized **$64.95**



COLORTRON ANTENNA Model C-43—Gold Anodized **$51.90**

COLORTRON ANTENNA Model C-42—Gold Anodized **$34.95**

COLORTRON ANTENNA Model C-41—Gold Anodized **$24.95**

Winegard ANTENNA SYSTEMS

3009-4 KIRKWOOD • BURLINGTON, IOWA

know your '63 COLOR CIRCUITS

The horizontal and high-voltage circuits, like other circuits used in color television, are going through gradual evolution from one year to the next.

Although no drastic changes in design have taken place in the '63 horizontal sweep circuits, there are a few important modifications you should know about if you intend to service color sets. First, we'll take an overall look at the sweep circuits used in this year's color receivers. Then we'll discuss the individual receiver circuits (RCA and Zenith).

Familiar Faces

In the schematics in Fig. 1 and Fig. 2, you'll find the tube complement of both circuits the same as in last year's receivers, with one exception: The damper in RCA's chassis has been changed to a 6DW4 novar type (a 6AU4 previously filled this slot).

If you'll mentally strip all the "accessory circuits" away, the horizontal output stage, flyback transformer, damper circuit, yoke, and HV rectifier are very similar to those in modern black-and-white sets, and they perform the same function. The main difference is in the construction, made necessary by the greater power demand. Since a color receiver demands three or four times as much CRT current —three guns in the tricolor CRT, plus the regulator tube—the flyback must be more *rugged*.

Circuits not usually found in monochrome receivers include the high-voltage regulator, the focus circuit, and the extra taps on the flyback, each for a special purpose.

Regulator

For proper operation, the high voltage in a color receiver must be kept at a constant value. If a large change takes place in this voltage, the raster will bloom, defocus, and change in height and width; the

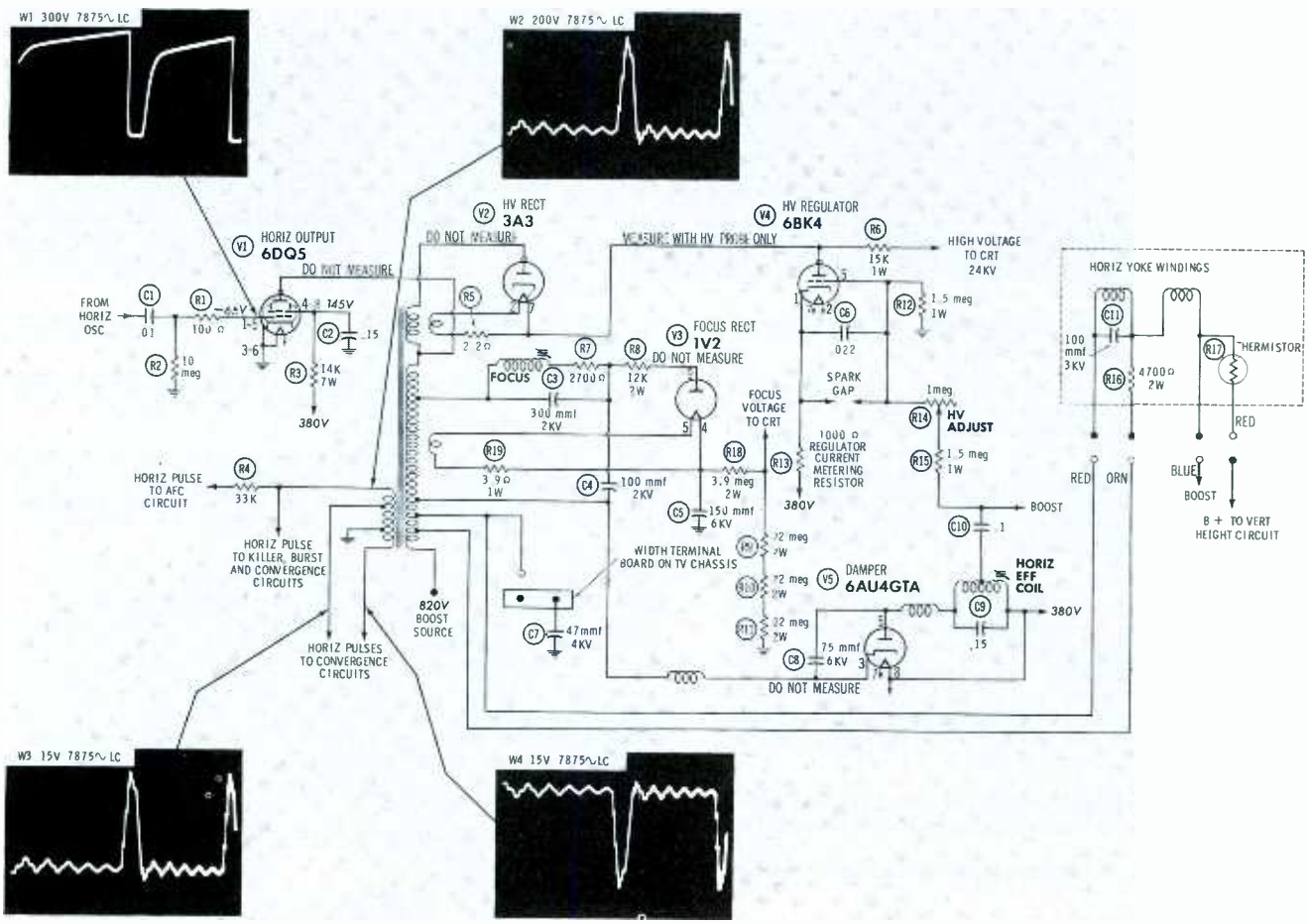


Fig. 1. Sweep and high-voltage supply used in Zenith's '63 color receiver.

Horizontal Sweep and High Voltage . . .

by George F. Corne, Jr.

overall hue on the screen and the convergence may also change. The regulator circuit keeps the high-voltage load constant, thereby preventing these adverse symptoms.

The regulator tube presents what is basically an added load for the HV supply, and is effectively shunted across the high-voltage supply. The cathode is connected to the B+ supply, and the grid is biased through a divider network across the boost source. With a dark screen (brightness control at minimum), and the high voltage set for a predetermined value, the regulator tube will draw a certain amount of current—normally between .85 and 1.05 ma. When the CRT demands more beam current—during a bright scene, for instance — the high voltage will tend to decrease; this makes the bias of the regulator tube more negative, as the result of lowered boost voltage. As the regulator tube draws less current, the current drain on the HV supply is automatically stabilized, keeping the high voltage constant. When the CRT current decreases, the current through the regulator increases; and the voltage is again held constant.

An interesting demonstration of the compensating action can be seen by monitoring the current through the regulator tube; the current reading will alter slightly with each change in average brightness level of the scene on the CRT. Vary the brightness control for more change.

Focus

This circuit develops the high DC voltage required to electrostatically focus the tricolor picture tube. A focus rectifier is driven by pulses of energy from the flyback, in a manner similar to the high voltage rectifier circuit. An output voltage of approximately 5 kv is developed in this circuit, and fed to the focus anode (pin 9) of the CRT.

Of particular interest in this circuit is the manner in which the focus is controlled. Separate pulses are fed to both the plate and cathode. Adjusting the focus coil controls the phase and amplitude of one of the pulses, adding to or subtracting from that on the other element.

Flyback Taps

Many of the circuits in a color receiver use horizontal pulses to synchronize their operation—more than in black-and-white sets. Examples of these would be the color killer, burst amplifier, horizontal blanker (when used), AGC, and the convergence circuits. The number of taps needed, the amplitude of the pulses, and their polarity, are all determined by the particular design of the receiver. These taps are similar to those you've seen in black-and-

• *Please turn to page 80*

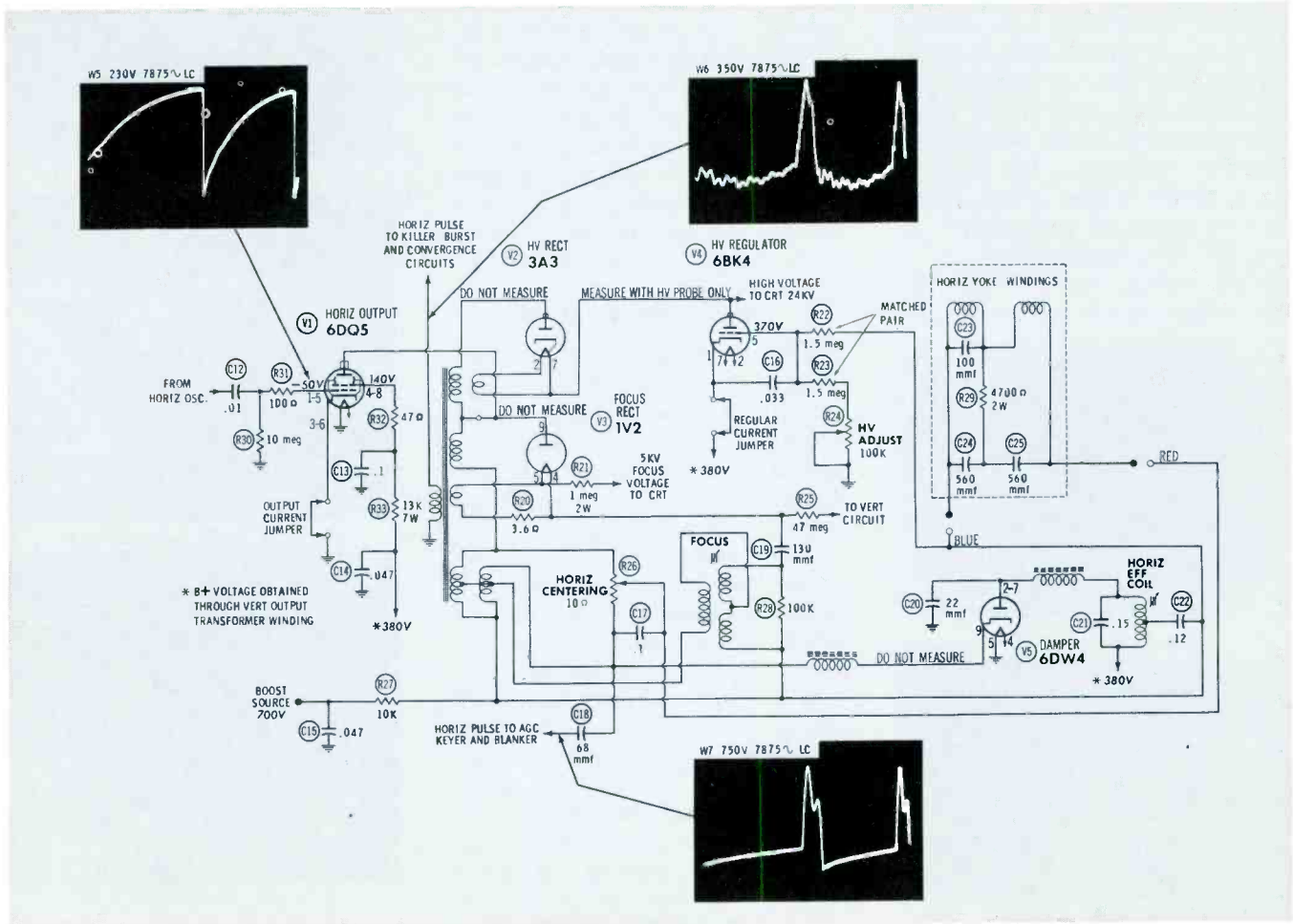


Fig. 2. High-voltage circuits used in RCA's '63 color set are familiar.

Shop Talk

BARS & STRIPES in Rasters

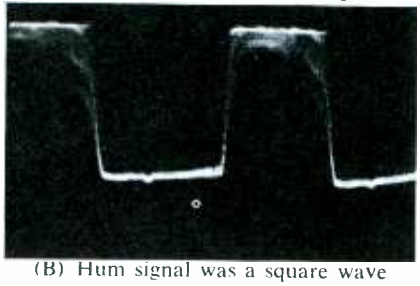
by Allan F. Kinckiner

A great many troubles in TV receivers are so similar to previously encountered troubles that they trigger the serviceman's memory into remembering the previous cure. Many other times, the symptoms suggest which stage or component may be responsible for the fault; given this clue, troubleshooting starts off on the right foot, and a quick repair frequently results.

Occasionally, however, a trouble symptom does not have a strong resemblance to anything previously seen, nor does it give clear-cut evidence suggesting the root of the trouble. The freak rasters pictured in the April, 1962 PF REPORTER are examples of this type of symptom. In this same class are the various patterns of bars or stripes that sometimes appear on TV screens. While some of these do have certain similarities to previous troubles, the resemblance is sometimes found to be just coincidental and the previous cure ineffective. The symptoms may seem to be mildly suggestive of faults in specific stages or components, but they may point to the wrong circuit. Virtually all types of components are capable of causing barred or striped rasters, but a specific effect seldom can be associated with a particular type of component.

It would not make sense to disregard any apparent tie-in with previous experience or knowledge, but neither does it make sense to expect that servicing from memory or from symptoms is going to be enough in solving these troubles. In most cases, an analytical troubleshooting procedure using a scope will be necessary to find the fault in the minimum amount of time.

(A) Complete blackout over large area



(B) Hum signal was a square wave

Fig. 1. Unusual 60-cps hum bar.

Square-Wave Hum

When an Admiral 17Z3 intermittently displayed the condition shown in Fig. 1A, a scope check at the video-detector output yielded a square-wave trace (Fig. 1B), indicating that the trouble stemmed from a prior signal stage.

A new 4BZ7 in the tuner cleared up the trouble. The old tube had a cathode-to-filament short. The resulting 60-cps sine-wave hum, amplified by the following high-gain stages, caused overdriving of an IF amplifier; thus, both peaks of the waveform were clipped, and a virtual square wave was the result. This video-signal distortion was not easily recognized as 60-cps hum, since the dark area on the screen did not have the gradually shaded edges characteristic of most hum bars.

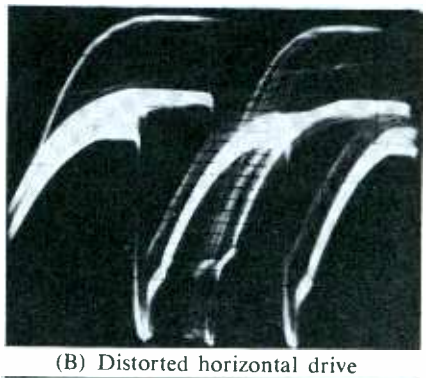
Similar Defect, Different Cause

To point up the fact that similar raster defects do not necessarily arise from similar circuit faults, look at the black-bar effect in Fig. 2A. A serviceman who had also experienced the trouble shown in Fig. 1 might presume a short in the RF-amplifier tube, but his conclusion would be dead wrong. Another man who is a skilled "symptom reader," knowing that the set (a Motorola TS-425) had a half-wave B+ rectifier, might reasonably suspect excessive ripple due to a bad filter had something to do with this defect. His opinion would also be wrong.

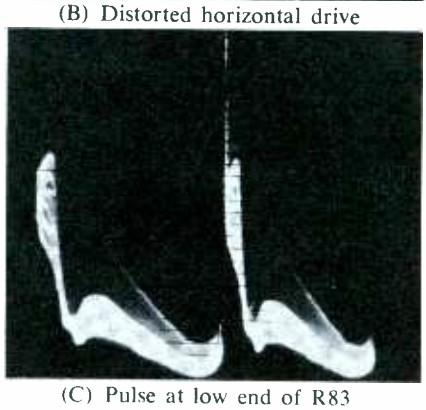
The three electrolytic filters in this set showed no abnormal ripple when scoped, the picture tube was receiving normal video, and no CRT-gun element was being subjected to modulation that would account for the semi-blackout.

A careful study of Fig. 2A will

(A) Zigzag line was important clue



(B) Distorted horizontal drive



(C) Pulse at low end of R83

Fig. 2. Hum was not to blame for this bar covering the lower half of screen.

reveal a significant symptom in addition to the sharp-edged black bar: a wiggly line at top center, symptomatic of horizontal-circuit trouble. Following this clue, I scoped the output signal of the horizontal multivibrator, and obtained a garbled trace (Fig. 2B). When changing the 6CG7 multivibrator tube had no effect, I scoped the B+ end of plate resistor R83 (Fig. 3) and was rewarded with Fig. 2C. Checking the circuit, I noted a curious fact—this last point is fed from a B+ line that a previous scope check had vindicated as being clean of abnormal ripple.

After corroborating my previous checks, I decided to trace the actual circuit. This led me to the discovery that the B+ path to R83 included a jumper between pins 1 and 8 of the yoke plug. I came to the inescapable conclusion that something was wrong with this jumper. One more check and a short session with the soldering iron cleared up this

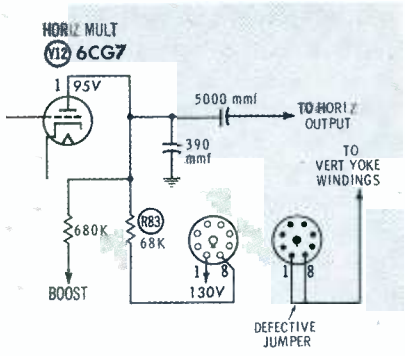


Fig. 3. Source of trouble was traced to jumper connection at yoke socket.

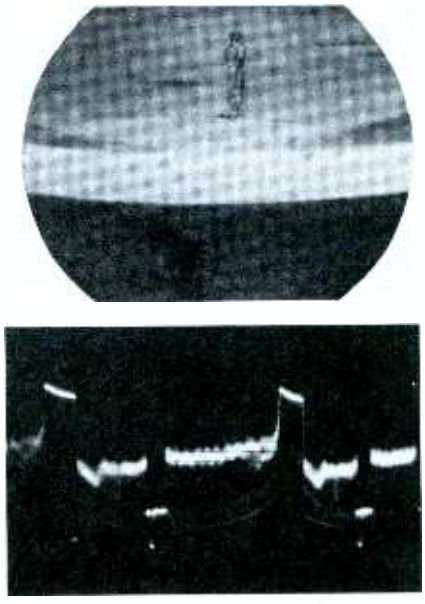


Fig. 4. Video-detector waveform contained pulse that caused white bar.

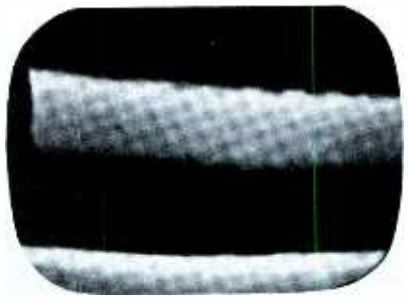


Fig. 5. Unusually intense 120-cps hum bars due to bad electrolytic filter.

bad connection and restored a full, normal raster.

Similar Cause, Different Defect

The picture in Fig. 4A, which looks like both games of a doubleheader being played simultaneously, was due to a defective 6J6 mixer-oscillator in an RCA KCS47. Fig. 4B shows how the video-detector signal looked while the defect was present. The condition cannot be attributed to a cathode-filament short, as the tube in this circuit has a grounded cathode; but it probably involved leakage between the filament and some other element, most likely the grid. I was anticipating a shorted tube in a front-end stage, but realizing that the 6J6 cathode was grounded, I was led to change the other tubes in the picture-signal circuits before I finally got around to changing the 6J6. This experience supports my contention that working from memory of similar defects is frequently a nonproductive method of removing bars or stripes from rasters.

Filter Troubles

Bars or stripes are two more possible troubles that can be added to the almost unlimited number of defects resulting from bad filters. Sometimes this type of bar or stripe effect has characteristics that readily identify its source. In receivers using a full-wave B+ rectifier, two dark hum bars cross the screen horizontally, and the picture may be twisted so that straight vertical lines take on the appearance of double S curves. Bars of such intense contrast as those shown in Fig. 5 are very rare. This condition, photographed from an RCA KCS97, was intermittent; about five seconds before the photo was taken, the set was operating with a perfectly normal picture. The location of the faulty filter was on the B+ line feeding the horizontal deflection circuit.

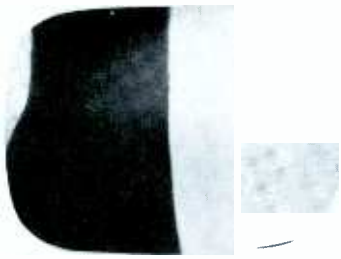
Hum bars running in a vertical direction might not be suspected as resulting from bad filters; but they did, in the cases illustrated in Figs. 6 and 7. On each occasion, a defective electrolytic was found in the horizontal sweep section. The exact nature of the fault was different from that in the receiver of Fig. 5, thus accounting for the difference in symptoms.

Fig. 8, depicting a trouble in a Silvertone 528.31801, is a variation of the "Venetian-blind effect" frequently found in sets using keyed AGC when the filter on the AGC line loses capacitance. Replacing the 4-mfd unit in this set cleared up the condition entirely. The condition shown here is not quite typical; usually, only about a half dozen thin bars, which stand out more clearly than this, are present in the top quarter of the raster.

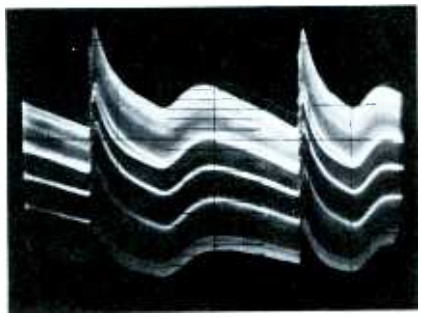
A Rare One

While most of the conditions presented in the previous cases are by no means common, they do recur occasionally, and probably are not totally unfamiliar to the full-time professional serviceman. Certain other symptoms are, to use an old maxim, "scarcer than hens' teeth"—like the one shown in Fig. 9, which I found in a Motorola TS-

• *Please turn to page 84*

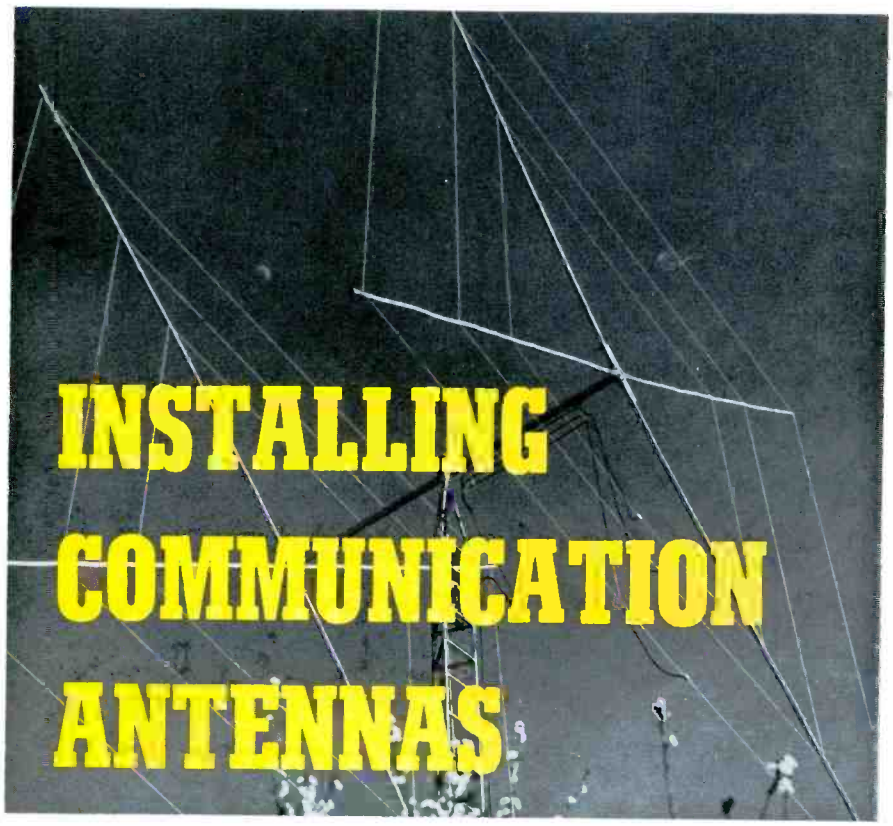


(A) Vertically arranged hum bars



(B) Ripple across defective filter

Fig. 6. Filter in horizontal circuit of RCA KCS94 caused this pattern.



INSTALLING COMMUNICATION ANTENNAS

A two-way radio system, whether commercial or Citizens band, is only as effective as the antenna system. Even the simplest of antennas will do its job if properly installed, but a poorly installed unit is likely to be a constant source of trouble.

Portions of the material in this article are from the Howard W. Sams books "Two-Way Mobile Radio Maintenance" and "CB Radio Antenna Guidebook."

Mobile Antennas

Communications antennas for vehicles fall into two categories— low-band whips, which are usually 60" to 80" in length, and the much shorter high-band whips. (For installation purposes, the 18" and 19" high-band VHF antennas and the 5" and 6" UHF antennas can be treated alike, since they are almost identical in mounting design.) Let's consider the low-band antennas first.

Low-Band Mountings

The most popular mounting for low-band antennas is the "split-ball-and-spring" base shown in Fig. 1. The base consists of a metal ball about 2" in diameter, mounted on an insulating disc. The ball is split diagonally as shown, and is held together by a heavy bolt. Another bolt extends from the bottom half of the ball assembly, and through the insulating disc. For mounting, two rubber discs provide slight shock protection, and make the mounting holes water-resistant. A thick metal disc, that goes on the inside of the car body, acts as a backup plate for added strength. The whole assembly is held to the body by three bolts. The antenna rod is attached to the heavy spiral spring so the assembly can flex, should it strike something. One end of the spring is screwed into the ball, while the antenna rod fits into a hole at the other end and is held in place by set screws. (The rod of some antennas screws directly into the top of the spring.)

To install this type of base, first select the mounting location on the car body. The best location is in the center of the roof, but these antennas are seldom mounted there because of their weight and length. Next best is between the rear-deck lid and the back window, near the fender. The fenders and skirts are usable, but slightly less desirable, locations. Least desirable from an efficiency standpoint is the bumper mount, because the antenna is

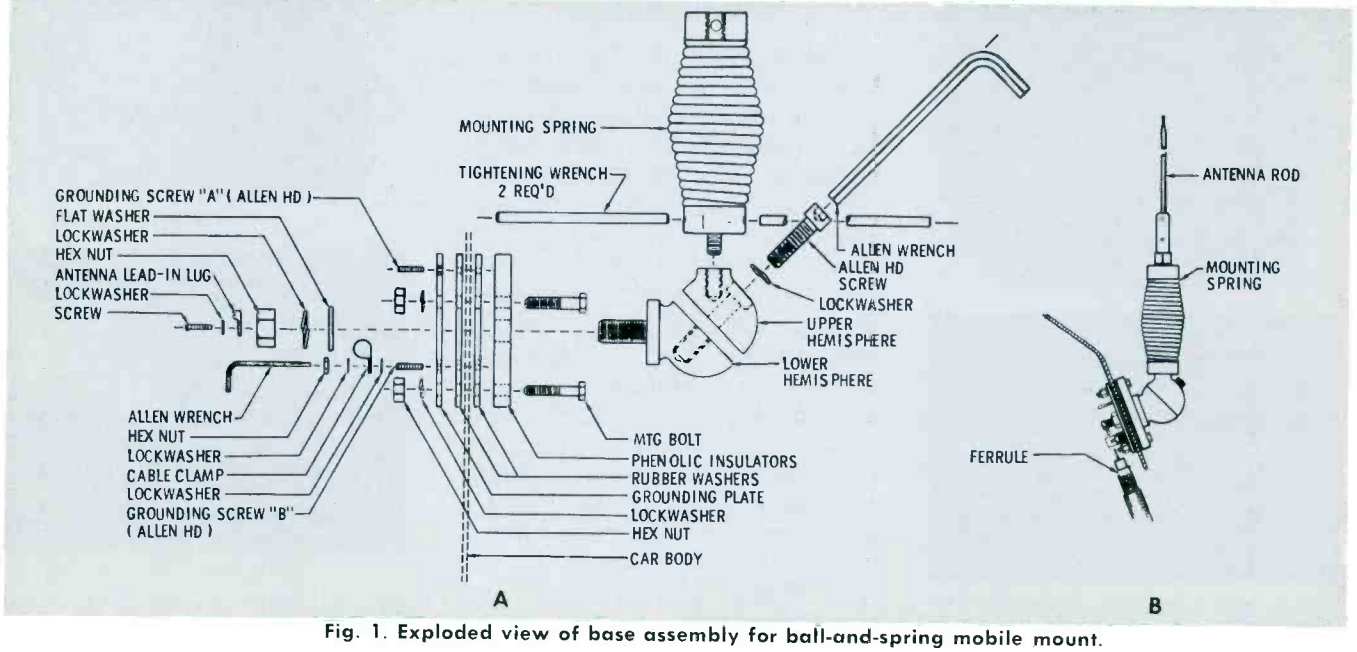


Fig. 1. Exploded view of base assembly for ball-and-spring mobile mount.

placed too low and assumes undesirable directional qualities. However, a bumper mount sometimes must be used to accommodate an extra-long antenna, or a customer who objects to holes drilled in his automobile.

Before drilling any holes, check inside the car body to make sure the space is clear. The base should be mounted where there are no braces, body members, or doubling of the sheet metal. The base must have an unobstructed, comparatively flat area at least 3″ in diameter, with 3″ of space below for the lead-in terminals. Also, you will need room to work, because the antenna connections must be made after the base has been installed.

Probably the easiest way to assure yourself of this space is to stand beside the car and reach into the trunk. Hold the antenna base near to the proposed mounting area with the outside hand, and feel inside the trunk with the other. You can usually tell when your hands are close together, and you can gauge distances this way. Be sure you're not going to run into braces, ridges, wiring, or the like. If the area on the inside is clear, you can begin the antenna installation.

Take the base assembly apart and use the metal disc as a template for marking the mounting holes on the car body with a grease pencil, as shown in Fig. 2. Use a large, sharply pointed punch to make a dimple in the center, to guide a small drill while making a hole large enough to pass the bolt of a shear punch. Now assemble the shear punch, which should be at least 1¼″ in diameter, and make the hole. (A socket wrench with a ratchet will speed it up.) This is probably the most practical method for making a large, smooth hole. Drill bits of this size are quite impractical, but holesaws are sometimes used. However, they need at least a ½-inch drill. As for filing out the hole—forget it!

After the large hole is finished, use the metal disc as a guide, and drill the three ¼-inch holes for the mounting bolts. The surest way is to drill the first hole and place one bolt through it to hold the disc in place; then drill the two remaining holes through the disc. In this way, you are assured of a good fit.

Next, put a rubber disc in place over the holes; place the insulator

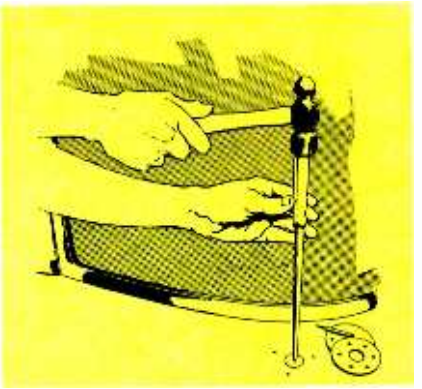


Fig. 2. Punch is used to mark center of mounting hole outlined in grease pencil.

disc and the ball on top of it. Pass the mounting bolts through the small holes and, reaching inside the trunk, place first a rubber disc and then the metal "backing" disc over the bolts. The lockwashers and nuts can then be put on the bolts. It may be a bit tricky to get the first nut started, using only one hand. Sometimes the only way is to lie on your back in the trunk and reach up over your head (uncomfortable, but necessary). When installing the metal plate, be sure the small screws which will clamp the coaxial lead-in down are placed so the lead-in will leave the antenna base in the direction of the radio.

Tighten the base down snugly, using a socket wrench on both sides if possible, or at least a box-end wrench on the underside. Tighten the bolts until the rubber disc on the outside just begins to "squeeze out" from under the insulator disc.

The lead-in cable is attached to the base by a screw which goes through its terminal lug into the end of the heavy bolt holding the ball. The shield braid is grounded carefully to the car body through a clip held by one of the two small screws in the "backing" plate; be sure the ground is thorough and secure.

The antenna rod can be lined up vertically by adjusting the split ball. This is done by loosening the large Allen screw that holds the two halves of the ball and the larger hex nut that holds the bottom of the ball to the insulator. The base assembly may then be turned, and the ball twisted, until the antenna rod is exactly vertical, after which the nut and screw are retightened.

High-Band Mountings

Installing the roof-top antennas

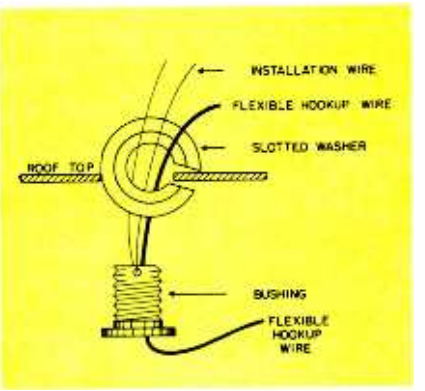


Fig. 3. Slotted washer can be worked under roof to fit over bottom bushing.

used with high-band radios is looked upon as a problem. It needn't be. A bit of body work may be involved, and you'll have to use extreme care to avoid damaging the upholstery. (Before doing any work inside the car, wash your hands! Greasy finger marks on head liners are almost impossible to remove.)

The first step is to drill a hole in the roof of the car. The center is easily located by snapping a chalk line diagonally from the corners. Next, check carefully on the inside to make sure you're not going to hit the dome light or one of the cross-braces. Always install the antenna between the seams of the head liner.

You won't be able to use the shear punch, since you can't reach the underside of the roof (unless you want to remove the head liner, which is a chore), so a hole saw is the best bet. Center-punch the prospective location of the mounting hole. From the underside find the approximate location of your punch mark; fasten a safety pin near it if the head liner is cloth, or a short piece of stiff wire with a hook on the end if it is a perforated fiber liner. Attach a small weight to the pin or wire (or have someone sit

• *Please turn to page 88*

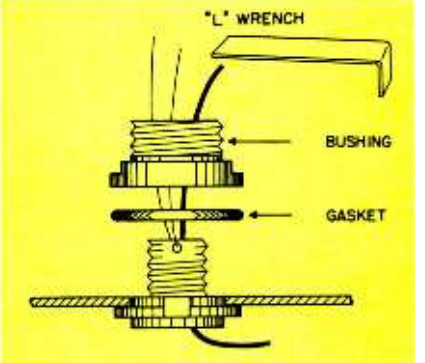
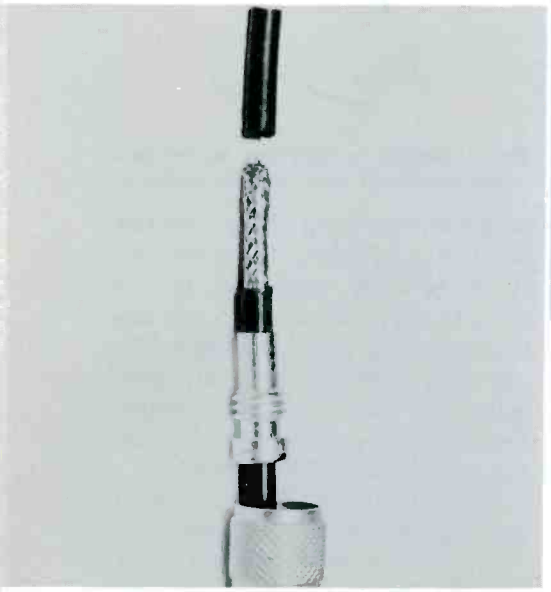
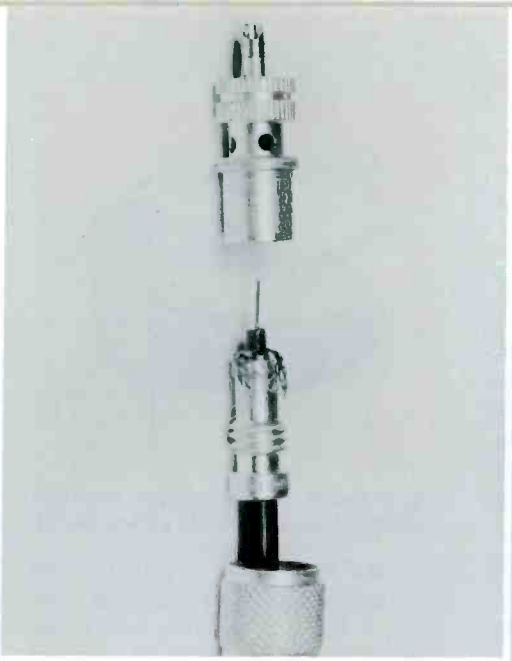
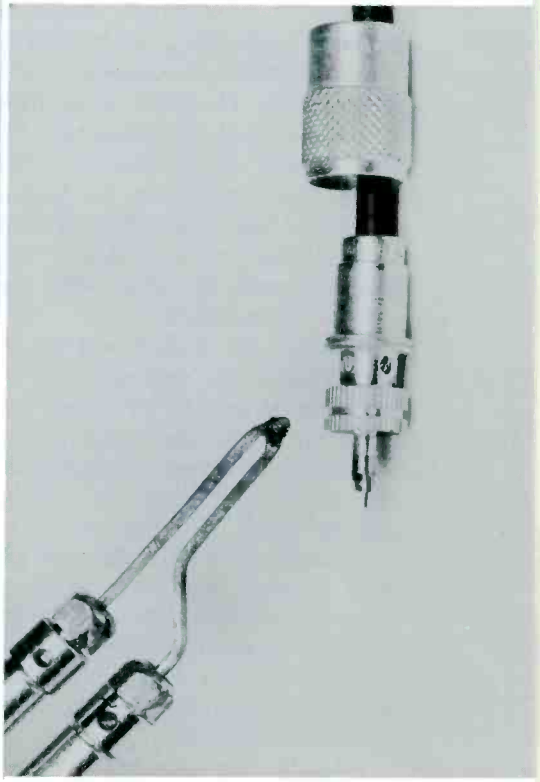


Fig. 4. Top bushing fits into place above roof, on top of rubber gasket.

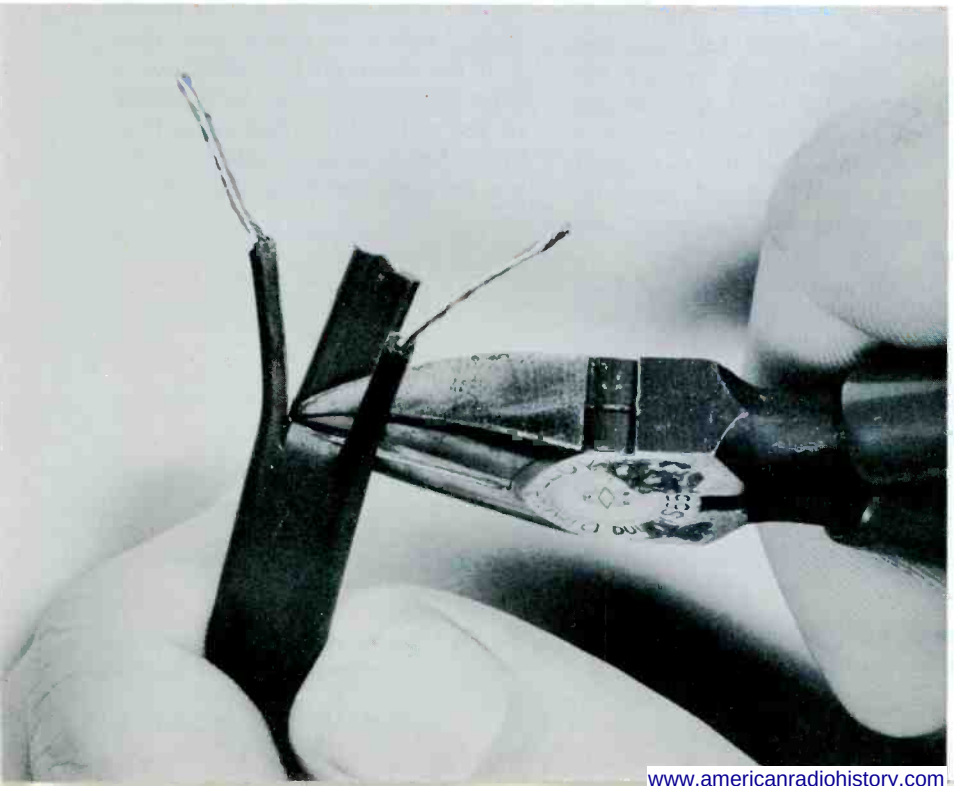






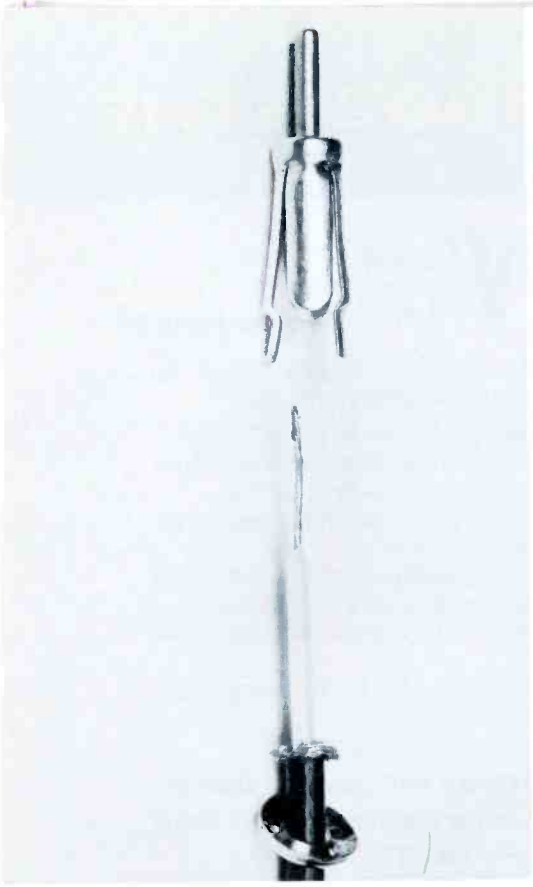
This is one of the preferred methods of preparing small-diameter coaxial cable for its connector. Place the adapter (not needed for larger cables) and the connecting sleeve on the cable. Strip ¾″ of the outer insulation from the cable. Unbraid the shield, removing ⅜″ of it and folding the rest back over the adapter as shown. Strip ⅝″ of insulation from the inner conductor. Screw the adapter into the plug, allowing the bare inner conductor to enter the tip of the connector. Solder the tip, and apply solder to the shielded lead through the holes in the connector shell.

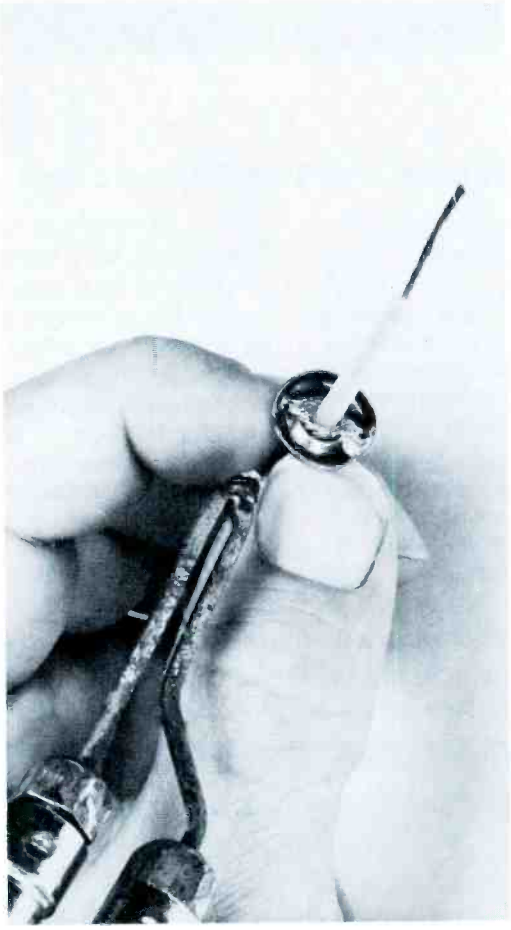
How to Strip and Solder Cables

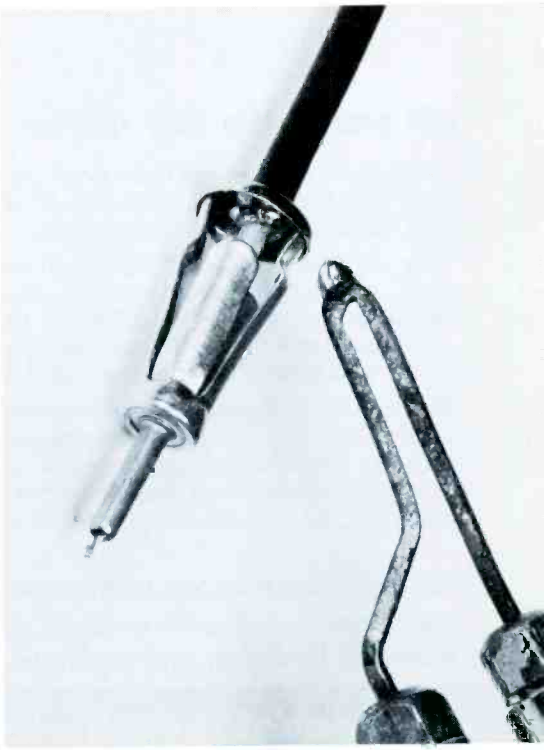


The most careful antenna installation can be rendered ineffective by a carelessly installed termination. The accompanying photos show accepted methods for handling various types of lead-ins.

This photo shows how to prepare a 300-ohm twin-lead for connection to a TV receiver. Strip ¾″ of the insulation from each lead. Then cut an additional ¾″ along each side of the lead, being careful not to bare the wires. Remove the center portion, leaving the insulation on each lead. Tin the exposed leads to prevent strands from shorting.

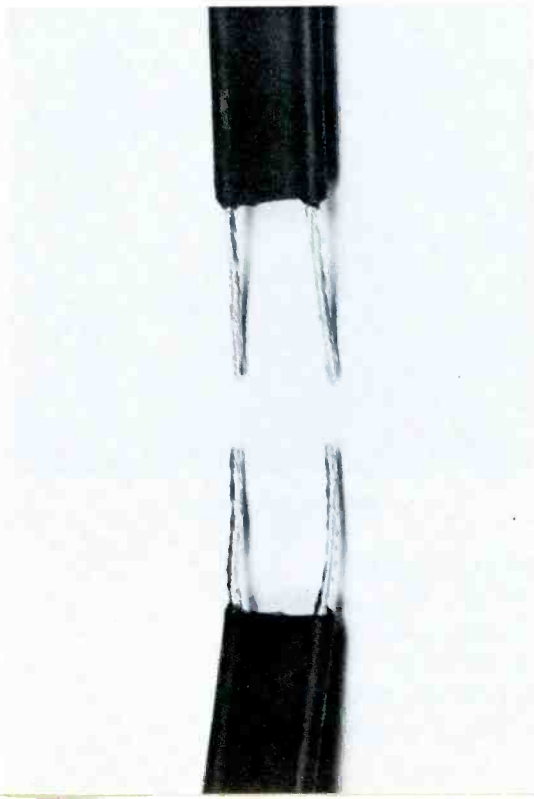


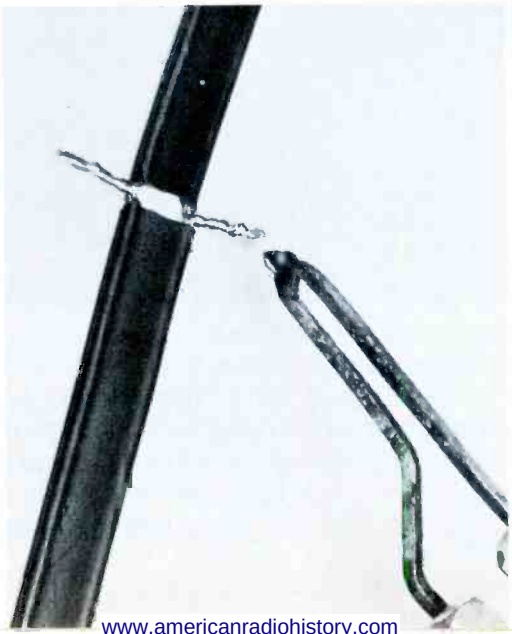


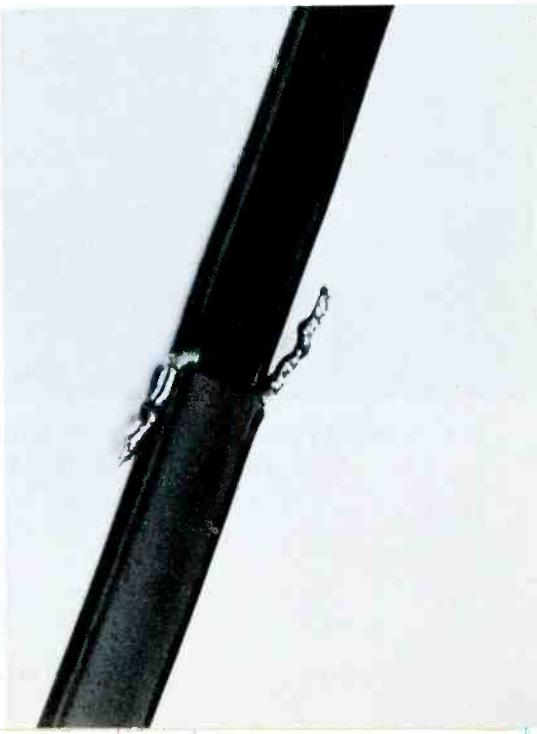


A sturdy auto-radio connector can be constructed using an ordinary plug and a cup washer. Slip the washer over the cable, and strip 1¾″ of the outer insulation. Remove 1½″ of the shielded lead, and solder the remainder to the cup washer. Bare ¾″ of the inner conductor and insert it into the plug tip. Solder the tip, plus both sides where contact is made with the cup washer. This "handle" eliminates strain on the lead-in when it is being unplugged.

Twin-lead shouldn't be spliced if it can be avoided; however, if it becomes necessary, here's how: Strip ¾″ of insulation from each lead of the two ends to be spliced. Twist the strands together and tin them. Butt the two ends together and solder. Bend the soldered leads in opposite directions and parallel with the lead-in. Taping the splice will protect it and prevent the leads from shorting. An acrylic spray will also help protect the joint.







AS OF OCTOBER 22, 1962—THE

(*it ended the day JFD introduced the Log-Periodic LPV $\frac{L_{(n+1)}}{L_n}=\tau$ TV antenna)

Wave goodbye to all the Rube Goldberg contraptions with their "Chinese puzzle" combinations of collectors, directors, reflectors.

Now you can solve **any** reception problem with **one** compact, precisely-engineered antenna—the **first** TV antenna based on the geometrically-derived **logarithmic-periodic** scale developed by the Antenna Research Laboratories of the University of Illinois for the U.S. Air Force.

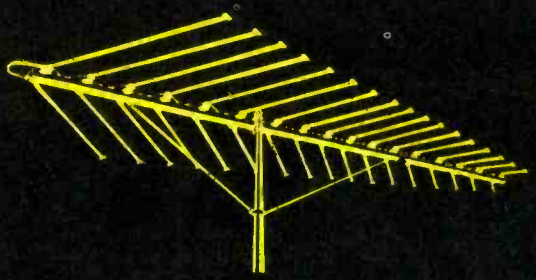
Because it is inherently frequency-independent, the JFD Log-Periodic LPV delivers **the same superb performance on every VHF channel**—performance comparable to that of a single channel Yagi. And delivers it not only in black-and-white, but in Color, and you get FM stereo too!

THE LOG-PERIODIC LPV ACTUALLY **TUNES ITSELF** TO EACH RECEIVED FREQUENCY—RESULTING IN:

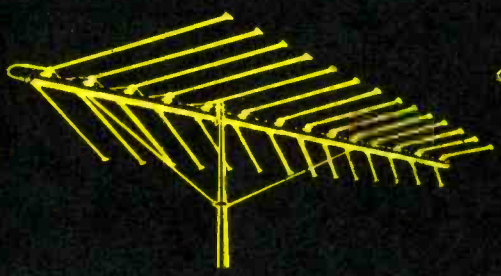
- **HIGHEST** GAIN—as high as 14 db. in the LPV 17!
- **SHARPEST** DIRECTIVITY—on high bands as well as low!
- **HIGHEST** FRONT-TO-BACK RATIO—up to 35 db.
- **LOWEST** VSWR—as low as 1.2 to 1—with constant impedance across the full bandwidth!
- **FLAT** RESPONSE ACROSS BOTH VHF BANDS—with greater gain on the high band, where it's needed most (average increase of gain in high band over low band: 3¼ db.)!
- **BROADEST** BANDWIDTH—thanks to its unique frequency-independent characteristics!

FOR THE FIRST TIME ONE SCIENTIFICALLY FORMULATED ANTENNA CONFIGURATION SATISFIES ANY LOCATION DEMAND:
Harmonically resonant V-elements operate on the Log-Periodic Cellular Principle in the Fundamental and Third Harmonic Modes for unprecedented performance —in color—in black and white—in FM STEREO

developed by the Famous Antenna Research Laboratories

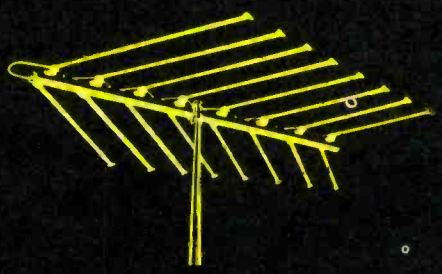


LPV-17: 15 Active Cells and Director System—up to 175 miles

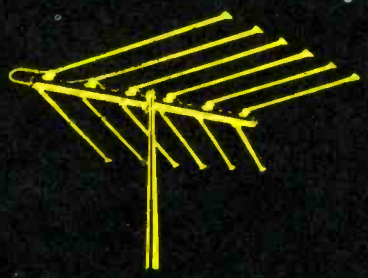


LPV-14: 13 Active Cells and Director System—up to 150 miles

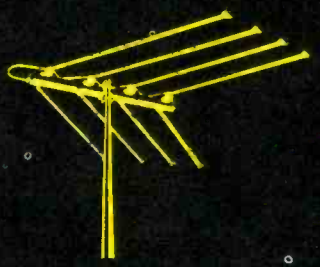
LPV-11: 9 Active Cells and Director System—up to 125 miles



LPV-8: 7 Active Cells and Director System—up to 100 miles



LPV-6: 6 Active Cells—up to 75 miles



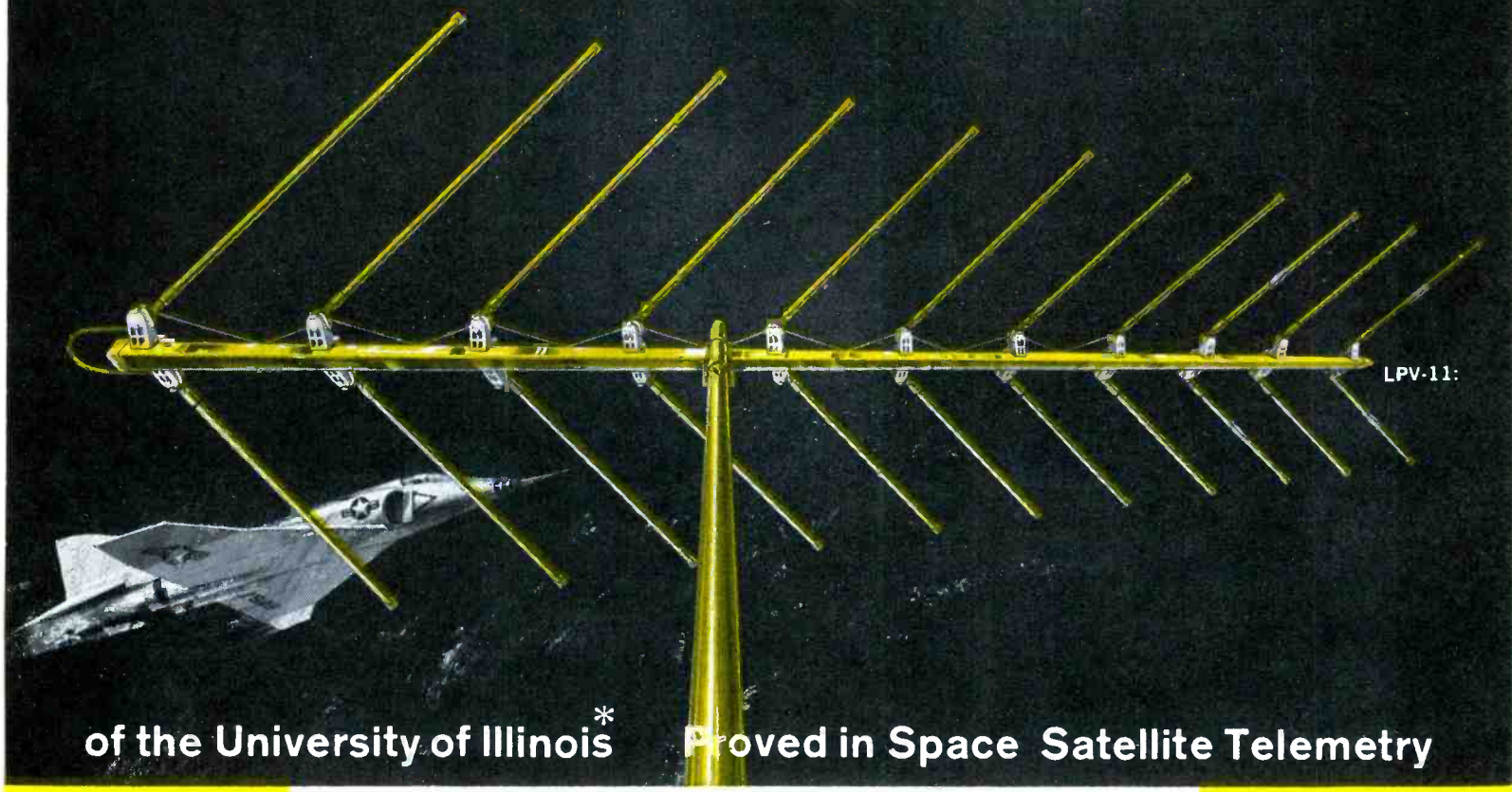
LPV-4: 4 Active Cells—up to 50 miles

Adapted to TV and FM Stereo by JFD

✓ ELIMINATES THE NEED FOR AREA-DESIGNED ANTENNAS
✓ 100% PREASSEMBLED "FLIP-QUIK" ASSEMBLY
✓ MASSIVE TANK TURRET BRACKETS THAT DOUBLE-LOCK ELEMENTS
✓ AAA† GOLD BOND ALODIZED TO KEEP THAT BRAND NEW LOOK
✓ EXTRA-RUGGED, DOUBLE-REINFORCED IN EVERY DETAIL
✓ LIGHTEST IN WEIGHT PER DB GAIN
✓ WIND-TUNNEL TESTED CONSTRUCTION
✓ LEAST SNOW AND ICE LOADING

†Attractive, Anti-corrosive Armor

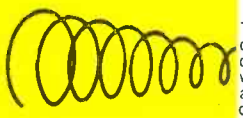
'ERA OF COMPROMISE' IS OVER!*



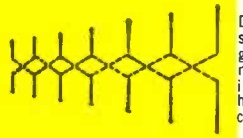
LPV-11:

of the University of Illinois* Proved in Space Satellite Telemetry

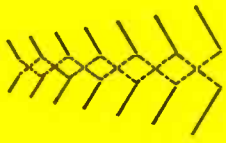
HOW THE LOG-PERIODIC LPV MAKES ALL OTHER ANTENNAS OBSOLETE



The JFD LPV antenna is a direct descendant out of the logarithmic conical spiral antenna used on the Transit satellite. This basic design is FREQUENCY INDEPENDENT—it works like a conical waveguide to yield almost constant gain, matched impedance and a unidirectional polar pattern across an extremely wide band of frequencies.



Dipole version of spiral antenna has elements whose length and spacing is determined by formula derived from conical spiral geometry, so that antenna acts like a spiral with parts of coils missing. A logarithmic scaling multiplier ties the dipoles together into active multi-element cells for each frequency. Crossed phasing harness inserts a 180 degree phase shift between dipoles that cancels signals from rear, reinforces signals from front.



JFD's LPV antenna for TV and FM goes one step further—increases gain and front-to-back ratio while maintaining frequency independence. Forward V-ing of elements shrinks rear radiation lobes, narrows forward beam for sharp directivity, helping to eliminate ghosts and adjacent channel interference. Forward V also permits low band dipoles to contribute to high band gain by operating on the third harmonic mode.

For example: Operation of the JFD LPV-11 on the low band: The larger dipole cells resonate to the low band TV frequencies at their fundamental wavelength. Within each cell, one dipole absorbs the greatest amount of signal for any particular channel, adjacent dipoles pull in 60% more and the next two dipoles add 30% more signal. Many active dipoles working on each channel with constant impedance guarantee high gain.

– – – – *indicates current distribution on fundamental mode.*

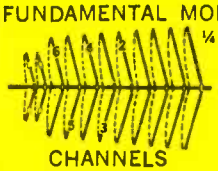
On the high band The third harmonic cell forms at the rear of antenna for channel 7 and as the frequency increases toward channel 13, the active region moves toward the apex of the antenna. It is this third harmonic operation which guarantees as much as 3¾ db. additional gain Continuous and co-linear directors sharpen forward pattern and give peak performance across the entire VHF TV band.

– – – – *indicates the current distribution for the third harmonic mode which will be received on all elements.*

. . . . . *indicates the active region for channel 10, i.e., the different efficiencies with which the elements of the LPV-11 act on channel 10.*

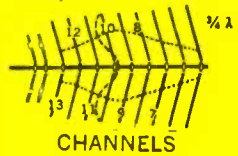
The actual gain curves measured for the LPV-11 in the JFD Antenna Research Laboratories confirm this fact. Within the band for which it is designed (the principle will also be adapted for UHF and other uses), the log-periodic LPV's impedance, polar patterns and front-to-back ratio are virtually constant—with gain for each channel as high as that furnished by a comparable-sized single-channel Yagi.

FUNDAMENTAL MODE

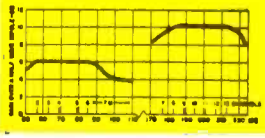


CHANNELS

THIRD HARMONIC MODE



CHANNELS



Each antenna in the LPV series consists of an array of resonant V-dipoles and crossed phasing bars, constituting a group of "cells." The size of each cell differs from the one before it by a Logarithmic factor. For any particular frequency, the active portion of the antenna centers on the resonant dipole (equal to one-half wavelength at that frequency), with the adjacent elements also absorbing significant signal energy. The resonances of adjacent cells overlap, so that as the frequency increases or decreases, it is transferred smoothly from one cell to the next.

In effect, the signal is passed along as the frequency increases—the active area moving toward the apex or small end—until, as the fundamental harmonic reaches one end, the other end approaches resonance in the third harmonic. Conventional wide-band antennas are like rows of compartments, one for each channel desired, with sharp cutoffs. The log-periodic antenna is like a continually moving belt that accepts smoothly any frequency that hops aboard.

U.S. Patents 2,958,081—2,985,879—3,011,168. Additional Patents Pending. Produced exclusively by JFD Electronics under license to University of Illinois Foundation

SEE THE JFD LOG-PERIODIC LPV AT YOUR JFD DISTRIBUTOR NOW—AND BE THE FIRST ONE IN YOUR AREA TO INTRODUCE AND PROFIT FROM THIS NEW ERA IN TV RECEPTION.

JFD

THE BRAND THAT PUTS YOU IN COMMAND OF THE MARKET

JFD ELECTRONICS CORPORATION
15th Avenue at 62nd Street, Brooklyn 19, N.Y.

JFD Electronics-Southern Inc., Oxford, North Carolina
JFD International, 15 Moore Street, New York, N.Y.
JFD Canada, Ltd., 51 McCormack Street, Toronto, Ontario, Canada
401-144 W. Hastings Street, Vancouver 3, B.C.

QUICKER SERVICING
by Fred G. Biesecker

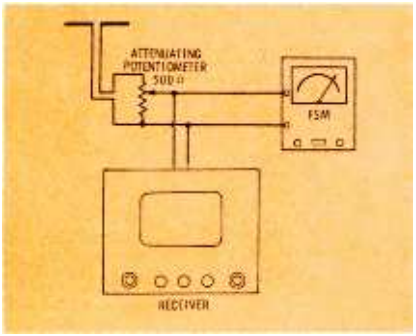


Fig. 1. Arrangement to calibrate FSM.

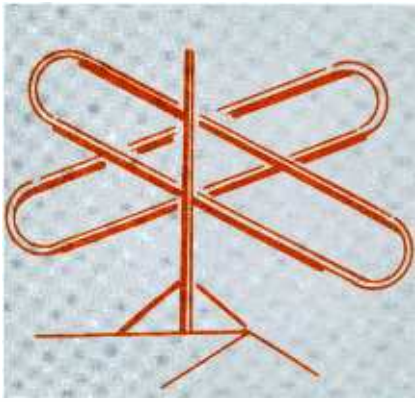
Spotting Antenna Failures Quickly

There are many times when a serviceman checks and double-checks a receiver, only to find the trouble is caused by a weak signal applied to the antenna terminals. If there were some quick and simple way to localize faults in antenna systems. . . .

Analyzing Complaints

When a prospective customer phones, saying, "The picture on my set sometimes flashes and gets snowy," do you stop to consider that this could be an antenna problem? A few simple questions over the telephone can often confirm or dispel your suspicion. First, does the trouble occur only on windy or stormy days? Second, is the trouble noticeable on more than one station? Third, how long has the present antenna system been in use? It may take a little extra time to obtain this information, but it is time well spent if it means one service trip instead of two. Unexpected antenna work may necessitate a second trip, because very few servicemen carry antenna equipment on the same vehicle that is used for service calls.

If your customer complains of interference—such as ignition noise from passing vehicles — remember that the symptoms may have existed



before, and merely remained unnoticed until recently. On the other hand, also remember that these interfering signals may be appearing as the result of a faulty antenna system. If the station signal picked up by the antenna system suddenly becomes weaker than the interference signals, the set will show a very noticeable difference.

In this article, we'll explore some ways to pinpoint troubles that are outside the receivers. In the process, we'll be discussing defects that occur in TV antennas, CB and communications antennas, and auto-radio aerials. Each type has its own peculiarities and characteristic problems.

TV Antenna Problems

Flashing, snow, and ghosts are possibly the most confusing of all service complaints; they can be caused by either the receiver or the antenna, thus making it difficult to be sure which is at fault. Whenever a service call is made for any of these symptoms, it's easy to make a quick visual check of the antenna system before entering the home. You should look for broken, bent, or loose elements on the antenna; also make sure the lead-in isn't broken, worn, or frayed. If everything appears visually satisfactory,

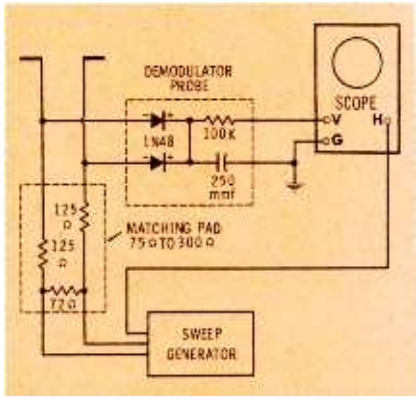


Fig. 2. Test hookup used for checking the response curve of an antenna.

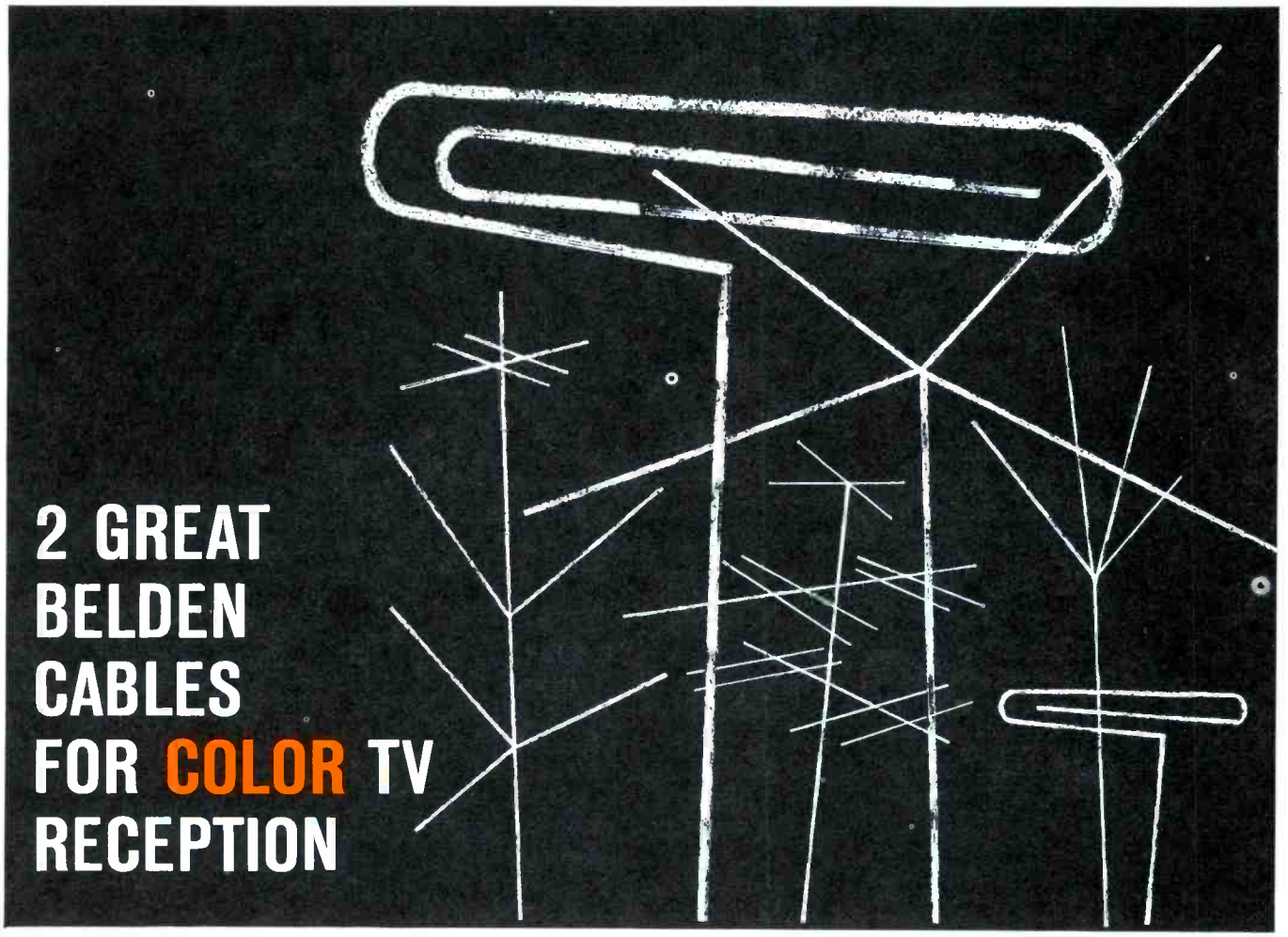
proceed with the preliminary checks of receiver operation.

Flashing

You can isolate flashing by shorting the antenna terminals of the set, and noting whether the trouble diminishes or ceases. If the complaint indicates that wind affects the problem, it may be necessary to have someone shake the antenna or the lead-in to make the trouble appear.

In extreme cases, you may have to disconnect the lead-in from the receiver and twist the loose ends together. It may even be necessary to move the lead-in completely away from the set, since the noise signals from severe flashing can be induced into the set by a lead-in lying in close proximity to the receiver. Flashing can be caused by a variety of different things. The top end of one lead-in conductor might be broken loose and rubbing on the other lead (or making intermittent contact with some other part of the antenna). It is possible the line has an intermittent break; these usually occur near a standoff, at the rotator loop, or where the lead-in enters the building.

Flashing can also be caused by loosened or corroded mechanical



2 GREAT BELDEN CABLES FOR COLOR TV RECEPTION

CELLULINE* 8275

Maintains uniform electrical characteristics by eliminating all possible moisture between conductors. The thick outer wall of polyethylene protects the cable from abrasion and sun damage, and the round shape offers less resistance to wind. The result is a long lasting, efficient transmission line for clearer color and black and white TV reception.

AWG & (Stranding)	Color	Nom. O.D. (Inch)	Nom. Velocity of Propagation	Nom. Capacitance (mmf/ft)	Nom. Attenuation per 100′ mc	Nom. Attenuation per 100′ db	Standard Package Lengths in ft
20 (7x28)	Brown	.300 x .400	80%	4.6	100 200 300 400 500 700 900	1.05 1.64 2.12 2.5 2.98 3.62 4.3	50′ coils 75′ coils 100′ coils 500′ spools 1000′ spools

PERMOHM* 8285

Conductors are encapsulated in cellular polyethylene. This exclusive design provides clearer TV pictures in all areas including areas where conditions of salt spray, industrial contamination, ice, rain, or snow exist. It further improves fringe area reception as well as strengthens UHF and color TV reception.

AWG & (Stranding)	Color	Nom. O.D. (Inch)	Nom. Velocity of Propagation	Nom. Capacitance (mmf/ft)	Nom. Attenuation per 100′ mc	Nom. Attenuation per 100′ db	Standard Package Lengths in ft
22 (7x30)	Brown	.255 x .468	73.3%	5.3	100 300 500 700 900	1.4 2.8 3.8 4.8 5.6	50′ coils 75′ coils 100′ coils 500′ spools 1000′ spools

Belden
WIREMAKER FOR INDUSTRY
SINCE 1902 — CHICAGO

Belden Cable is Packaged in Standard Lengths for Display and Handling

Power Supply Cords • Cord Sets • Portable Cordage • Electrical Household Cords • Magnet Wire • Lead Wire • Automotive Wire and Cable • Welding Cable

*Belden Trademark—Reg. U. S. Pat. Off.

8-5-2

connections on the antenna. Much attention should be given to the lead-in connections, even though they appear mechanically sound; corrosion between the metal surfaces can act as a partial insulator. To remove all suspicion, the connections should be loosened, thoroughly cleaned, and retightened.

Ghosts

Ghosts can be caused by a multitude of conditions, and may be slightly difficult to interpret and remedy. However, there is one excellent way to determine whether the ghost is being caused by the set or by the antenna: If you can alter the ghost considerably by adjusting the fine tuning, the fault generally lies within the set; if the ghost isn't tunable, the problem is with the antenna or lead-in.

Excessive antenna wire behind a receiver is a common cause of ghosts—especially in UHF areas. Once in a while you see an installation where an abundance of lead-in was left over, so the customer has rolled this into a neat coil and placed it behind the receiver. Result —ghosts. The cure is obvious.

Another cause of ghosts is the standing-wave effect produced by an open or a mismatched antenna. This type of ghost is very stable; it cannot be tuned, nor does it vary any appreciable amount during viewing. This latter fact helps prove that the ghost is not a "normal" ghost caused by reflections from buildings, hills, and similar large objects.

The fixed ghost will generally be caused by a fault within the antenna system; the varying ghost can also be caused by the antenna system, but it can just as well be caused by poor antenna orientation or by circumstances which cannot be controlled. The solution to external ghost problems—those not caused by antenna faults—will vary with the particular problem. The main things to try are: reorienting the antenna, elevating it, or replacing it with a more directional type.

Snow

Snow in a TV picture is usually the result of insufficient signal reaching the tuner. The lack of signal voltage can be caused by an open lead-in, by a faulty antenna, or simply by too much distance between the antenna and the TV transmitter.

If you suspect the antenna or lead-in, a fairly simple test can help you decide. Disconnect one side of the antenna lead at the receiver, and observe the picture. If the picture is clearer with only one lead connected, one side of the twin lead is open. It may be necessary to try both sides to determine which one is bad. If the picture is just as good without the antenna as with it, the lead-in or the antenna is definitely at fault.

A field-strength meter (FSM) can be used for determining whether sufficient signal is present at the receiver. The accuracy of the meter is unimportant, since the main point is the relative amount of signal needed by the set to produce a snow-free picture. You can "calibrate" your FSM by taking a series of readings with the FSM connected to your shop antenna, and comparing the reading with desired picture standards. Connect a TV receiver and the FSM to the same antenna, and provide some means of varying the signal (Fig. 1 shows a way). You will be able to determine the amounts of signal necessary for a slightly snowy picture and for a snow-free picture. With this information available, it will be easy to determine if the lead-in or the antenna is providing sufficient signal at a customer's home.

Another test instrument that comes in handy for checking antennas and lead-ins is the ohmmeter section of your VOM. The lead-in connected to a folded-dipole antenna can be checked with a VOM simply by connecting the ohmmeter leads across the line. Make sure the line is disconnected from the receiver, so the antenna matching coils won't cause a false reading. There are certain limitations to this test

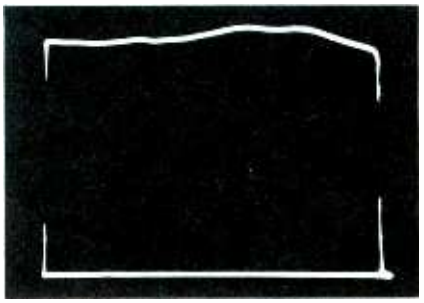


Fig. 3. Normal antenna-system curves.

CENTRALAB'S FRK-300 GIANT FASTATCH II® CONTROL KIT

Your **FRK-300** *Kit contains:*

67 front controls covering 24 different values and tapers
50 rear controls covering 23 different values and tapers
212 shafts consisting of:
8 types for single controls
2 types for tandem twins
13 types for push-pull dual concentrics
30 types of front shafts for dual concentrics
33 types of rear shafts for dual concentrics
2 types for color TV
15 KR Fastatch on-off switches
10 KR push-pull line switches
10 AK-38 twist-tab mounting plates and
Up-To-Date Current Guides and Cross-References

Centralab's FRK-300 Control Kit is a new giant-size kit designed to provide even the largest service organization with all the components needed to replace any popular $^{15}/_{16}$" diameter control. This includes single, dual concentric, and twin models. 452 control components are packed in a heavy gauge, 18 drawer cabinet specially designed for Centralab.

Any control assembled with the FRK-300 is an exact replacement, electrically and dimensionally, for the manufacturer's original control. Construction is a snap when you use the Fastatch II.® Just plug in and snap together; no complicated alignment or twisting is necessary.

Centralab®

THE ELECTRONICS DIVISION OF GLOBE-UNION INC.
942D EAST KEEFE AVENUE • MILWAUKEE 1, WISCONSIN
In Canada: Centralab Canada Ltd., P.O. Box 400, Ajax, Ontario

method; for example, conicals and other antenna types having "open" elements will be impossible to check in this way. This problem can be remedied when the antenna is installed, by placing a 100K resistor across the terminals. You can then measure the resistance between the leads from the receiver end, and thus discover whether the lead is open, shorted, or okay. The resistor value is high enough to have little effect on the signal.

If an intermittent lead is suspected, connect the VOM across the leads and have someone shake or move the antenna and lead-in back and forth while you observe the meter. If the meter shows no continuity, an open lead is indicated; any reading considerably less than 100K indicates a short. Whenever the lead-in is strongly suspected of being defective, a safe bet is to replace the entire lead instead of wasting valuable time trying to pinpoint exactly where the fault might be.

Probably the most accurate and thorough practical test of an antenna system can be made by the sweep-analysis method, using a sweep generator, a scope, and a balanced demodulator probe. The time and effort involved are greater than for the quick checks described above, but the results are far more conclusive, and many slight faults can be revealed that will show up in no other way.

The procedure consists essentially of checking the response of the entire system at television-channel frequencies. Fig. 2 shows the connections for the equipment. The sweep generator is connected to the antenna lead-in and set to sweep the frequency or band of frequencies the antenna should cover. (If your generator has limited sweep width, you can move the center-frequency dial through the TV band, noting the system response at all the various channel frequencies.) The balanced demodulator probe is connected to the lead-in as shown, and its output is applied to the vertical input terminals of the scope. The scope and generator are otherwise interconnected in the same way as for checking alignment response.

The key to these tests is to note any irregular response in the television band, especially sharp dips in the response curves. Fig. 3 shows normal response curves that may be seen on the scope during such tests, and Fig. 4 shows the effects of antenna-system faults. The antenna system should be perfectly tuned to a certain broad range of television frequencies, depending on the particular design of the antenna. If a lead-in is broken, or a rivet is corroded in an antenna joint, or a phasing bar is defective, the pattern will become very irregular — indicating the need for further checking of the system. As you see, this test can reveal faults that might otherwise evade even a careful visual inspection.

Communications Antennas

When a Citizens-band or other communications receiver shows signs of weak or noisy operation, be sure to check the possibility of antenna-system defects. If both the

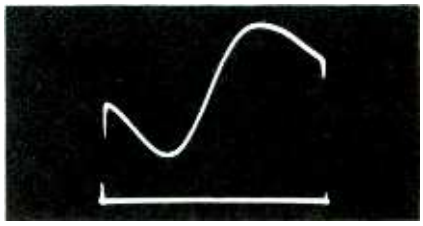


Fig. 4. Faulty antenna-system response.

says BILL HULBERT, WATERTOWN ELECTRONICS...

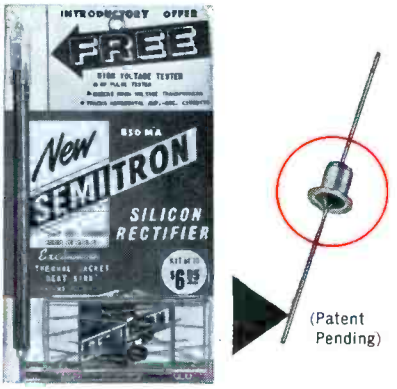
Left: Jerry Eamer, Electronics Serviceman

Right: Bill Hulbert, Watertown Electronics, Watertown, N. Y.

Look for the Semitron famous tested and proven Transistor Replacement Display. Replaces over 2000 EIA American, foreign and special type transistors — 90% of your needs.

"Our technician customers ask for SEMITRON REPLACEMENTS because they're quality products engineered to the serviceman's needs."

FREE — ask your Distributor for Semitron replacement and substitution charts for transistors and diodes.



(Patent Pending)

ANOTHER SEMITRON EXCLUSIVE!

Silicon Rectifier with exclusive Thermal Jacket Heat Sink. **SPECIAL INTRODUCTORY OFFER** — Kit #TH850 — 10 Silicon Rectifiers (850MA, 500PIV), PLUS High Voltage Tester, BOTH for ONLY $6.95.

SEMITRONICS CORP.
265 Canal Street
New York 13, N. Y.
(212) CAnal 6-5401

SEMITRON

SERVICE ENGINEERED REPLACEMENTS

• TRANSISTORS • RECTIFIERS • DIODES • IF TRANSFORMERS • CAPACITORS

SOLD THRU DISTRIBUTORS ONLY

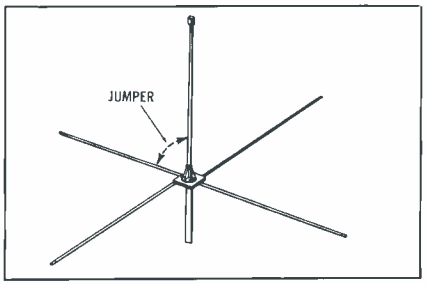


Fig. 5. A typical ground-plane antenna shown with a jumper to ease checking.

transmitter and receiver seem to be affected, there is good reason to suspect antenna trouble. The first step is, of course, a visual check for broken, missing, or damaged elements, and for loose or corroded lead-in connections.

A shorted coaxial cable or antenna can be detected with the ohmmeter section of your VOM, the same as with a TV antenna system. However, an open lead can be checked only after a jumper is connected from the radiating element to the ground plane—as in Fig. 5.

On the other hand, the "unipole" type of antenna (Fig. 6) is a closed circuit for DC. A continuity check of the transmission line is simple with one of these antennas, but some other method is necessary for spotting a short.

The reverse-reading wattmeter is a very useful test instrument for communications - antenna systems, for the transmitter serves as the signal source. (If the antenna is bad for receiving, it is also defective for transmitting.) The operation of this instrument is based on the fact that if there is a defect or a mismatch in the transmission line or the antenna a certain amount of RF energy will be reflected back toward the transmitter. The antenna normally acts as

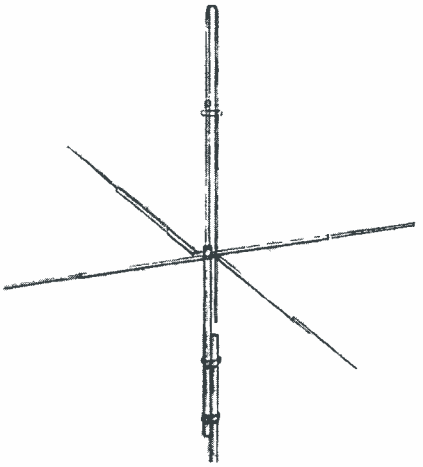
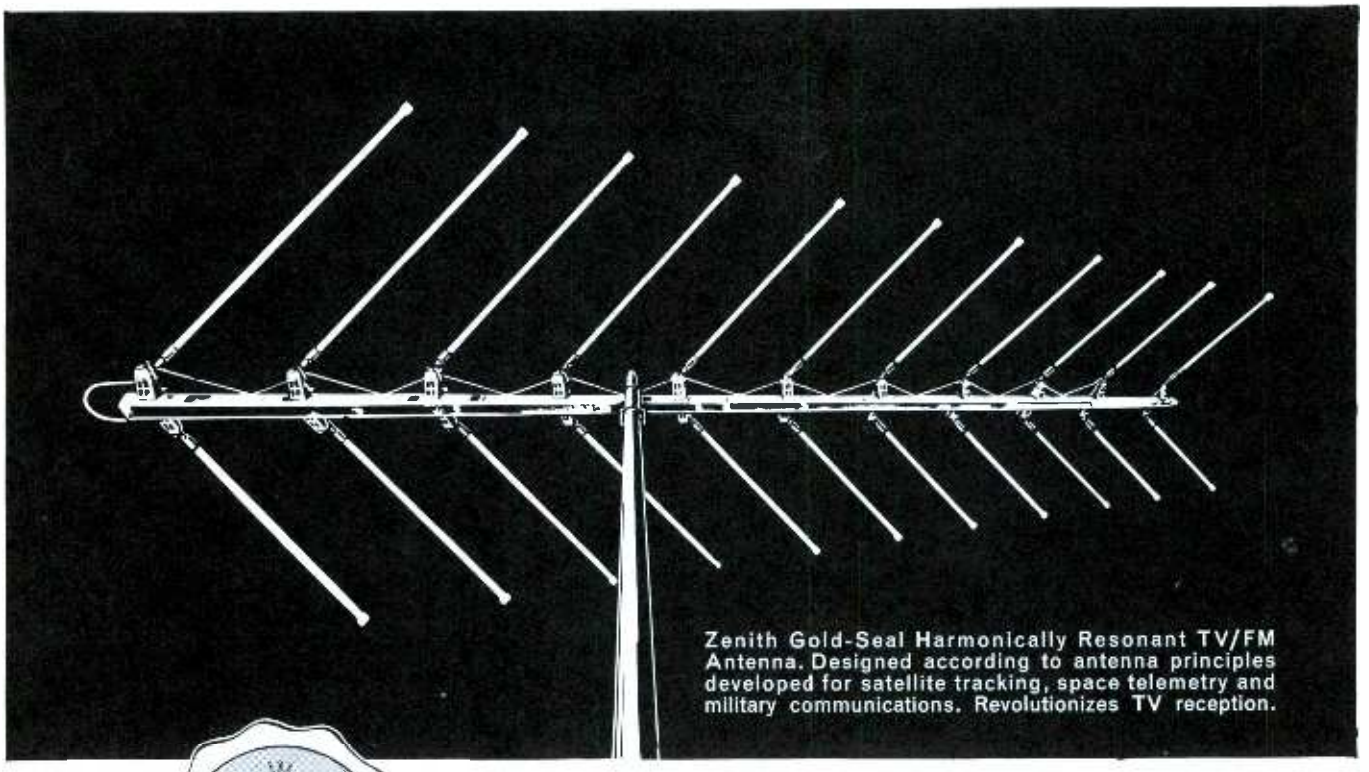


Fig. 6. The popular "unipole" antenna shows continuity without using jumper.



Zenith Gold-Seal Harmonically Resonant TV/FM Antenna. Designed according to antenna principles developed for satellite tracking, space telemetry and military communications. Revolutionizes TV reception.

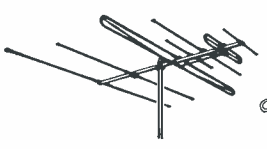
ZENITH Gold·Seal

QUALITY COMES TO INDOOR AND OUTDOOR

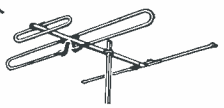
TV & FM ANTENNAS!

Now Zenith brings you a complete line of Stereo FM, Color TV, UHF and VHF quality antennas—easy to sell, easy to install, packed with profits! Zenith Gold-Seal Antennas cover every installation requirement, from super fringe to metropolitan areas. And you can offer your customers a wide selection of indoor and outdoor antennas, plus a complete line of exact replacements for Zenith instruments. Best for Color TV! Best for black-and-white TV! Best for FM and Stereo FM! Best for UHF! Zenith Gold-Seal Antennas are built to the highest Zenith quality standards to give you extra sales and profit opportunities!

ZENITH QUALITY ANTENNAS FOR B&W OR COLOR TV • FM AND STEREO FM • REPLACEMENTS

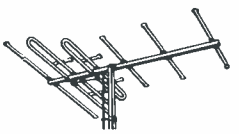


Zenith Gold-Seal Broadband Yagi VHF Antenna (Channels 2 to 13)

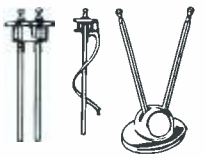


Zenith Gold-Seal VHF Folded Inline Antenna (Channels 2 to 13)

Zenith Gold-Seal UHF Stacked Bow-tie Antenna (Channels 14 to 83)



Zenith Twin Driven FM Stereo Yagi Antenna (For FM frequencies 88-108 MC)



Zenith indoor TV antennas and exact replacements for Zenith instruments

BUILT TO HIGHEST ZENITH QUALITY STANDARDS!

Contact your Zenith Distributor for further information or write: Zenith Sales Corp., Parts Sales Division, 5801 W. Dickens, Chicago 39, Illinois

Specifications subject to change without notice.

a resistive load for the transmission line, reflecting none of the power.

Many of these testers also show the standing-wave ratio (SWR), which indicates the efficiency of the system. The meter is usually calibrated to compare the transmitted power and the reflected power directly as an SWR reading. If the SWR is high, check the antenna system carefully for faults. A standing-wave ratio in excess of 3:1 is too much for top efficiency of the system; it indicates that adjustments may be needed in the antenna-system, or the antenna-system impedance may not be correct for the set.

A faulty coaxial transmission line must be replaced; repairs are seldom practical. The coaxial lines ordinarily used are usually very durable, but an improperly installed cable can be a constant problem. Also, an unsecured coaxial cable that can move about with high winds may, with the continued flexing of the line, develop a break in its inner conductor. If a long vertical run is made inside a tower with a heavy coaxial cable, the line should be secured first to one leg and then the other; the strain relief will prevent the inner conductor from slipping (due to its weight) inside the outer shield, and breaking loose at the antenna terminals.

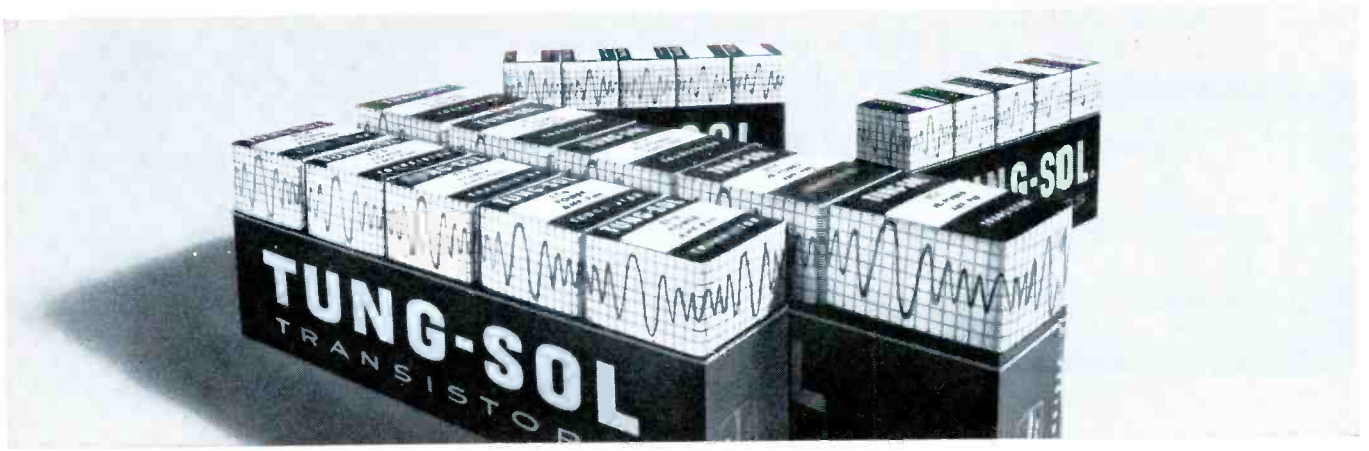
Auto-Radio Antennas

No discussion of antenna problems would be complete without some mention of auto-radio antennas, even though testing them presents few problems. The tests that apply to them also apply to communications antennas mounted on vehicles. Let's examine the tests we might use if we suspect an auto antenna of being faulty.

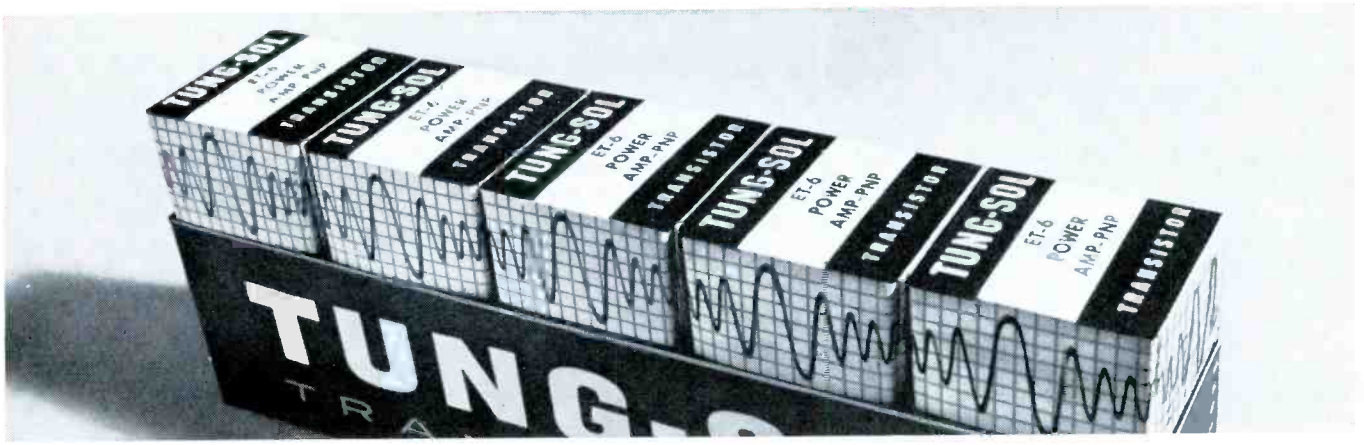
Make a visual check of the antenna, looking for loose, bent, broken, or missing parts. Check the mounting bracket, making sure it is tight. Turn the receiver on and move or tap the antenna while you listen for noise or "cutting out."

If these preliminary tests are inconclusive, three checks with your ohmmeter will settle the question. First, check continuity from the antenna rod to the tip of the antenna plug; the reading should be from 3 to 5 ohms. Second, measure from the tip of the plug to ground; you

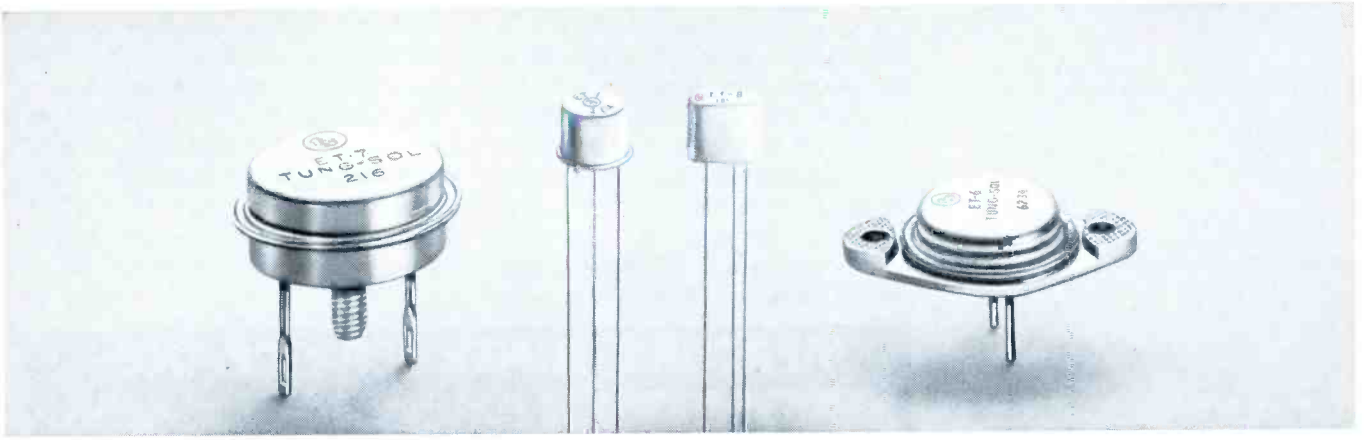
THREE REASONS WHY TUNG-SOL ET TRANSISTORS ARE YOUR BEST REPLACEMENT LINE



1. COMPLETE SERVICE NEEDS



2. EASY PRODUCT SELECTION



3. TUNG-SOL RELIABILITY

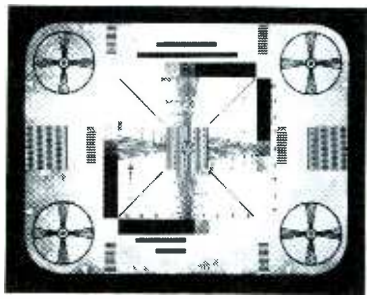
You can make almost all radio transistor replacements from these twelve Tung-Sol types. In addition to part number, packages are marked with type of service. All units are the equivalent of the original part and are products of American plants. The ET transistor line reflects the same quality standards that have made Tung-Sol the leading independent tube manufacturer. Tung-Sol Electric Inc., Newark 4, N. J.

TELL YOUR SUPPLIER YOU'D RATHER HAVE

CENTER LINE QUALITY **TUNG-SOL®**

TV TIPS FROM TRIAD

"SPECIAL"



"Haven't you fixed that kluge, yet?" the senior PTM said to Joe.

"No, Bill, it shrinks a little horizontally after it's on for an hour, and I see 'Callback' written all over it."

"What are you going to do next?" queried Bill, as he poured himself a cup of coffee.

"I've already done it," said Joe with a grin. "I knew you'd show up if I waited."

"All right, what do you know about the chassis for sure?" said Bill.

"Well," Joe recited, "New Charley Dog Six, flyback, and damper tube, high voltage ok, boost a little low after an hour, screen ok – –"

"How do you know the screen is ok?"

"The service folder says so. It says the screen voltage should be 165 and this one measures about 178, which is within ten percent."

"Let's use the Check Chart* on it," said Bill.

"Here we go. Set off. Screen resistance?"

"8.2K," replied Joe.

"Set on? Voltage across screen resistor?"

"192."

"Chart shows current is 23 ma. Measure screen to ground."

"Still 178," Joe said.

"Wattage dissipated in screen 4.3. Max safe level 3 watts. *Expected tube life probably less than one hundred hours!*"

"What's next?"

"Let's try it with a 10 watt 18 K. Voltage across resistor?"

"210."

"Current 12 ma. Voltage to chassis?"

"160," Joe said, surprise in his voice.

"Screen wattage 1.9, width better, and boost normal," said Bill, as he finished his cup of coffee. "Now, you could have done that yourself, couldn't you?"

*Triad Callback Stopper, that is.

MORAL: The **Triad Callback Stop-Per Check Chart** may be just as useful to you as it was to Bill and Joe. Get yours from your distributor, or write to us and we'll send you one. **Triad Distributor Division**, 305 North Briant Street, Huntington, Indiana.

A DIVISION OF LITTON INDUSTRIES

should find a completely open circuit, indicated on the highest ohmmeter scale. Third, a continuity check from the outer shell of the plug to ground should provide a zero reading on the lowest ohmmeter scale.

A problem that occasionally causes trouble is water in the antenna base. This can cause a high-resistance short for the signal voltages, preventing them from reaching the receiver. This fault appears only on rainy days or after the auto has been washed, but can sometimes remain for days afterward.

Conclusion

If antenna trouble is evident, the procedures described should help you spot the fact with the least amount of lost time. Check the obvious troubles first, and make every test possible before going to the trouble of removing the antenna from its mounting. If it does become necessary to remove the antenna, you will already know—from your tests—just what faults to look for.

Transistor Radio Supply

This multiple-voltage DC supply source for transistor radios is the Precision Model P-25 Transistor Radio Battery Eliminator. It can supply voltages as high as 25 volts DC, and current up to 100 ma. A panel knob controls the voltage at the output test leads, which are terminated in small alligator clips.

A third test lead (in the center) is multipurpose; a tap arrangement works in conjunction with it to supply either 1.5 volts DC (constant) or exactly one-half of whatever voltage is being applied through the main test leads. This facility is useful with the several transistor radios that use tapped power supplies.

A 2½" panel meter can be set to indicate either the voltage being applied to the set being tested or the current being drawn by it; a slide switch on the panel chooses which. The meter has separate scales for 25 volts DC and 100 ma.

A well-filtered DC supply such as the P-25 can serve extra duty as a bias supply for use during television alignment procedures. The output of this unit is filtered by a 300-mfd electrolytic capacitor, to minimize hum and aid decoupling.

The operating manual tells how the P-25 can be used for charging the nickel-cadmium batteries being used in some transistor equipment. A chart tabulates a number of popular types, suggesting charging rates for a quick charge or a slow charge. The manual also gives instructions for using the instrument as a tuning indicator during transistor - radio alignment: Simply tune IF and RF adjustments for maximum indication on the current-meter function. ▲

NOW *EVERYONE* CAN QUICKLY
Set up and Service Color TV

1 PATTERN DISPLAY STANDARD
Shows correct pattern in window viewer for visual guide

2 PATTERN SELECTOR
Produces each pattern individually for quick, easy convergence

3 AUTOMATIC DECONVERGENCE
Simplifies static and dynamic convergence. No digging into set

4 COLOR SELECTOR
Produces each color one at a time for accurate color set-up

5 COLOR GUN KILLER
Automatically enables the technician to actuate any combination of the 3 guns

6 DEMODULATOR ALIGNMENT
Makes alignment extremely simple, without going into the color set

New! B&K Model 850 COLOR GENERATOR

Most Complete, Most Versatile, Portable Instrument for Use in the Home and in the Shop Makes Color TV Set-up and Service Easier, Faster than ever!

Now every service technician can be ready to set-up and service color TV with amazing new ease and speed! New advanced design simplifies the entire operation, saves time and work in every installation. Eliminates difficult steps in digging into the color TV set. Gives you new confidence in handling color.

Produces Patterns, Burst, and Colors Individually—Provides dot pattern, crosshatch, vertical lines, horizontal lines, burst signal, and individual colors—one at a time—on the TV color set—for fastest, easiest check. Unique window-viewer on front of the instrument panel shows you each pattern as it should be—gives you an exclusive display standard to use as a sure guide for quick, visual comparison.

Provides Accurate, Individual Color Display—Produces Green, Cyan, Blue, B—Y, Q, Magenta, R—Y, Red, I, Yellow, and Burst—one at a time. All colors are crystal-controlled and are produced by a precision delay-line for maximum accuracy. Each color is individually switch-selected—no chance of error.

Provides Accurate NTSC-Type Signal—Color phase angles are maintained in accordance with NTSC specifications.

Makes Convergence and Linearity Adjustments Easy—Highly stable crystal-controlled system with vertical and horizontal sync pulses, assures the ultimate in line and dot stability.

Simplifies Demodulator Alignment—The type of color display produced by this instrument provides the ultimate in simplicity for precise demodulator alignment.

Provides Automatic Deconvergence—Eliminates the necessity for continual static convergence adjustments. The instrument automatically deconverges a white into a color dot trio without digging into the color set to misadjust the convergence magnets. It also deconverges a white horizontal or vertical line into red, green and blue parallel lines. This greatly simplifies dynamic convergence adjustments.

Provides Exclusive Color Gun Killer—Front-panel switch control makes it easy to disable any combination of the three color guns. Eliminates continuous adjustment of the background or screen controls, or connection of a shorting clip inside the receiver. The switch also selects the individual grids of the color tube and connects to a front-panel jack to simplify demodulator alignment.

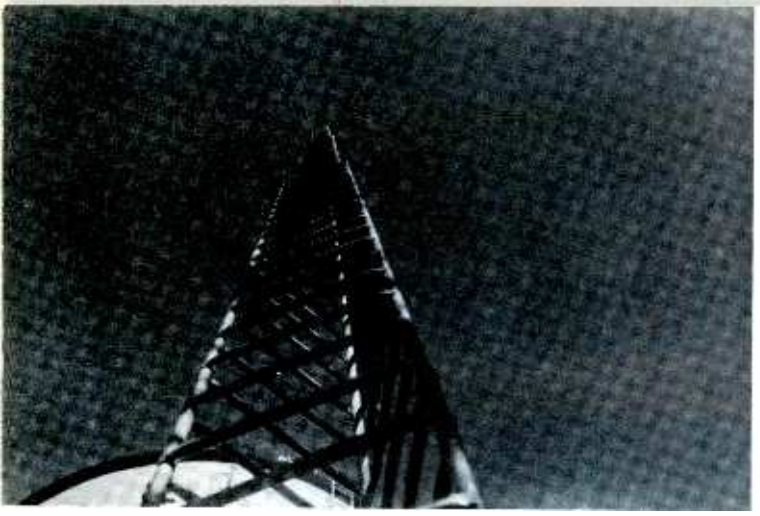
Provides Switch-Selected R.F. Signals—Factory-tuned, for channels 3, 4, and 5—for open channel use in your area.

Model 850 also includes other features that make it invaluable for home and shop use. Net, **$199.95**

See Your B&K Distributor or Write for Catalog AP20-R

B&K

B & K MANUFACTURING CO.
Division of DYNASCAN CORPORATION
1801 W. BELLE PLAINE AVE. • CHICAGO 13, ILL.
Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.
Export: Empire Exporters, 253 Broadway, New York 7, U.S.A.



SIZING up Antennas

Design principles behind today's TV antennas . . . by Forest H. Belt

The choice of a television antenna is very often left up to the installer, and he bases this decision on his knowledge of signal conditions, the type of set, and the gain and directional characteristics of various antenna types.

His choice is not necessarily difficult, but neither is it a matter to be taken lightly. Let's consider some design factors that make different types of antennas particularly suitable for one application or another.

Yagi Antennas

Yagi antennas are essentially high-gain, narrow-band antennas designed for very directional pickup of one particular channel. The yagi is an older design, although it is still quite popular in areas where ghosting is a considerable factor, or where stations are distant. Many modern yagi designs have sufficient bandwidth to satisfy even the critical requirements of color transmissions.

The gain of the yagi antenna depends on the number of elements used. The single-channel yagi generally uses only one driven element, or dipole; the other elements are parasitic types carefully arranged to reinforce the gain and directional characteristics of the antenna. There is seldom more than one *reflector* behind the driven element, but there may be as many as 14 *directors* in front of it. The more directors, the higher the gain of the antenna, and the more concentrated its "beam" effect in the forward direction (see Fig. 1). This concentration of the forward lobe causes increased pickup from the favored direction, and thus more gain. Some yagi antennas for extreme fringe reception have gain figures as high as 20 to 21 db.

There are a few yagi antennas of modern design that have much greater bandwidth characteristics than older types; indeed, some of these cover an entire band of television frequencies—either the high or low VHF band. The design of the driven element is the major difference; one of these is shown in Fig. 2. The increased bandwidth is usually obtained at the expense of gain, and the resulting antenna system may not always show sufficient gain for extreme fringe areas. However, all-channel yagi antennas are entirely satisfactory for ordinary weak-signal conditions and have proved quite popular for fringe and near-fringe applications.

Conical Antennas

Experience has shown that the diameter of the driven element of an antenna has a marked effect on the bandwidth. By carrying this concept a step further, designers came up with a variation of the simple dipole wherein each element, instead of being cylindrical or tubular, was shaped like a cone—which could theoretically extend to an infinitely large diameter. The frequency response of such an antenna or dipole is very wide, with few frequency peaks. By trimming the length of the infinite cone as shown in Fig. 3, a center frequency was established for the conical dipoles.

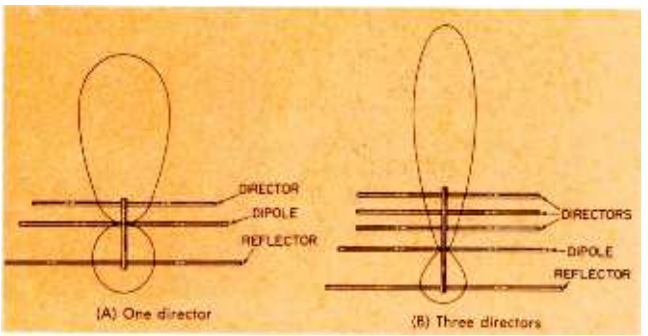


Fig. 1. Effect of adding directors to the simple yagi.

It was soon discovered that the entire surface of the cone wasn't needed, and the next step was the "cage" shown in Fig. 3. The problem of supporting this antenna was solved by using aluminum elements, which would be self-supporting. Directional characteristics were added by using only one half of each conical array and placing a parasitic reflector behind the unit.

In some fringe areas, where gain is an important factor, it has been found useful to stack conical antennas in arrays of as many as four. The bandwidth is sufficient to cover both the high and low bands because the center pair of elements are made resonant in the center of the high band, while the other elements

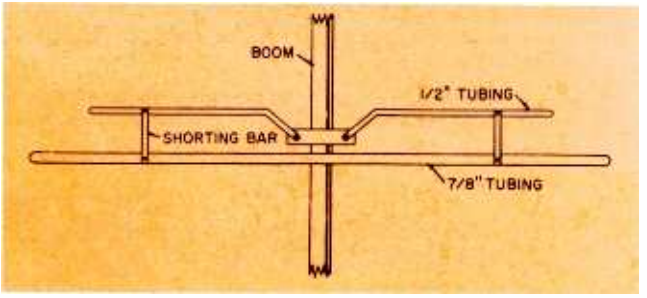


Fig. 2. Special dipole provides greater bandwidth.

NEW JERROLD TACO

COLOR GUARD

TV ANTENNA

Big performance, little price

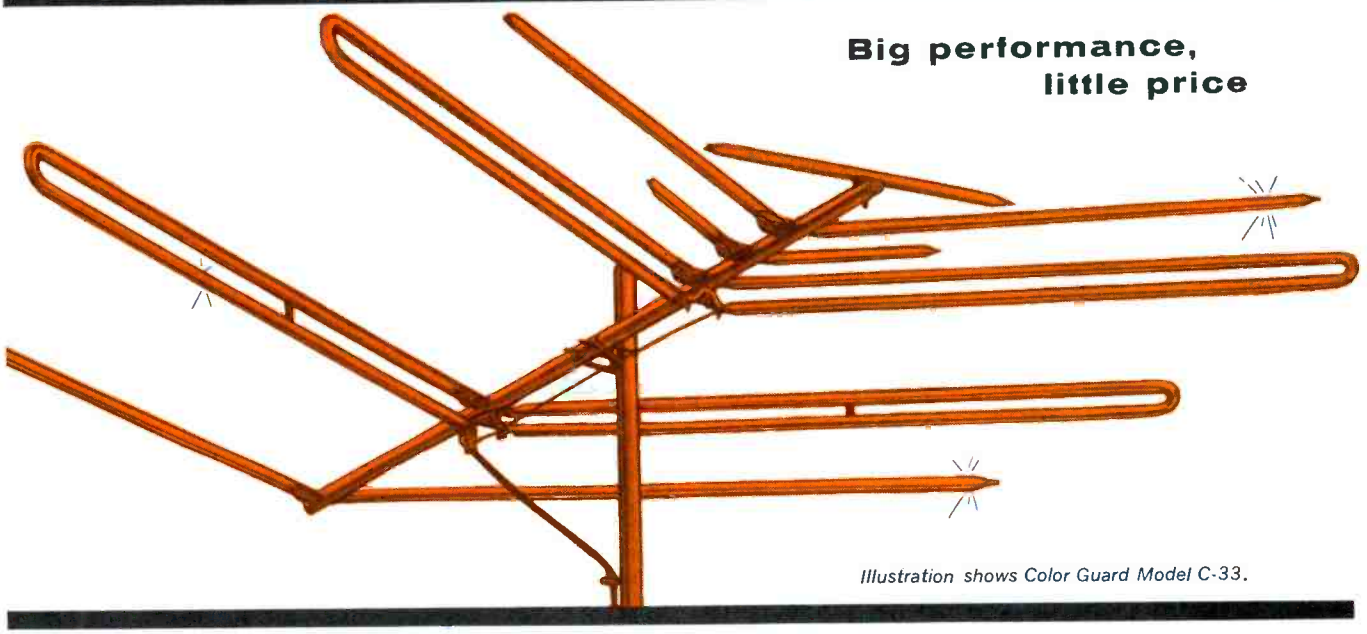


Illustration shows Color Guard Model C-33.

Engineered for metropolitan and suburban areas, delivers sparkling color—superb black-and-white

The day of the old conical and V-cone antennas is definitely over. Today you need something better to pull in satisfactory pictures on modern big-screen sets.

The new **Color Guard** is just that — something better! It's patterned after the large, rugged fringe-area antennas; but it's compact, a top performer, and budget-priced for high volume throughout metropolitan and suburban reception areas.

Listing from $7.95 (Model C-31) to $17.95 (Model C-33), **Color Guard** antennas give you the flat response and gain to meet your customers' needs at modest prices. Get on the color bandwagon with the JERROLD-TACO **Color Guard.** See your Jerrold distributor today, or write:

JERROLD ELECTRONICS
Distributor Sales Division • Philadelphia 32, Pa.
A subsidiary of THE JERROLD CORPORATION

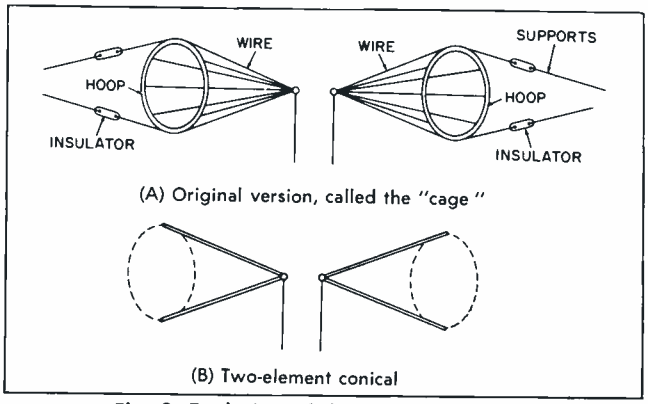


Fig. 3. Evolution of the conical antenna.

of the "fan" are made resonant in the low band.

V-Type Antennas

The V-type antenna is generally formed from ordinary or folded dipoles that have been "pushed forward" into the shape of the letter "V". Bringing the dipoles into the angled formation has a broadening effect on the bandwidth characteristics of the dipole, and narrows the forward response, but does little or nothing for the gain. To offset this, several of the V-shaped dipoles can be used in a single antenna, and parasitic elements can be added to enhance the gain figure.

The "V" configuration is used in a number of antennas, mostly for use in primary signal areas. It is well suited for UHF, for two reasons: The first has to do with the small size of the elements, which lends itself well to this form of construction. One UHF type is the "trombone," which couples several V-type elements with a trombone-shaped phasing bar to add extra gain. The second reason for the popularity of the V-type antenna for UHF is its broad bandwidth. A single "V" element can cover the entire UHF band, with good gain.

In some designs, the elements are made resonant at three half-wavelengths instead of one, further adding to the gain of the array. V-type antennas can be stacked for gain, but not so conveniently as certain other types, because of phasing problems.

The Loaded-Director Antenna

To fulfill a rising demand for an all-channel VHF

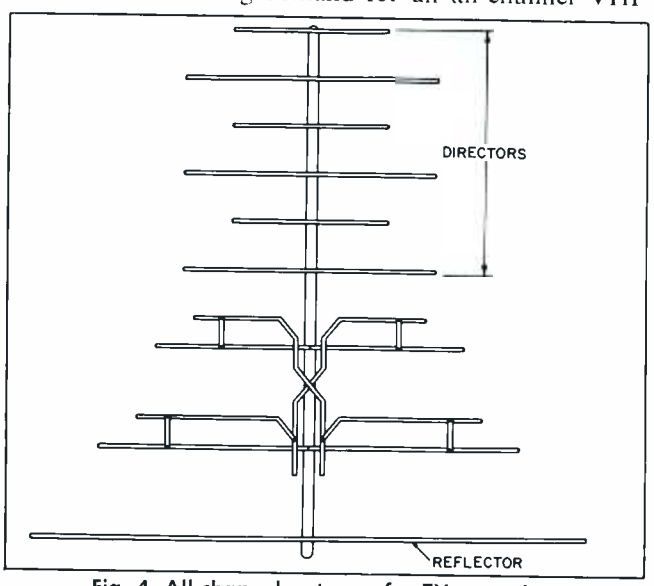


Fig. 4. All-channel antenna for TV reception.

New TRANSISTOR RADIO ANALYST

makes it Easy and Profitable to Service all Transistor Radios

B&K Model 960

TRANSISTOR RADIO ANALYST

with Exclusive DYNA-TRACE Single-Point Probe—and Built-in Metered Power Supply and VTVM

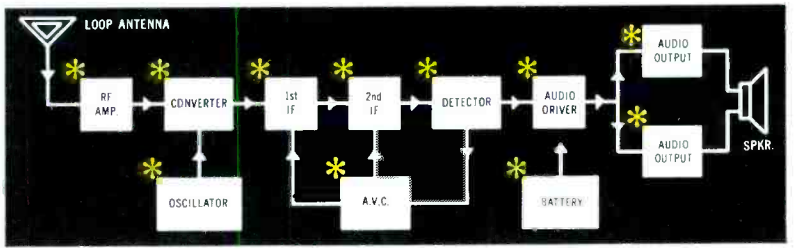
Complete Transistor Radio Service Shop in One Instrument

Signal-Generator, Power Supply, Milliammeter, VTVM, Battery Tester, Ohmmeter, and Both In-Circuit and Out-of-Circuit Transistor Tester—All in One

Also Speeds Servicing of Tube-Type Radios

Check all circuits - Pinpoint any trouble ... in minutes

Now you *can profit* from transistor radio servicing! This amazing new B&K "960" ANALYST gives you *everything* in *one* complete easy-to-use instrument. Makes transistor radio servicing *quick and easy*. Nothing else is needed except the transistor radios themselves waiting to be serviced. Brings you new customers for service, parts, and batteries. Makes this new business *yours*.



EASILY TROUBLE-SHOOT ANY STAGE BY UNIQUE POINT-TO-POINT SIGNAL INJECTION

The ANALYST gives you a complete signal-generating source for point-to-point signal injection. Easily enables you to trouble-shoot any transistor radio—check all circuits stage-by-stage—isolate and pinpoint the exact trouble in minutes.

Supplies modulated signals, with adjustable control, to check r.f., i.f., converter, and detector. Supplies audio signal to check audio driver and audio output. Provides unmodulated signal to test local oscillator. Provides separate audio low-impedance output for signal injection into loudspeaker voice coils to check speaker performance.

BUILT-IN METERED POWER SUPPLY FOR EASY SERVICING

Makes it easy to operate radio under test, while you inject your own signals. Provides from 1 to 12 volts in 1½ volt steps. Supplies all bias taps that may be required.

SIMPLIFIES IN-CIRCUIT TRANSISTOR TEST WITH NEW DYNA-TRACE SINGLE-POINT PROBE

Unique single-point probe needs only the one contact to transistor under test. No longer are three wires required to connect to emitter, base, and collector. Gives fast, positive meter indication. Saves time. Makes trouble-shooting simple and easy.

BUILT-IN VTVM

Includes high-input-impedance vacuum-tube voltmeter, which is so necessary for transistor radio servicing.

TESTS ALL TRANSISTORS OUT-OF-CIRCUIT

Meter has "Good-Bad" scale for *both* leakage and beta. Also has direct-reading Beta scale, calibrated 0-150. Assures quick, accurate test. Also automatically determines whether transistor is NPN or PNP. Meter is protected against accidental overload and burn-out.

Model 960. Net, **$99.95**

Solve Every Service Problem and Profit with a Modern B&K Service Shop. See Your B&K Distributor or Write for Catalog AP20-R

B&K MANUFACTURING CO.

Division of DYNASCAN CORPORATION

1801 W. BELLE PLAINE AVE. • CHICAGO 13, ILL.

Canada: Atlas Radio Corp., 50 Wingold, Toronto 19, Ont.
Export: Empire Exporters, 253 Broadway, New York 7, U.S.A.

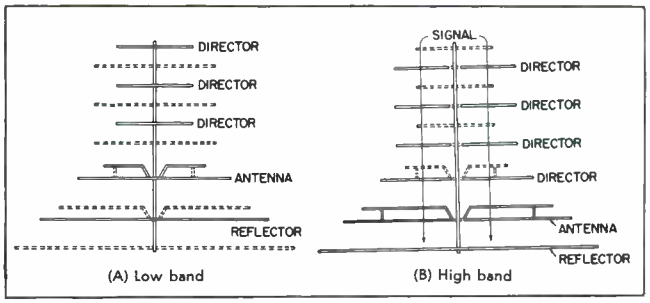


Fig. 5. Mode of operation for "loaded-director" antenna.

antenna with high gain, designers have built various units that incorporate a pair of wide-band dipoles (Fig. 1) and a group of parasitic elements such as those normally associated with yagi antennas. In fact, antennas of this type—such as the one in Fig. 4—have come to be known as "all-channel yagis." In some such designs, the longer driven element is resonant at the center of the low TV band, while the shorter element is cut for the high band. In others, a slightly different mode of operation is used to increase the gain of the array; this latter system is called the *loaded-director* configuration.

The operation of this higher-gain system is shown in Fig. 5. The shorter elements are cut to the proper length to resonate in the *lower* TV band, as shown in Fig. 5A. The longer elements in this antenna are made to operate "side by side" in the higher TV band, thus acting very much like two antennas stacked horizontally, as shown in Fig. 5B. This form of operation is accomplished by using a loading coil at the center of each director, making the element electrically longer than its physical length would dictate, and giving rise to the name "loaded director."

The yagi configuration imparts to these antennas many desirable characteristics such as high gain and excellent directivity, while keeping the frequency response over the entire VHF band flat enough even for color signals. This antenna type can be used for fringe-area reception, and extremely high-gain models have been designed for use at the extreme fringe. Several variations are possible in both the driven elements and the parasitics, all intended to impart special operating characteristics—usually greater gain or directivity.

Transposed-Harness Antennas

Another type of fringe-area antenna makes use of special phasing arrangements to attain the gain and directivity necessary for long-distance reception. Fig. 6 shows how a large number of dipoles can be phased

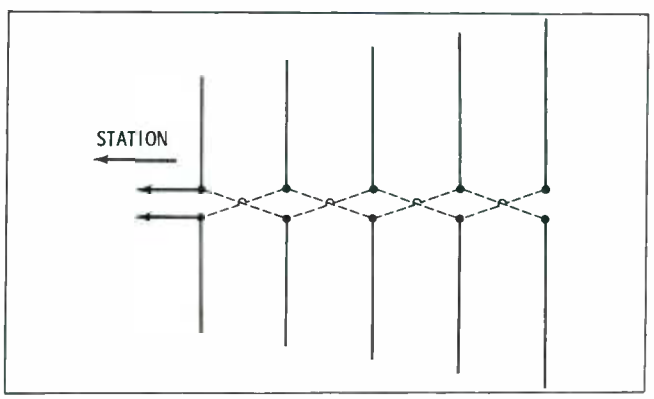


Fig. 6. Transposed harness increases front-to-back ratio.

Changes in the '63 Volkswagen.

We've always had just one engine. But this year, we're a two-engine truck. (Which is a pretty revolutionary change for a VW.)

You can choose our old faithful, air-cooled, 24 miles-to-the-gallon job.

Or, for a little extra dough, our more powerful engine.

(It's still air-cooled, still goes 24 miles on a gallon of regular.)

If you carry a heavy load or do a lot of driving over hilly terrain, then you'll probably want the extra power.

Another change: the new engine comes with bigger brakes.

What else is new?

The driver has his own adjustable seat. (The passenger seat comes out to make more room for the cargo.)

The cab has more legroom.

There's a new fresh air heater.

And a new clutch.

The nice thing is, that after 13 years and 216 changes like these, you don't have to wonder what kind of shape our truck is in.

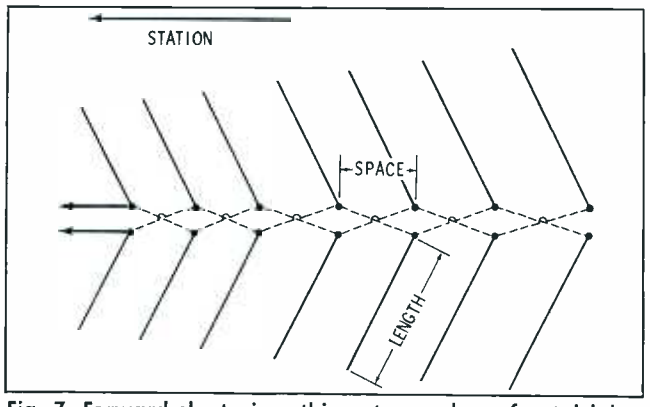


Fig. 7. Forward slant gives this antenna sharp frontal lobe.

together to provide coverage of the entire TV band. Each dipole is a driven element for a particular frequency, and the transposed phasing wires place each driven element 180° out of plase with those adjacent. This "spiral" phasing results in reinforcement of signals arriving from the front of the array and cancellation of pickup from the rear.

Adding Parasitic Elements

Certain transposed-harness antennas incorporate an additional parasitic element in front of each dipole to act as a director. In most units, this element acts predominantly on the high-band frequencies; it helps the driven elements—which are half-wavelength dipoles for low-band frequencies—to function efficiently as three side-by-side half-wavelength dipoles on the high band. The result is a high-gain antenna, with broad response characteristics in both VHF bands, and high directivity with very little side or rear pickup—all prime requisites for fringe antennas.

Log-Periodic Spacing

Another recently introduced design feature is the concept of spacing the active dipoles in accordance with a logarithmic formula based on the theory of an infinite spiral. This critical spacing broadens the bandwidth of the array, by "blending" the resonant characteristics of each dipole into a uniform frequency response that covers the entire VHF television range.

Transposed wiring of the phasing harness reduces the side and rear pickup of the antenna considerably, and the forward lobe is narrowed and extended by angling the dipoles forward in the "V" formation shown in Fig. 7.

The gain of these antennas across the entire VHF-TV spectrum is unusually even, regardless of the number of elements actually used; the *amount* of gain, however, depends on how many active elements are incorporated in the array.

Conclusion

The serviceman and the antenna installer have no need to be antenna-design engineers; but, to be able to make a wise choice among the many antennas presently available, they should understand the workings of modern antenna designs, and should pay careful attention to every characteristic of the signal to be received. The informed service technician should have little trouble in choosing an antenna which fits the needs of his particular customer. ▲

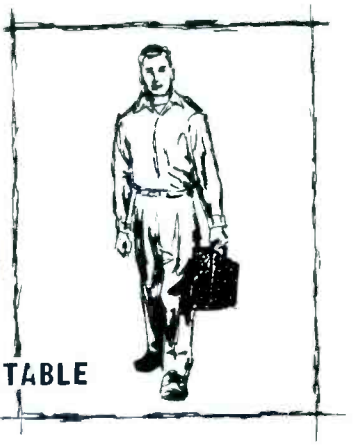
NEW

GC ELECTRONICS

FEWER CONTROLS

VERSATILE

CONTROLLED REJUVENATION



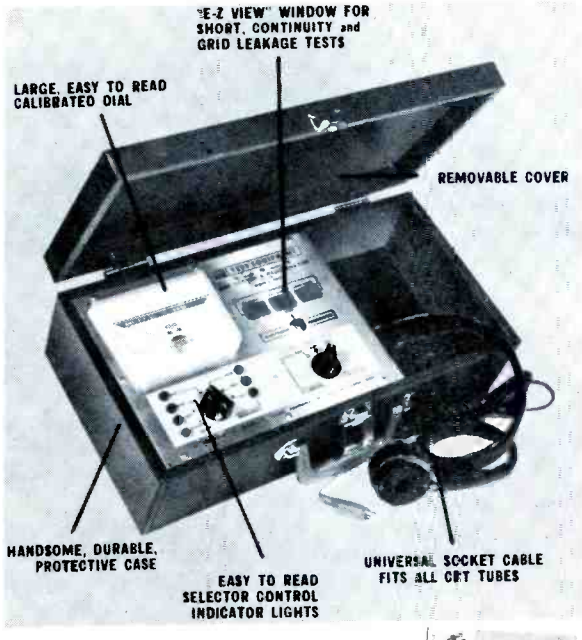
PORTABLE

Designed by VYTANT ALEKS

Easy to Use!

GC-CRT TESTER and REJUVENATOR

FOR COLOR and Black and White!



Just off the GC Production lines . . . designed for the serviceman to answer his specific need, simply and practically. The GC CRT Tester and Rejuvenator brings you, in addition to conventional testing, a unique DYNAMIC EMISSION test together with an effective CONTROLLED SHOT REACTIVATION circuit.

CATHODE EMISSION TEST is a GC first. A high voltage pulse applied to the 2nd anode of the CRT provides more accurate tube condition. Provisions for bias cut-off test.

LIFE TEST to predict the remaining useful life of the picture tube.

CONTROLLED DC shot REACTIVATION cleans cathode surface for normal emission provided by 3 levels of reactivation intensity. Indicator light safeguards against overdose and tube damage.

ADAPTABLE TO ALL 110° PICTURE TUBES with special filament voltage, as well as the newest 19" and 23" Tubes (23EP4).

CHECKS SHORTS, FILAMENT CONTINUITY, GRID LEAKAGE with "E-Z View" neon window indicator. Easy . . . positive.

TESTS, REACTIVATES ALL COLOR CRT TUBES, each gun separately including the newest "small button" Diheptal RCA unit.

100% SELF CONTAINED in handsome, protective carrying case.

ACCESSORY COMPARTMENT contains power cord . . . a single combination socket cable to accommodate ANY CRT.

PLUS easy to read wide angle, calibrated meter and selector control indicator lights clearly indicate test functioning.

No. 36-616 CRT TESTER AND REJUVENATOR **Net 69.95**

FREE Send for new catalog of complete line of GC Test Equipment. Write Dept. 44, GC Electronics, 400 S. Wyman, Rockford, Ill.

Name_____

Address_____

City_____ State_____

GC ELECTRONICS CO.

DIVISION OF TEXTRON ELECTRONICS, INC., 400 So. WYMAN STREET, ROCKFORD, ILLINOIS, USA

NOTES ON TEST EQUIPMENT

by Forest H. Belt

Complete Stereo

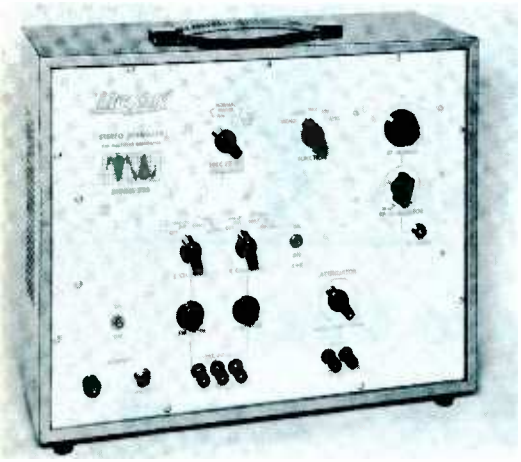


Fig. 1. New unit contains all signals needed for aligning stereo adapters.

The need for a complete stereo-FM signal generator has been filled by the Hickok Model 725 *Stereo Standard* FM Multiplex Generator—pictured in Fig. 1.

Specifications are:

1. *Power Required—105-125 volts AC; 50-70 cps; 75 watts.*
2. *RF Output—Frequency range from 92 mc to 104 mc, variable at front panel; attenuator permits adjustment of output level from 50 to 2000 uv.*
3. *Composite Stereo Output—From 0 to 4 volts peak to peak, variable; output impedance, approximately 250 ohms; contains either full stereo signal, monophonic signal (L+R only), 19-kc pilot carrier, 38-kc signal, or 67-kc signal, all depending on setting of* FUNCTION *switch; any combination of these can be frequency modulated on the RF carrier; less than 2% distortion; channel separation 35 db.*
4. *Internal Signals—400-cps and 1200-cps audio sine wave, separately or simultaneously (in right and left channels, respectively); 19-kc pilot signal, ±2 cps accuracy, self-checking for proper phase; 38-kc signal controlled by 19-kc oscillator; 67-kc SCA signal.*
5. *External Signals — None needed for stereo servicing, but any stereophonic audio signal source of 1-volt level can be connected to input terminals and used for stereo program source.*
6. *Controls and Terminals—Four rotary switches:* FUNCTION, *19-*KC PILOT, L CHANNEL, *and* R CHANNEL; *four potentiometers:* L ATTENUATOR, R ATTENUATOR, COMPOSITE ATTENUATOR, *and* RF ATTENUATOR; *an* RF TUNING *control; two on-off toggle switches:* L+R *and* POWER; *coaxial* RF OUTPUT *jack; banana* COMPOSITE OUTPUT *jacks; banana* EXT INPUT *jacks; fuseholder; red pilot lamp.*
7. *Size, Weight, Price—14½" x 18" x 7"; 23 lbs; $495.00.*

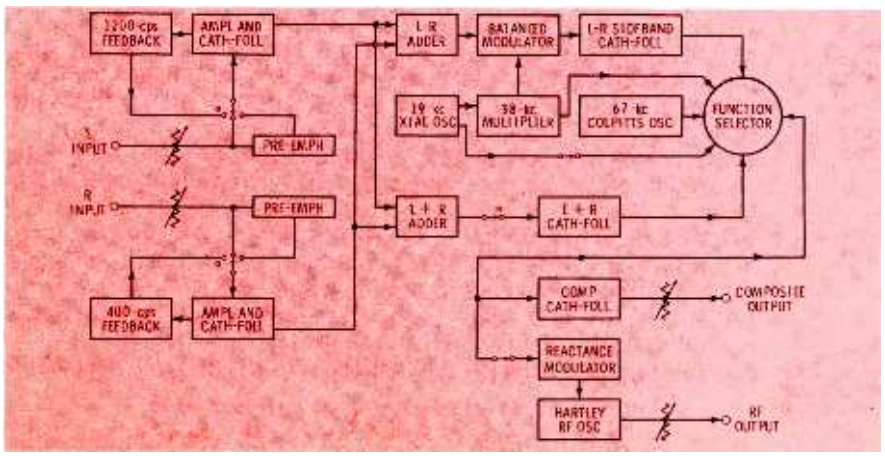


Fig. 2. Function-selector switch is key to operation of stereo generator.

The Model 725 is a self-contained stereo-FM alignment standard. It incorporates its own left-channel (1200 cps) and right-channel (400 cps) signals, as well as making provisions for modulating both channels with any external stereo program source the service technician may desire. Thus, a stereo phonograph or tape recorder can be used with the Model 725 to create an exact replica of a stereo music program such as might come from a station. The external stereo program source can be adjusted to any modulation level; each channel has its own attenuator control. When an external signal source is used, the 75-microsecond audio pre-emphasis normally included in a true station signal broadcast can be inserted in either or both channels at will.

The choice of 400 cps and 1200 cps as the frequencies for the audio oscillators in the *Stereo Standard* permits a stable display of both channels on an ordinary oscilloscope. Their relationship to each other is such that the scope can be adjusted to display three cycles of the 400-cps waveform and nine cycles of the 1200-cps signal. This ease of scope viewing considerably enhances certain overall tests of stereo adapters.

The pilot-carrier circuit includes a testing arrangement to permit a check of the phase. The 19-kc output can be modulated either at the normal level or at one-half the normal level to check the sensitivity of the stereo synchronizing circuits in the receiver. The pilot signal is also available alone, for direct alignment tests.

A FUNCTION switch on the front panel of the Model 725 permits instant choice of a monophonic signal, a stereo signal, 19-kc output, 38-kc output, or 67-kc output. Fig. 2 shows generally how the instrument operates.

Each channel has its own amplifier that is DC coupled to a cathode follower. When the channel switch is set for external operation, the input jacks are connected via their respective attenuators to the amplifier for each channel. To form an oscillator circuit, the channel switch connects a four-section phase-shift network from the output of the cathode follower back to the grid of the amplifier. The time constant of the feedback network in the left channel causes oscillation at 1200 cps, while the right-channel feedback network has a time constant that produces 400-cps oscillations. Both channel amplifiers thus form phase-shift oscillators that are extremely stable at audio frequencies.

The outputs of both channel amplifiers are connected to an L + R adder, from which the combined signal is fed through a disabling switch and a cathode follower to the function selector; there, it is available for mixing with other signals that are generated within the unit.

A crystal-controlled version of a cross-coupled multivibrator generates the 19-kc pilot carrier, which is fed to the function selector, where it could be added to

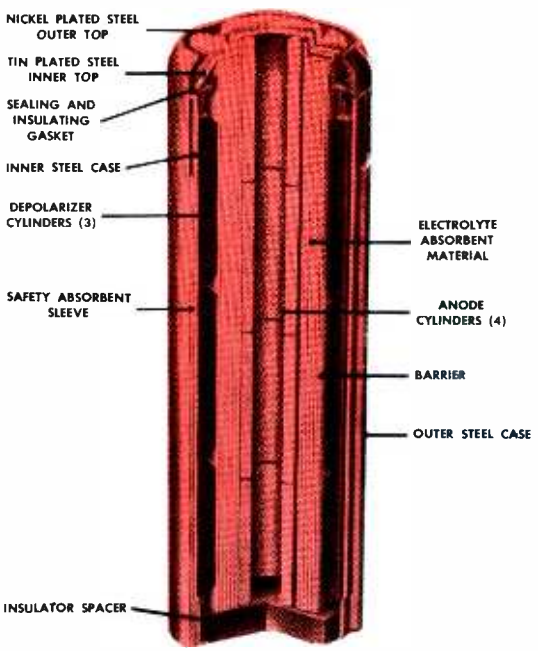
P. R. MALLORY & CO. Inc.

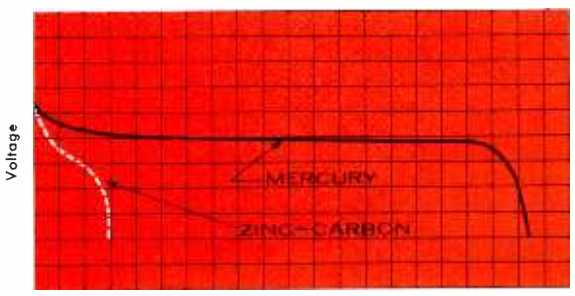
MALLORY

Tips for Technicians

Mallory Distributor Products Company
P. O. Box 1558, Indianapolis 6, Indiana
a division of P. R. Mallory & Co. Inc.

The new generation of batteries ...how to use them





You may not realize it, but dry batteries used in modern electronic circuits are as different from old style dry cells as 1962 autos are from the Model T.

Of primary interest to you as a technician is the mercury battery. Instead of the ordinary combination of zinc, carbon, and electrolytic compounds, Mercury batteries use mercuric oxide and a zinc amalgam in combination with an alkaline electrolyte. This chemical system produces a dry battery uniquely matched to solid-state electronic circuits. For example, Mercury batteries have about four times the milliampere-hour capacity of ordinary batteries of the same physical size.

Not only do mercury batteries contain more actual power, they hold this power for long periods of time. Ordinary batteries start to lose power from the instant they are assembled *whether used or not.* On the other hand the storage life of a mercury battery is amazing. We've had some on storage test for more than nine years . . . AND THEY'RE STILL ALIVE.

Perhaps the best thing about mercury batteries is their steady output voltage. It stays nearly constant throughout the entire life of the battery (see chart). Ordinary battery voltage drops steadily. Constant voltage is important in solid state circuits . . . it means constant gain and linearity.

Terminal voltage on a mercury cell is 1.35 volts $\pm \frac{1}{2}\%$! This is so accurate there's a special multi-voltage reference battery (Pt. No. 303113) that's widely used as a secondary voltage standard. It's excellent for setting scopes, meters, etc., and all sorts of lab work. We'll be happy to send complete information. Just ask.

Mercury batteries are a Mallory development. We like to think we're experts on them. But we know there are jobs a mercury battery shouldn't do. Jobs where very high surge drains or continuous heavy drains are required . . . flash cameras, flashlights, movie cameras, etc. So we developed the Mallory Manganese Battery. It's the king of heavy drain batteries . . . with excellent storage life and moderate price.

There are literally dozens of other battery systems available from Mallory. We simply don't have space to go into them here. But if you're interested in rechargeable batteries, or ultra low temperature types, or extreme low or high voltage types, or other exotic types, write to Dept. 762. We'll send the information.

Meanwhile, when you need a battery for a grid bias circuit, or a portable instrument, or a transistor radio, use a Mallory Mercury Battery. For flashlights and similiar applications use Mallory Manganese Batteries. You can get them from your Mallory Distributor. He's the man to see for Mallory capacitors, controls, switches, semiconductors, and vibrators . . . and for all your electronic requirements.

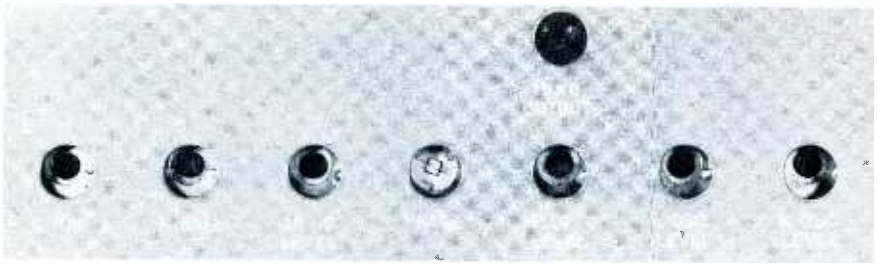


Fig. 3. Rear-panel adjustment controls.

the composite output signal when desired.

The composite signal from the function selector can also be connected, via another switch, to a reactance modulator for frequency modulating an RF signal. The RF signal is generated by a Hartley oscillator circuit connected by an attenuator to the RF output jack. This RF oscillator is tunable to any center frequency between 92 mc and 104 mc.

Maintenance of the generator should prove relatively simple. Certain of the circuit adjustments are accessible from the rear of the cabinet, as shown in Fig. 3. All of these can be correctly calibrated with the help of a scope, by carefully following the instructions included in the instruction manual. The only rear-panel control that is best left alone is the 38-KC-LEVEL control. This potentiometer should be adjusted only if special equipment is available.

In checking the calibration of the unit we examined, we discovered that the composite display could best be stabilized on the screen of the scope at certain very critical settings of the L and R balance and level controls. At other settings, there was a tendency for the 400-cps signal to "creep through" when the 1200-cps signal was stabilized on the scope screen. The best stability was finally obtained with the 400-cps (right-channel) signal level set between 5% and 10% lower than the 1200-cps signal level. After retouching the balance adjustments of the two channels, we found both signals to be very stable on our scope.

The instruction manual that accompanies the unit outlines several possible test and alignment procedures. Tests of multiplex receivers can be made using —as an indicator—a dual-channel oscilloscope, two single-channel oscilloscopes, two AC VTVM's, or even a single scope or VTVM. When using only one indicator unit, you must connect it first to one channel and then to the other, during tests.

In our lab, however, we found we could use an ordinary scope and an electronic switch attachment (such as described in *Notes on Test Equipment*—January, 1963). Since the 400-cps and 1200-cps signals can easily be synchronized on the scope at a single setting of its sweep frequency, stabilizing the displays was easy. (We have two different kinds of electronic switches in our lab: one that includes internal sync and another that doesn't. When using the latter, we took a synchronizing signal from the composite output jack of the Model 725 and fed it directly to the scope sync jack. This eliminated the tendency of the non-synchronizing electronic switch to lock the scope sweep on the switching rate rather than on the test signals.)

While multiplex adapters—and the multiplex circuits of stereo-FM receivers —vary considerably in their manner of handling the stereo signals, the Model 725 provides all the signals needed to test and adjust every type we've encountered. A very comprehensive section on test procedures appears in the instruction manual, and can be a great help to both the experienced stereo service technician and the serviceman who is less familiar with stereo-FM equipment.

The Model 725 can even be used to check FM-tuner response. An inadequate response will affect the composite signal that appears at the multiplex output jack of the tuner. While a compre-

hensive alignment of an FM tuner or receiver can't be properly performed with the Model 725, we found it easy to touch up the IF and RF adjustments of the tuners we checked.

If thorough alignment of an FM tuner or receiver fails to result in the correct composite stereo pattern, as viewed on the scope, it is reasonable to conclude that particular unit may not have sufficient bandwidth for proper multiplex reception. Thus, a quick means is provided for the service technician to determine whether it is feasible to add multiplex adapters to certain older FM tuners and receivers—a question which is becoming more and more common as stereo FM gains in popularity. The Model 725 can help answer that question with a minimum of wasted time and effort.

All-Purpose CB Tester

With Citizens-band units becoming so popular, service technicians all over the country are supplementing their radio and television service income by procuring the proper FCC license and undertaking repair of these transceivers. The unit shown in Fig. 4, the G-C Model 36-590 *Signal Optimizer,* is a multifunction instrument designed to aid these CB technicians in working on transmitters.

Specifications are:

1. *Power Required—Self-contained 9-volt battery.*
2. *Wattmeter—Up to 10 watts measured directly, in internal 52-ohm resistive load.*
3. *Standing-Wave Ratio Meter—Checks SWR of antenna systems for transmitters up to 750 watts; shows percentage of reflected power or indicates standing-wave ratio directly.*
4. *Receiver—Untuned input, diode detector, transistor audio amplifier; output matches 2000-ohm headphones; built-in telescoping antenna.*
5. *Field-Strength Meter—In conjunction with receiver; measures relative field strength near transmitters of any frequency through VHF; sensitivity adjustable.*
6. *Modulation Monitor—Combines features of receiver and field-strength meter.*
7. *Crystal Tester—Tests all third-overtone crystals of type used in CB units; Colpitts-type oscillatory circuit checks activity of crystal.*
8. *Panel Meter—8¾" face size; plastic covered.*
9. *Controls and Terminals—rotary* FUNCTION *switch;* METER SET *potentiometer; crystal socket; three UHF-series coaxial connectors:* POWER, TRANSMITTER, *and* ANTENNA; PHONES *jack; telescoping antenna detachable at top of case.*
10. *Size, Weight, Price—8½" x 1⅞" x 5"; 2 lbs; $47.50.*

The Model 36-590 is, first of all, an untuned, single-transistor receiver, whose output can be measured on the panel meter or listened to through a set of headphones plugged into a panel jack. A built-in antenna can be extended to nearly 36", making the receiver quite sensitive to nearby transmitters. A 1N34A crystal diode acts as detector for the AM signal, developing the audio voltage across the 5000-ohm potentiometer that serves as a volume control. The slider of the potentiometer is connected to the base of a common-emitter transistor amplifier. The 9-volt internal battery supplies collector voltage for the transistor, and the 1N34A develops the base-bias voltage.

The field-strength meter, commonly used for optimizing transmitter tuning, can be used in other ways, too. For example, you can check the radiation pattern of your antenna, so you can take advantage of any directional characteristics it might have. To check this pattern, simply place the *Signal Optimizer* at some arbitrary distance from the transmitter—say, 20 feet. With the transmitter radiating, adjust the panel control for a meter reading at approximately center scale; this is the calibration point. Move in a circle around the antenna, maintaining the same radius, and at each 30 degrees note the reading from the panel meter. The results can be plotted on a polar graph to show the actual radiation pattern of the antenna. We found, while using the Model 36-590 in this way, that it worked best if the antenna end of the unit pointed always toward the transmitting antenna. Placing the instrument on the ground (with both hands off) elim-

Fig. 4. Test unit has many purposes for servicing CB and communications units.

inated the effects of body capacitance on each reading.

Using the *Signal Optimizer* as a permanent signal modulation monitor can help at the base station. If you place the unit in a fixed position and note the field-strength reading, you can tell if the transmitter begins to weaken at any later date. With a set of phones plugged into the phones jack, you can monitor the quality of your transmitter signal at any time, and thus spot any modulation defects that might develop.

The Model 36-590 can measure the RF output of any transmitter of less than 10 watts. Citizens-band units rarely have an output greater than three watts, so they are well within range of the instrument. A 52-ohm, noninductive, 10-watt resistor is included in the unit as a dummy load, and is useful to prevent unwanted radiation from the transmitter while making tuning adjustments. A 1N34A crystal rectifies the RF power developed in the load resistor, and provides DC current for the meter. One scale of the panel meter is calibrated in watts, and the output of the transmitter can be read directly from it.

Tuning adjustments can be undertaken with the unit connected as a wattmeter, simply by striving for maximum power output. The output circuits of some CB transmitters require only very simple adjustment for maximum output. Other circuits are designed to match exactly whatever antenna is used with the system, and must be finally peaked with the actual antenna connected to the trans-

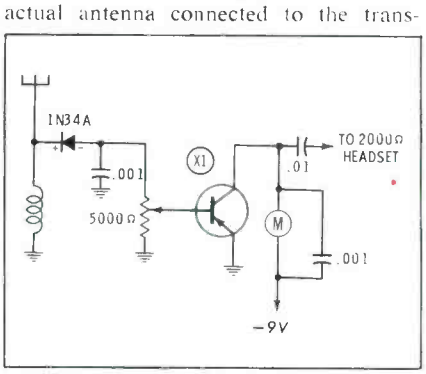


Fig. 5. Untuned receiver is part of the GC Model 36-590 field-strength meter.

BURGESS merchandisers offer COMPLETE SALES & SELF-SERVICE in MINIMUM space! . . .

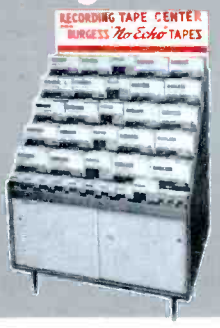
Complete line of Transistor Battery Merchandisers

NO. 630 FLOOR STAND DISPLAY
- Stocks and displays 218 Burgess Transistor Batteries and 72 popular Burgess No. 2 'D' cells.
- New pegboard-type sturdy floor stand.
- Creates a mass display effect with a modest stock.

NO. 623 COUNTER DISPLAY
- Displays Burgess No. 2U6 and No. 930 Transistor Batteries. Holds 36 cards, 72 batteries.
- For shelf, counter or pegboard use.
- Compact 6⅞" x 6⅞" x 13¾"

NO. 631 COMPARTMENTALIZED DISPLAY
- "D", "C", & "AA" cells are self-service, while 9-volt and mercury types are displayed under protective glass cover.
- Luxurious walnut counter or shelf display.
- Only 8½" wide, 12" deep, 8½" high.

Complete line of Magnetic Tape Merchandisers



NO. 619 COUNTER DISPLAY
- Holds 20 reel assortment of most popular 3", 5", and 7" tape.
- Dramatic, all new counter-top display.
- Requires less than 1 sq. ft. of space.

NO. 622 STORE FIXTURE DISPLAY
- Tape center displays 192 reels of 3", 4", 5", and 7" tape.
- Colorful, complete-line floor display.
- Width 36", Depth 26", Height 44" and 56" with sign. Extra storage space!

NO. 629 DISPENSING DISPLAY
- Displays 72 reel assortment of 3" and 3¼" Burgess Magnetic Recording Tape for transistorized recorders.
- Fits on shelf, on the counter, on pegboards.
- Compact—only 10" wide.

BURGESS IS THE COMPLETE LINE. . . PLUS BIG, IMPACT NATIONAL ADVERTISING TO HELP YOU SELL MORE

Zinc Carbon Mercury Nickel-Cadmium Alkaline

Life, Look, Saturday Evening Post, True, Mechanix Illustrated, Outdoor Life, powerful Sunday Magazines and top trade publications will build lasting impressions for Burgess!

BURGESS BATTERIES

BURGESS BATTERY COMPANY
DIVISION OF SERVEL, INC.
Freeport, Illinois

mitter.

There is also a third method of using the Model 36-590 as a wattmeter. The transmitter can be connected to the input jack, and the antenna to its respective jack, on the panel of the *Signal Optimizer*. The energy in the transmission line is developed across either of the two diodes in a device known as a directional coupler (Fig. 6). A switch connects the meter to rectifier diode M1, and the signal traveling from the transmitter to the antenna is measured (in relative terms) according to the amount of energy picked up in the directional coupler. If, for some reason, the antenna is not radiating all the power it receives, standing waves are set up on the transmission line; the directional coupler picks up this portion of the power within the line, rectifying it with diode M2. The switch, when it is set for reflected power, connects this diode to the meter, and the reflected power is measured. The unit will handle up to 750 watts of forward power when used as a reflected-power wattmeter.

In operation, the most expedient method of determining the standing-wave ratio (SWR) is as follows: First measure the forward power, and calibrate the meter-sensitivity control for a full-scale reading (at the "set" line). Then, with the meter switch changed to read reflected power, again note the position of the meter needle. In the Model 36-590, the panel meter is marked to indicate either the percentage of reflected power or the equivalent standing-wave ratio.

The more power that is reflected, the higher is the standing-wave ratio, and the less efficient is the antenna system. An ideal SWR is 1:1, but this is seldom achieved in practice. The *Signal Optimizer* indicates anything less than 1:3 as acceptable, but most maintenance technicians try for an SWR of 1:1.5 or less. With a well-designed antenna, properly connected and matched to the transmitter, an SWR of 1.5 or less is not uncommon. Some CB transceivers, however, cannot be adjusted to match the antenna precisely, resulting in higher standing-wave ratios.

There is still another function of the Model 36-590 that can be handy for servicing a CB system. The transmitter crystal from the system can be plugged into the panel of the *Optimizer* for testing. When plugged in, the crystal becomes part of a transistorized oscillator, which radiates the resulting signal via the telescoping antenna of the instrument. If this low-power transmitter signal can be received by one of the system receivers, it is a sure sign the crystal is okay.

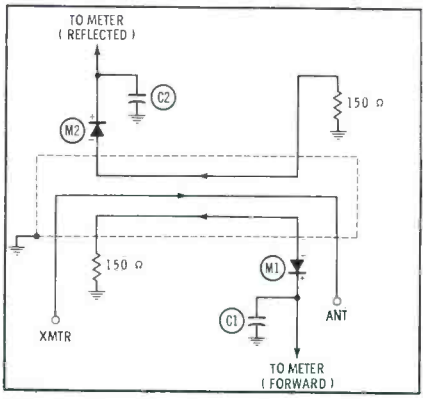


Fig. 6. Directional coupler for RF test.

The signal thus generated can be used to align receivers. For example, suppose you have a unit in your home or office, and two or three units in vehicles. A crystal from the main transmitter can be inserted in the *Signal Optimizer* socket, and the receivers of the other units adjusted to receive optimum signal at that exact frequency. In the terms of commercial communications technicians, this is known as "netting in" the system. Thus, the Model 36-590 can be used as an alignment generator. With so many CB sets on the market, units such as the *Signal Optimizer* are finding more and more applications in this field of servicing. ▲

now in our lab . . .

We're analyzing these test instruments for future "Notes" columns.

Blonder-Tongue Model FSP-3 FSM
EICO Model 427 DC-AC Scope
Electro Model EC-3 Power Supply
Heath Model IM-30 Transistor Tester
Jackson Model 800 Color Generator
SENCORE Model CA122
Color Generator

FINEST MONEY-MAKER FOR Professional Servicemen

Multiple-Socket Speed with Gm Accuracy

PLUS OBSOLESCENCE PROTECTION

TESTS All TV and Radio Tubes —Old and New

TESTS Nuvistors and Novars

TESTS European Hi-Fi Tubes, Voltage Regulators, and Most Industrial Types

TESTS the New 10-Pin Tubes

TESTS for True Dynamic Mutual Conductance (Gm)

TESTS New 12-Pin Compactrons

Model 700 DYNA-QUIK

DYNAMIC MUTUAL CONDUCTANCE TUBE TESTER

See your B&K Distributor or Write for Catalog AP20-R

TESTS BOTH OLD AND NEW TUBE TYPES—SELLS MORE TUBES PER CALL

All over the nation, thousands of professional servicemen rely on the "700". Once you use it, you'll be as enthusiastic as they are. *Everyday use has proved its speed . . . its accuracy . . . its efficiency.* This up-to-date, obsolescence-proof tube tester is designed for maximum use *today and tomorrow.* 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 new tube types in Dyna-Quik emission circuit. Also includes provision for future new sockets.

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.*

Makes complete tube test in seconds. Checks average set in a few minutes. Discovers weak tubes that need replacement. *Satisfies more customers. Sells more tubes. Saves call-backs. Insures your reputation. Pays for itself over and over again.* Net, $169.95

Time-Saving, Money-Making Instruments Used by Professional Servicemen Everywhere

Model 960 Transistor Radio Analyst

Model 360 V O Matic Automatic VOM

Model 375 Dynamatic Automatic VTVM

Model 1076 Television Analyst

Model 440 CRT Rejuvenator Tester

NEW TUBE INFORMATION SERVICE

Available every 3 months, on subscription, for all B&K Dyna-Quik Tube Testers

B&K MANUFACTURING CO.

Division of DYNASCAN CORPORATION

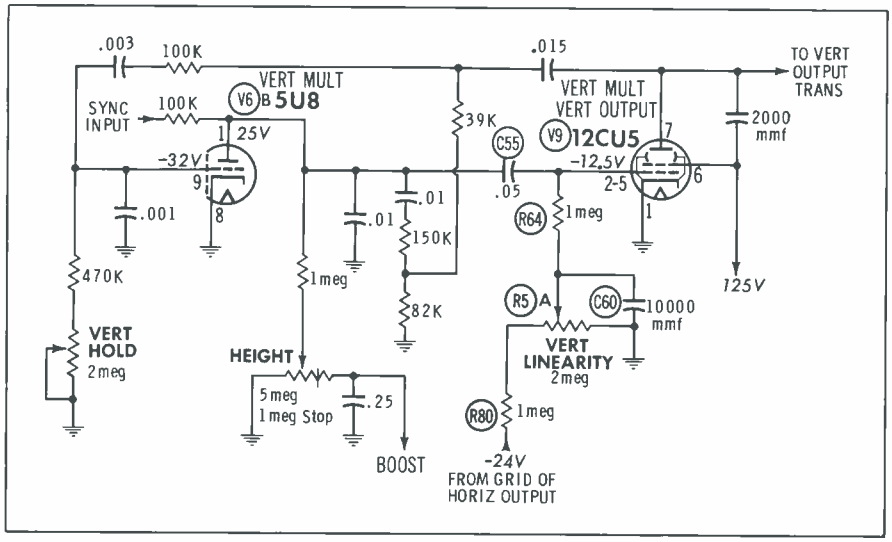
1801 W. BELLE PLAINE AVE. • CHICAGO 13, ILL.

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

Export: Empire Exporters, 253 Broadway, New York 7, U.S.A.

THE TROUBLESHOOTER

answers your service problems



Fold Under

I have a problem with a Motorola Model Y14P3-1 (PHOTOFACT Folder 366-7). After a short warmup period, the bottom part of the raster folds up, and the vertical hold control becomes very touchy. Voltage and resistance checks have not pinned down any definite faults. I'm sure you can help.

DOLPH NOWAK

Bay City, Mich.

Bottom foldover in a vertical multivibrator is usually traceable to an upset in output-tube bias. In this particular circuit, critical hold frequently occurs as a secondary symptom—not only because the

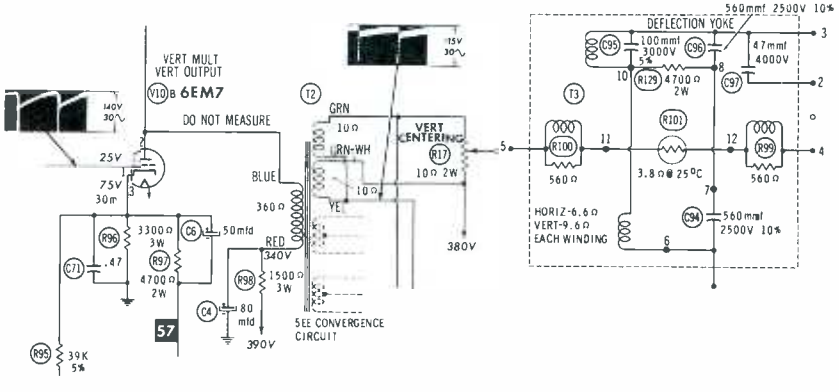
COLOR COUNTERMEASURES

Symptoms and service tips from actual shop experience

Chassis: RCA CTC10, 11

Symptoms: Bottom of raster suddenly shrinks, with two or three inches of black showing at the bottom of the screen; in some cases raster will remain shrunken.

Tip: To save yourself lost time and trouble when this symptom appears, make a simple test before troubleshooting anything else in the vertical circuit: While the symptom is present, bridge electrolytic capacitor C6 (coupling capacitor to the convergence circuits) with a known good 50-mfd unit. If C6 is faulty, you'll see the vertical sweep on the CRT return to normal. The trouble might be intermittent, with the bottom edge of the raster jumping up and down; or, it might remain up. For callback insurance, replace C6 with a new unit having at least a 350-volt rating.



Want a quick lesson in acoustics? It's this: the larger the diameter of a microphone, the more directional it becomes at high frequencies. That's why this microphone, the Electro-Voice Model 636, started a major trend when it was introduced in 1949.

It was the first truly slim dynamic microphone for PA applications. So it was less directional than any other. More than that, it set a new standard for flat response, while maintaining a high output level. No wonder it became a "best seller" right off the bat.

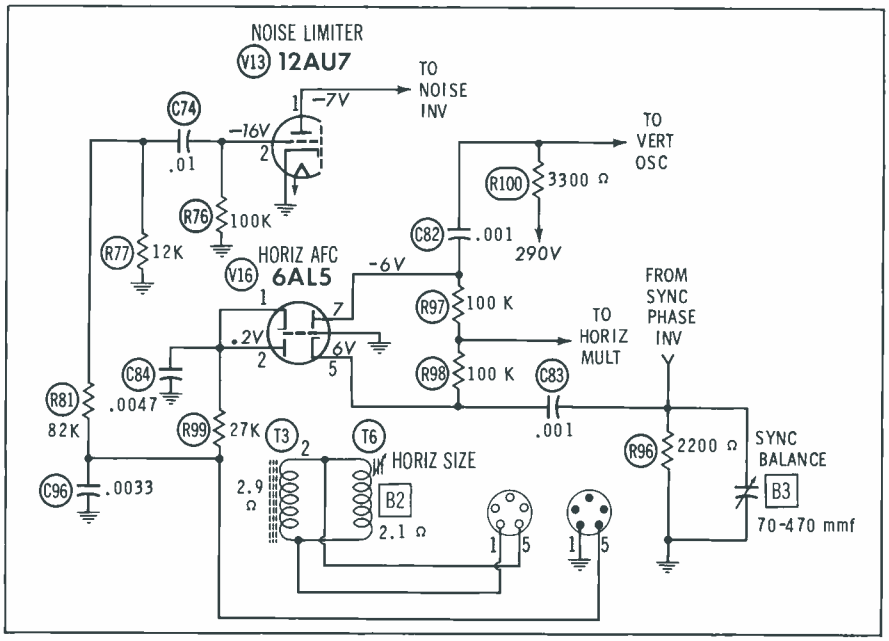
The 636 has remained popular, too, because we haven't been satisfied with its design. We constantly add, modify, improve. Our goal: even smoother response, greater sensitivity, and a longer useful life.

We know these improvements will give you better recordings and/or less feedback. Because the 636 is now flat from 60 to 13,000 cps, ± only 2 db. From just about any direction. And every new 636 is identical to every other new 636. Any pair is ideal for stereo. For dependable, predictable sound.

Part of the reason for 636 uniformity lies in the Acoustalloy® diaphragm we use. We invented it. We make it. We can control its characteristics precisely by controlling its size to the nearest .001". And, mounted in a 636, Acoustalloy is almost indestructible, despite the worst weather, noise or shock.

That's it in a nutshell. The 636 is a tough, wide range microphone that is truly omnidirectional. It's chromium plated, too, for just $72.50 list (less normal trade discounts). Or choose a gleaming gold finish. Only $5.00 more. Both are first cousins to the most famous (and most used) professional microphones in the world. And better for it. Better for you, too! Electro-Voice, Inc., Dept. 432R, Buchanan, Michigan.

Electro-Voice®
SETTING NEW STANDARDS IN SOUND



change in conduction of output tube V9 alters the feedback to vertical multivibrator V6B, but also because the fault may distort the sync signal on its way through V9 and the feedback network to the grid of V6B.

Leakage in C55 seems to be a likely culprit. This defect would not only decrease the bias on V9, but would also lower the plate voltage on V6B, thus causing a further upset in the operation of that tube. For a complete account of how leakage in this coupling capacitor affects the operation of a similar multivibrator, see Symptom 2 of November, 1962 Symfact.

Another possible origin of your trouble is the unusual resistive network through which V9 obtains DC grid bias from the grid of the horizontal output stage. One of the resistors (especially R5A or R80) could be changing value, or C60 could be developing leakage under load. Also, if the horizontal drive voltage weakens slightly as the set warms up, V9 may lose enough bias to produce noticeable foldover, even though horizontal sweep may not be seriously affected.

Horizontal Instability

A Sylvania Model 420M (covered in PHOTOFACT Folder 234-13) has a normal raster and solid vertical sync. However, the horizontal sync is very unstable. All components in the sync phase inverter and horizontal AFC stages have been checked, and the tubes have been checked by substitution. The ringing coil in the horizontal multivibrator has been replaced. I need help.

D. M. BARTAY

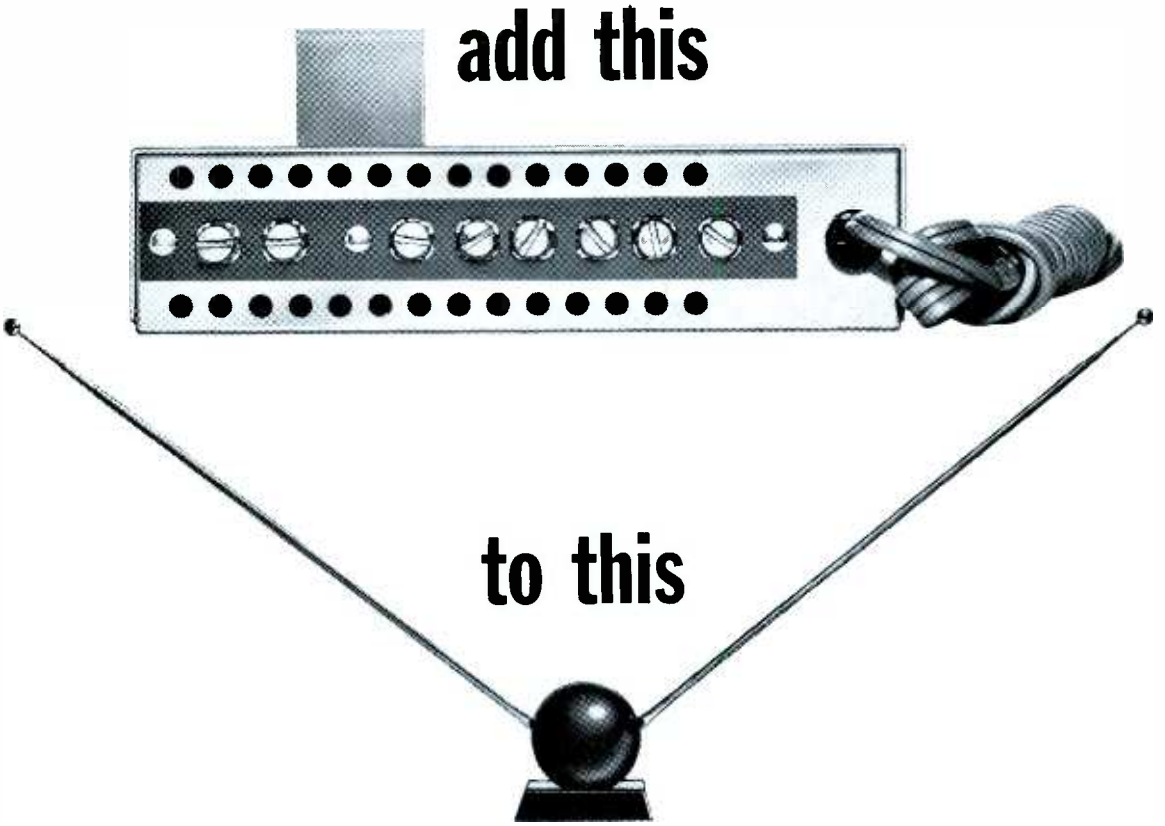
Pasadena, Texas

I would suggest you measure C84 to be sure it is of the correct value—.0047 mfd. Then trace through R99 and the interchassis plug to be sure the connections to pins 1 and 5, or on terminals 1 and 2 of the flyback transformer, haven't somehow been reversed. Next, check the components concerned with the noise-limiter keying pulse—C74, C96, R77, R76 and R81. Any fault in this area can cause horizontal instability.

V12, the sync phase inverter, could also be responsible for this sort of trouble, if it compressed the horizontal pulses.

Therefore, you might recheck the components involved—R96, R97, R98, R100, C82, C83, and the setting of trimmer B3. In the case of capacitors, be sure that their values are correct, and that they are free from even the slightest leakage. ▲

add this



to this

you'll be amazed at the improved performance

BLONDER-TONGUE B-24c INDOOR BOOSTER

Some people think a booster is only for use with outdoor antennas. Not so. In many cases, the new Blonder-Tongue B-24c indoor TV FM booster produces a dramatic improvement in reception when used with an indoor antenna. Simply add it to any garden variety indoor antenna, and you get up to 12 db gain in signal strength—enough to turn your indoor antenna into a powerful antenna system.

The Blonder-Tongue B-24c is easy to install anywhere in the home—patented, stripless screws eliminate the need to cut and twist twin lead. It can be used to amplify signals from any indoor or outdoor antenna. It's an excellent solution where your customers can not or do not want to utilize an outdoor antenna. Hook up a B-24c and show your customers how much sharper and clearer it makes the picture. Tell them of the extra TV or FM sets they can operate from single indoor antennas — up to 4. You've got a profitable sale.

In very difficult reception areas an outdoor antenna is necessary because it delivers a better signal-to-noise ratio than an indoor antenna. In that case you still can use a B-24c indoor booster, or any one of the indoor or outdoor boosters in the Blonder-Tongue line. Blonder-Tongue boosters perform best. Try them today.

engineered and manufactured by
BLONDER-TONGUE
9 Alling St., Newark, 2 N. J.

Canadian Division: Benco Television Assoc., Ltd., Toronto, Ontario
home TV accessories • closed circuit TV • community TV • UHF converters • master TV

STOCK GUIDE FOR TV TUBES . . .

This list omits over 100 of the rarest TV tube types, which many shops do not find it practical to keep in stock. To simplify the chart as much as possible, common radio and hi-fi tube types used in TV combinations are omitted; so are UHF types. Tubes marked* are primarily used in color sets. New types introduced this year are listed separately on the next page; to help you determine if you have an immediate need to stock these tubes, each listing includes the brand or brands of receivers using that particular type of tube.

In the main chart, the figures on a gray background suggest a stock of 300 tubes which should account for close to 90% of your replacement needs, and should minimize your risk of being "caught short" even if you travel all day without refilling your tube caddy. However, if you prefer a more limited caddy stock, the other set of figures (on white background) will help you decide which types to cull out. These figures indicate the number of tubes of each type you could expect to find in a random sample of 1000 tubes taken from all TV sets now in service. Where the usage is below 1 per 1000, a dash is shown. To scale down your stock, you can omit many "dashed" types, and also reduce quantities of other types. In so doing, keep in mind three other factors besides usage rates which influence the demand for various tubes:

1. Relatively high failure rate of power output and similar types.
2. Your specialization in certain makes of sets.
3. Average age of sets containing a particular tube type.

Temporary substitution of available types for rare types, as outlined in the Howard W. Sams book, *Tube Substitution Handbook, Vol. 5*, can also help you reduce stock requirements.

Another way to ease tube-stock headaches is to use only the latest –A or –B versions of various tubes. Types in common use are listed in the chart.

Would you like to have an extra copy of this Stock Guide for shop or caddy use? Reprints on durable card stock are available free upon request to the Editor.

PER 1000	CADDY STOCK	TUBE TYPE	PER 1000	CADDY STOCK	TUBE TYPE	PER 1000	CADDY STOCK	TUBE TYPE	PER 1000	CADDY STOCK	TUBE TYPE	PER 1000	CADDY STOCK	TUBE TYPE	PER 1000	CADDY STOCK	TUBE TYPE
22	2	1B3GT	5	2	5AQ5	8	2	6AV6	1	1	6CQ8	—	1	6GC5	—	1	10EG7
15	1	1G3GT	1	1	5AT8	14	3	6AW8A	4	1	6CS6	6	2	6GH8	—	1	10EM7
5	1	1J3	1	1	5B8	21	3	6AX4GTB	3	1	6CU5	5	2	6GK5	—	1	10HF8
5	1	1K3	—	1	5BK7A	3	1	6BA6	—	1	6CU8	3	1	6GK6	—	1	11JE8
—	1	1S2A	1	1	5BR8	1	1	6BA8A	3	1	6CW4	4	1	6GM6	1	1	12AF3
—	1	1V2*	—	1	5BW8	2	1	6BC5	—	1	6CW5	3	1	6GN8	4	1	12AT7
5	2	1X2B	4	2	5CG8	2	1	6BC8	2	1	6CX8	2	1	6GW6	14	2	12AU7
2	1	2BN4	1	1	5CL8A	3	1	6BE6	2	1	6CY5	2	1	6GX6	1	1	12AV5GA
—	1	2CW4	1	1	5EA8	—	1	6BF6	—	1	6CY7	3	1	6GY6	—	1	12AV7
3	1	2CY5	—	1	5EW6	1	1	6BG6GA	—	1	6CZ5	1	1	6HF8	7	2	12AX4GTB
—	1	2FH5	—	1	5FG7	1	1	6BH8	2	1	6DA4	1	1	6HJ8	4	2	12AX7
—	1	2FS5	—	1	5GH8	—	1	6BJ8	7	2	6DE4	3	1	6HS8	1	1	12AZ7A*
—	1	2GK5	—	1	5GM6	1	1	6BK4*	3	1	6DE6	1	1	6J5	1	1	12B4A
4	1	3A3	—	1	5J6	—	1	6BK5	1	1	6DE7	10	2	6J6	6	2	12BH7A
1	1	3AL5	1	1	5T8	4	1	6BK7B	1	1	6DG6GT	—	1	6JE8	1	1	12BQ6GTB
3	1	3AU6	31	3	5U4GB	3	2	6BL7GT	5	2	6DK6	3	2	6K6GT	1	1	12BY7A
1	1	3AW3	4	2	5U8	4	2	6BL8	2	1	6DN7	—	1	6K11	3	1	12C/-CU5
—	1	3BC5	2	1	5V3	1	1	6BN4	1	1	6DQ5*	1	1	6S4A	1	1	12CA5
3	1	3BN6	—	1	5X8	8	2	6BN6	21	3	6DQ6B	—	1	6SL7GT	2	1	12D4
4	2	3BU8	2	1	5Y3GT	3	1	6BN8	1	1	6DR7	27	3	6SN7GTB	—	1	12DB5
18	2	3BZ6	—	1	6AB4	8	2	6BQ5	—	1	6DT5	1	1	6SQ7	7	2	12DQ6B
7	2	3CB6	2	1	6AC7	9	3	6BQ6GTB	—	1	6DT6	7	1	6T8	—	1	12DT5
2	1	3CS6	1	1	6AF3	8	2	6BQ7A	10	2	6EA8	10	2	6U8A	2	1	12L6GT
—	1	3CY5	2	1	6AG5	1	1	6BR8A	5	1	6EB8	—	1	6V3A	1	1	12SN7GTA
3	1	3DG4	—	1	6AG7	6	2	6BU8	4	1	6EH7	7	2	6V6GT	1	1	12W6GT
2	1	3DK6	1	1	6AH4GT	—	1	6BX7GT	3	1	6EJ7	—	1	6W4GTA	—	1	13DE7
6	2	3DT6	2	1	6AH6	2	1	6BY6	2	1	6EM5	4	2	6W6GT	—	1	13DR7
—	1	3ER5	—	1	6AK5	2	1	6BY8	7	2	6EM7	4	2	6X8A	1	1	13EM7
1	1	3GK5	27	2	6AL5	30	3	6BZ6	1	1	6ER5	2	1	7AU7	1	1	17AX4GT
—	1	4AU6	4	1	6AM8A	2	1	6BZ7	2	1	6ES8	2	1	8AW8A	—	1	17DE4
—	1	4AV6	3	1	6AN8A	3	1	6C4	—	1	6ET7	2	1	8BQ5	3	1	17DQ6B
1	1	4BC8	20	3	6AQ5A	57	3	6CB6A	7	2	6EW6	1	1	8CG7	—	1	17GW6
1	1	4BQ7A	2	1	6AS5	1	1	6CD6GA	—	1	6EW7	—	1	8CX8	2	1	19AU4GTA
4	2	4BZ6	1	1	6AS8	2	1	6CF6	—	1	6FD7	—	1	8EB8	—	1	22DE4
1	1	4CB6	1	1	6AT6	30	3	6CG7	1	1	6FG7	—	1	8EM5	—	1	25AX4GT
1	1	4CS6	1	1	6AT8A	13	2	6CG8A	2	1	6FH5	—	1	8ET7	—	1	25BK5
1	1	4DT6	5	2	6AU4GTA	1	1	6CL6	5	1	6FQ7	2	1	8FQ7	—	1	25BQ6GTB
—	1	4ES8	51	2	6AU6A	1	1	6CL8A	1	1	6FS5	—	1	8GN8	—	1	25CD6GB
2	1	5AM8	2	1	6AU8A	5	2	6CM7	—	1	6FV8	—	1	9AU7	1	1	25DN6
—	1	5AN8	1	1	6AV5GTA	2	1	6CN7	2	1	6FY5	2	1	10DE7	2	1	25L6GT

• Please turn to page 78

No, we don't do it with mirrors

How can we now put a low $159.95* price tag on this popular Raytheon Ray-Tel TWR-2 CB unit and still include the same desirable features?

We don't do it with mirrors! It's simply that increased demand and universal acceptance of this rugged, top-performing unit have meant increased production, lowered components cost, and a streamlined production operation—all generating savings we can pass along to you and your customers.

From its sensitive dual-conversion superheterodyne receiver for maximum coverage, selectivity and sensitivity—to full range automatic volume control, automatic tuning, noise-free standby and "on-the-nose" frequency trim tabs, this TWR-2 unit by Raytheon packs top operator value.

Two national automotive manufacturers—convinced of Ray-Tel's unbeatable quality and reliability—have approved the TWR-2 as optional accessory equipment for their vehicles.

Citizens Band radio is a profitable, fast-growing business that you should be in. For proof, prices and full particulars—including detailed Ray-Tel spec sheet and schematics—contact your nearby local Franchised Raytheon Distributor.

RAYTHEON

*Suggested list price

Tube Stock Guide

(Continued from page 76)

NEW TUBE TYPES INTRODUCED IN '63 TV

2AH2	General Electric
2GW5	Sylvania
3EJ7	Olympic
3FS5	Silvertone
4GK5	Motorola
4GM6	Sylvania
4GZ5	Admiral
4HM6	Westinghouse
4HT6	Westinghouse
6AF11	General Electric
6AL11	General Electric
6AR11	General Electric
6AS11	General Electric
6AV11	Muntz
6AX3	Admiral General Electric
6AY3	RCA Muntz Zenith
6B10	General Electric
6BA3	Packard Bell
6DS4	Admiral General Electric RCA color Setchell-Carlson Wells-Gardner (various private labels)
6DW4	RCA color
6FJ7	General Electric
6FM7	Zenith
6G11	General Electric
6GE5	General Electric Muntz Zenith
6GF5	General Electric Muntz
6GJ5	RCA
6GL7	Zenith color
6GT5	Magnavox Muntz
6GV5	Zenith
6HC8	Setchell-Carlson
6HG8	Philco
6HL8	Zenith color
6HM6	Westinghouse
6J11	Muntz
6JC8	General Electric
6JT8	Zenith
6JU8	RCA color
6KA8	Curtis Mathes Muntz RCA
6KD8	Zenith
7HG8	Motorola
8B10	General Electric
10GN8	Westinghouse
10JA8	Westinghouse
11AR11	General Electric
12AL11	General Electric
12AX3	Admiral Muntz
12FX5	Westinghouse
12GE5	Admiral
12GW6	TraVler (various private labels)
13GB5	Wells-Gardner (various private labels)
15AF11	General Electric
15CW5	Motorola
15FY7	General Electric
15HB6	Motorola
16AQ3	Motorola
17AX3	General Electric
17AY3	RCA
17GE5	General Electric
17JZ8	Westinghouse
21GY5	Westinghouse
27GB5	Motorola

'63 Color Circuits

(Continued from page 35)

white receivers, used for AFC, AGC, etc.

Zenith Circuits

A schematic of the sweep and high-voltage circuits used in the '63 Zenith color chassis is shown in Fig. 1.

All the tubes are identical to those used last year. Drive signal W1 is fed to the grid of the output stage from the sine wave horizontal oscillator used in this set—notice the unusual shape of this waveform.

The secondary windings of the flyback transformer are similar to previous Zenith color chassis. Waveform W2 is the high-amplitude pulse that operates the killer and burst stages, in addition to supplying currents to one section of the horizontal convergence circuits. After passing through resistor R4, this pulse is also fed to the horizontal AFC circuit. Another positive pulse (W3) and a negative pulse (W4), both of lesser amplitude than W2, supply current to the convergence circuits.

Boost voltage is obtained at the usual point—the bottom of the flyback winding. Several circuits in this chassis use boost voltage for their operation—as you'll see. The focus, damper, and regulator circuits are for all practical purposes identical to the circuits used last year.

The biggest change from last year's chassis is in the yoke circuits. The flyback now has an additional tap to which the center tap of the horizontal deflection coils is returned — through a 4700-ohm, 2-watt resistor. Another new component, thermistor R17, is located inside the yoke housing, and furnishes a voltage path from the boost source to the vertical height circuit. You'll find a large red wire (connected to one side of the thermistor) emerging from the back side of the yoke; this lead terminates in a female connector that mates with a male receptacle on the chassis and completes the path to the vertical circuit.

From the changes mentioned above, it might seem necessary to obtain a new yoke for your bench color setup. But, Zenith has provided the following information to permit the use of a 29JC-series

(last year's) yoke, with the new chassis: Connect the vertical leads (yellow and yellow-black) to the yoke in the normal manner; these connections are the same for both chassis. Leave the orange lead from the HV cage disconnected. Connect the red lead to yoke receptacle #3, and connect the blue lead to yoke receptacle #1. Then connect a 1-meg, 1-watt resistor from boost voltage to the terminal plug that normally receives the thermistor lead, to complete the B+ path to the vertical circuit. The yoke in last year's receiver didn't have a thermistor; it used a common 1.5-meg, 1-watt unit for this purpose.

In previous Zenith chassis, the width was adjustable by inserting a jumper (on the yoke) that shunted a 47-mmf capacitor across the horizontal deflection coils for maximum width. This year, the 47-mmf capacitor (C7 in Fig. 1) is mounted on the rear of the chassis; a lead extending from the flyback cage is used to connect C7 into the circuit.

Horizontal and vertical centering in this chassis are accomplished by the same method as in the '62 sets. Permanent magnets within the yoke sleeve can be adjusted to center the picture on the CRT.

New Spring Model

A new series of color chassis—the 26KC20—has been introduced by Zenith. A number of changes have been made in the horizontal sweep and high-voltage circuits, and we'll mention those of importance.

New tubes include: 6HF5 horizontal output, 3AT2 high-voltage rectifier, and 6DW4 novar damper. A 1V2 and a 6BK4 are again used in the focus and regulator stages.

The focus coil adjustment, used in the '62 and early '63 chassis, has been replaced by a variable potentiometer. Focus voltage is selected by tapping off, with the control arm, a portion of the DC voltage developed by the 1V2.

The thermistor (vertical B+ resistor from boost) is not used in this chassis series; the B+ is derived directly from boost voltage via a 680K resistor, similar to the 1.5-meg resistor used in '62. However, the horizontal deflection coils have the new center-tapped arrangement.

The adjustments for high voltage, regulator current, and horizontal

output current in the Zenith and RCA chassis will be covered together, a bit later.

RCA Circuits

Fig. 2 shows a schematic of the sweep and high-voltage circuits used by RCA in their '63 color receiver. W5 is the drive signal to the grid of the 6DQ5, and should be familiar to most technicians.

As in last year's chassis, a single secondary winding supplies horizontal pulses (W6) to the killer, burst, and convergence circuits. The AGC-keying pulse was also taken from this point, but this year it is obtained via C18 from the same tap that feeds the damper cathode (see W7). This same signal is also applied to the horizontal blanker circuit. The electrical horizontal centering control is the same as before.

One of the main changes in the '63 circuits is found in the focus rectifier circuit. Focus is still controlled by adjusting a coil, but the three 22-meg, 2-watt bleeder resistors, wired in series across the focus circuit, are omitted; also 47-meg resistor R25 connects to the plate of the vertical multivibrator, supplying a portion of the focus voltage to the vertical stage and improving vertical linearity. As mentioned before, the damper has been changed to a 6DW4 novar type, so note the new pin numbers when you're servicing in the damper stage. The width connector, that shunted a capacitor across the yoke windings, has been omitted; no provision is made in this chassis to vary the width.

High-Voltage Adjustments

An important feature of color receivers is the HV-circuit adjustments —crucial for trouble-free performance. There are two interacting adjustments that must be made, requiring three test meters.

Horizontal Output Current

The average value of this current will fall between 190 and 210 ma, so the meter should have a DC current range of 300 ma. In Zenith's receiver, the meter is connected by removing the sweep fuse and inserting the meter in its place. In RCA's chassis, you'll have to open the jumper that's provided for this purpose in the cathode circuit of the 6DQ5. The efficiency coil is adjusted for minimum current.

Regulator Current

A meter with a 3-ma range is suitable for this measurement. The regulator current will average between .85 and 1.2 ma. RCA's circuit has a jumper that can be opened to insert the current meter in the cathode of the 6BK4 regulator. In Zenith's set, a 1000-ohm metering resistor is included in the cathode circuit of the regulator. A 20,000 ohms-per-volt meter can be connected across the resistor, and set to read voltage. The reading can be converted directly to ma, because of the 1000-ohm value of the metering resistor. The HV ADJUST control sets the operation of this circuit.

High Voltage

A VTVM equipped with a high-voltage probe is the instrument you'll need to measure the anode voltage. (The focus voltage, normally 5 kv, can also be measured with the same instrument.) Set the VTVM range to a high DC scale; usually, the 300-volt range will let the meter measure up to 30 kv with

the probe. The high voltage should fall between 22.5 and 24 kv. This voltage can be set to exceed 30 kv, and that's entirely too much.

CAUTION: connect the probe to the CRT anode with the set *turned off;* otherwise, the meter might be damaged.

Adjustment Procedure

Set the test instruments to monitor the output current, regulator current, and high voltage. Tune in a station signal, and set the operating controls for a normal picture on the CRT. (1) Adjust the horizontal efficiency coil (plate circuit of damper) for minimum current on the 300-ma meter. (2) Adjust the high-voltage control for 24 kv at the CRT anode. (3) Turn the brightness and contrast controls to completely extinguish the raster—fully counterclockwise — and check the current through the 6BK4 regulator. It should be at least .85 or .9 ma; if it isn't, readjust the high-voltage control. Final readings should be: high voltage, 22.5 to 24 kv; 6DQ5 current, 180 to 210 ma; regulator current, .85 to 1.2 ma.

Conclusion

The circuits we've reviewed in this article aren't much different from those used in last year's color receivers. A good point to remember about all high-voltage circuits is to *respect* the current and voltage they can deliver! The adjustments are really very simple once you've performed them a couple of times—and they are important. Checking out the high-voltage supply, using the procedures mentioned above, only takes a few minutes; and it is dandy callback insurance. ▲

"Please Ma'am—we're not allowed to accept gratuities for jobs well done!"

Bars and Stripes

(Continued from page 37)

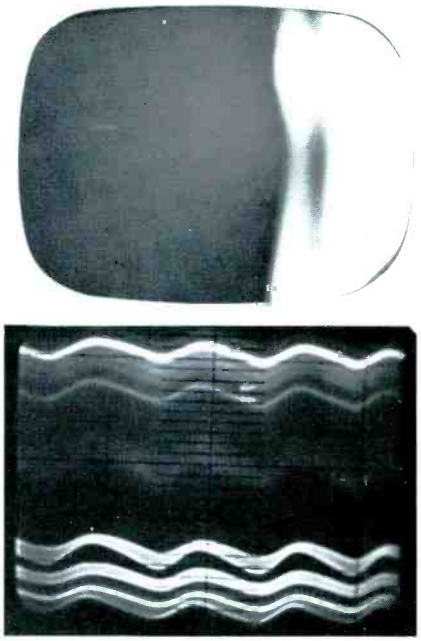


Fig. 7. Philco TV-300 had trouble almost identical to that in Fig. 6.

534. Oddly enough, I was able to cure the trouble by drawing on previous experience—a rare circumstance in itself! Because the bar pattern had a slight similarity to the previously encountered symptom shown in Fig. 1 on page 32 of the April, 1962 PF REPORTER, I immediately studied the schematic of this set with the purpose of locating a component having the same function as the part that had caused trouble in the earlier set. Without any voltage checking, tube changing, parts testing, or other trouble-shooting, I settled on the probability that C1 (Fig. 10) was the trouble-maker. When I shunted this capacitor with one of the proper value, the stripes disappeared from the raster. C1 was mounted within a fiber cylinder which serves as a coil form for choke L47. To remove the old capacitor, I merely unsoldered its leads and melted the wax holding it in the cylinder.

Fig. 8. Unusual variation on "Venetian blinds" due to bad AGC filter.

Fig. 9. Rare vertical stripes responded to same treatment as earlier case.

Once In A Lifetime

The striped raster shown in Fig. 11 is one I don't ever expect to see duplicated, because it resulted from delicate component positioning which could be reproduced only with difficulty. It was produced by a Motorola TS-221 that went through a whole series of raster presentations before the "enlarged fingerprint" in Fig. 11 finally appeared. The picture would be perfectly normal for about ten minutes after the set was turned on; then the screen was corrupted by diathermy-like interference. Next, wide vertical bands appeared, and these remained until the raster settled into the condition shown.

To make the job more interesting, or perhaps more "cussworthy," the set seemed sensitive to body capacitance. For example, if I moved my hand toward the 5U4 tube, the stripes changed radically; the same was true if I touched the neck of the picture tube. After a considerable amount of testing which led me to believe this body-capacitance symptom had little to do with the cause of the trouble, I tacked to a different course of troubleshooting.

First, I shorted the antenna leads, with no effect. Next, I pulled out the RF tube, and the striped pattern

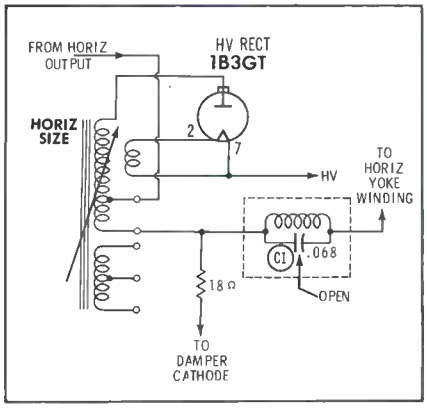


Fig. 10. Stripes were caused by open capacitor inside flyback-circuit choke.

disappeared. The result of this last maneuver was inconclusive, inasmuch as the RF stage could be picking up interference from other portions of the set. To check on this possibility, I left the scope attached to the video detector while I progressively pulled out tubes to kill other sections of the receiver. Even after the only tubes left in the set were the RF, mixer, IF's, and low-voltage rectifier, the scope still showed the same pattern of pips caused by the stripes. I pulled out the third IF, and darned if the scope still didn't show the interference, although it was of smaller amplitude. To sum up the ensuing tests, I found that the intereference was present even with just the RF-amplifier tube in place. Obviously, this stage was oscillating—but why?

Early in troubleshooting the receiver, I had checked voltages throughout and compared them with values given in service literature. All were just about as perfect as you will ever see in any similar comparison. Now, I critically rechecked the voltages in the RF stage (the only stage still "tubed up"), and found a definitely negative voltage on the grid of the 6CB6 tube. I had previously replaced all tubes, but just to play safe I tried still one more new 6CB6. Same thing—stage still oscillating. Bypassing the capacitors in the stage had no result, either. Finally, with a plastic rod, I probed the area surrounding the RF tube socket. When I exerted a slight pressure on the 3900-ohm resistor R13 (Fig. 12), the stripe-causing signal disappeared from the scope screen. With slightly more pressure on the resistor, it cracked apart. Replacing R13 and reinstalling all the original tubes, I was not the least disappointed when the set operated almost as well as a new one. But considering how much of my service time R13 had consumed, who said 13 wasn't unlucky?

Fig. 11. Narrow horizontal stripes produced by oscillation in RF amplifier.

Common, But Elusive

Another bad omen is the type of barred raster shown in Fig. 13.

Basically, the stripes are caused by ringing within the horizontal sweep section. They may reach the picture circuits by radiation from the horizontal yoke leads; in these instances, a cure is sometimes accomplished by shielding these leads. In some Motorolas using a "floating" ground circuit, the trouble could be traced to a change in value of a capacitor that tuned a tertiary winding on the flyback transformer.

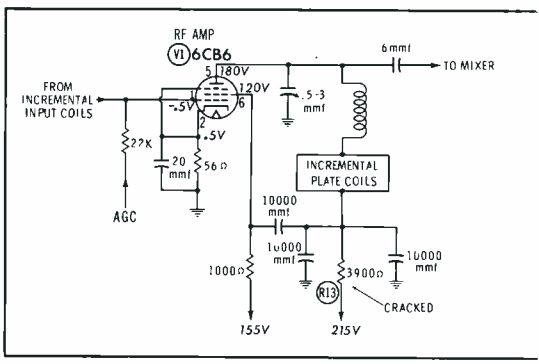


Fig. 12. Stage oscillated because of hairline fracture in unlucky R13.

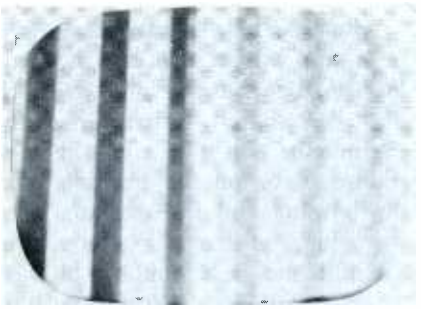


Fig. 13. Exaggerated case of ringing in the horizontal deflection circuit.

In other Motorolas where the flyback was mounted beneath the chassis, the interference could be minimized by enlarging the metal shield adjacent to the flyback.

In one late-model Philco, the striped raster was a veritable "will-o'-the-wisp," appearing only at certain picture-contrast levels. It never seemed to be present for troubleshooting. Finally, careful study of a scope trace showed the undulating line pointed out by the arrow in Fig. 14. This line was found to straighten out if a certain electrolytic capacitor was shunted, so this component was scoped and found to have a small amount of the same ripple signal on it. Replacing the can containing this filter section got rid of the bars.

The most stubborn condition of this type I have ever seen was cured only after a realignment of the IF section in a Motorola TS-89. The original bandpass curve was found to have one very sharply peaked corner, and the only improvement needed was to shape the top of the curve for a smoother arc.

It should be quite obvious by now that any type of component is capable of causing barred or striped rasters, and the more unlikely the cause, the harder it will be to pin down. One good piece of advice pertinent to troubleshooting these symptoms is, "Expect the unlikely and you will rarely be disappointed." ▲

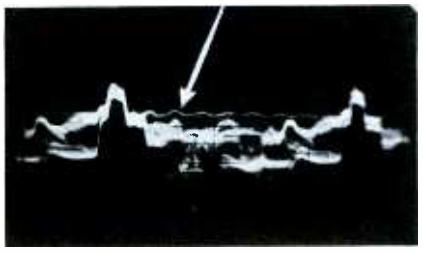


Fig. 14. Faint wavy line in video signal pointed to cure of bar trouble.

Communication Antennas

(Continued from page 39)

inside and hold it down) to keep the head liner away from the drill tip. Otherwise, it may be damaged by the drill. Drill a hole exactly the size of the widest portion of the base bushing—see Fig. 3.

You'll need an electrician's "fish tape" (a flat, narrow steel tape with a rounded end and smooth edges). From the top, feed the end of the tape through the hole, being careful not to poke a hole in the head liner. Aim the tape toward the side where the two-way unit is located. A helper may have to guide the end of the tape from below.

In some cars, it's no problem guiding the tape along inside the head liner and out into the trunk. In others, you may have to remove the rear-window trim and reach up under the upholstery. Most cars have access holes at the top corner of the trunk through which the tape can be guided. If you get into difficulty here, check with the local dealer for that make; the body man should know where the obstructions are and can probably help you.

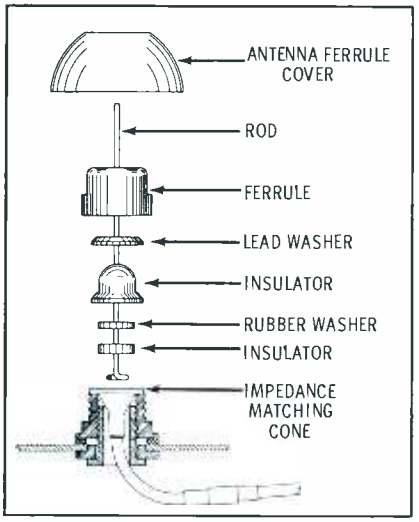


Fig. 5. View of entire assembly, showing how lead-in termination is made.

Before assembling the base, fasten a length of hookup wire to the end of the fish tape and pull it down inside the head liner, all the way to the trunk. Thread a piece of bare #20 wire through the two tiny holes in the top of the bushing. Then slip the bushing over the end of the hookup wire and drop it through the hole; at its largest diameter, the bushing should barely pass through the hole in the roof.

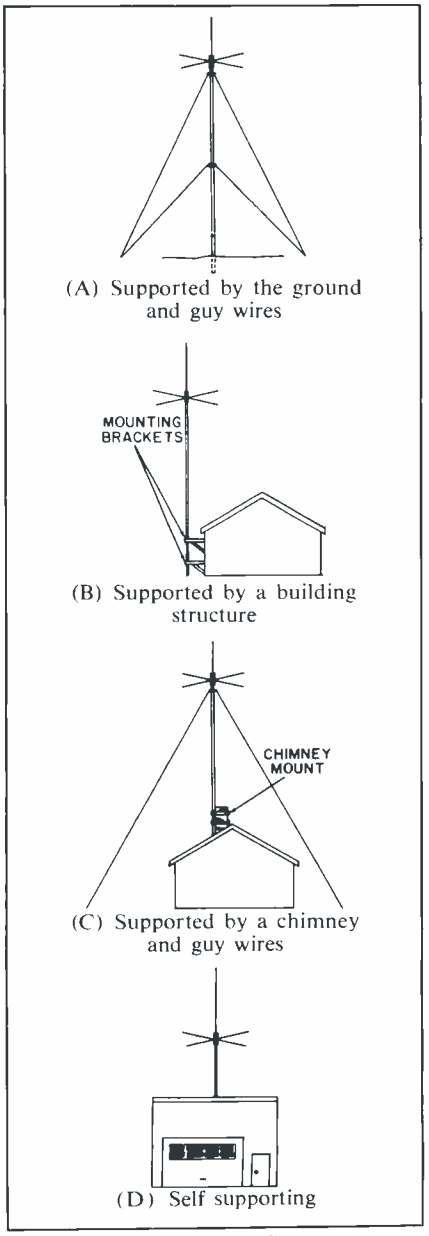
Most roof-top antenna bases have a slotted washer that fits between the threaded bushing and the roof. Slip the slotted washer over the edge of the hole (Fig. 3) and work it into place on the bushing. Pull the bushing and washer into place by using the bare-wire loop, and assemble the gasket and top bushing as shown in Fig. 4. You'll find two slots in the top of the lower bushing; use a flat L-wrench in these slots to hold the bottom bushing stationary while you tighten the top one with an open-end wrench. Remove the bare #20 wire by breaking it in the center and pulling out the two pieces.

The antenna end of the coaxial lead-in cable is usually terminated in an impedance-matching cone (Fig. 5). The cone fits into the socket formed by the top bushing. The terminal connector is installed after the lead-in is fished into the trunk. The center conductor of the coax can be "tack-soldered" to the hookup wire, and pulled to the trunk; a small piece of plastic tape can be pulled back up and used to fish the coax cable through. After

the lead-in is in the trunk, pull the impedance-matching cone down into the bushing and seat it properly. Next, assemble the antenna rod. The top assembly holds the antenna rod in place against a contact within the cone. A soft rubber cover, slipped over the whole assembly, protects the base insulator from dirt and moisture, and completes the mounting job. (The "Strip and Solder" article in this issue shows how the terminal connector should be installed.)

Base-Station Antennas

A base-station antenna should be mounted to take full advantage of whatever height is available and permissible by FCC rules. Fig. 6 illustrates several methods of supporting an antenna without resorting



(A) Supported by the ground and guy wires

(B) Supported by a building structure

(C) Supported by a chimney and guy wires

(D) Self supporting

Fig. 6. Ways to mount base antenna.

to a tower. Tall masts require guying for support, whereas a tower may be either self-supporting or guyed.

The type of installation will dictate the tools and mounting brackets needed. A few of the many brackets available for roof mounting are shown in Fig. 7. The one in Fig. 7A permits the mast to be fastened to the chimney. The upper portion should generally be supported by guy wires—a good idea from the standpoint of safety, even though the chimney appears sturdy.

The mounting bracket in Fig. 7B straddles the peak of the roof. Lag screws are the best means of fastening this "saddle-mount"; be sure they reach the wood in the roof. Waterproof sealing compound must be spread around the screw heads to prevent a leaky roof. A nice feature of this mounting is the swivel socket which permits the bottom of the mast to be secured in place with the antenna mounted and the guy wires already fastened to the mast. The mast can then be erected and steadied, while one or more helpers secure the guy wires.

Another type of mounting bracket, shown in Fig. 7C, mounts the antenna on the gable of a building. Here again, guy wires may or may not be needed, depending on the condition of the building, the weight of the antenna, and the length of the mast. The side-mount (Fig. 7D) requires similar consideration.

In each of the above mountings, certain problems may call for somewhat different installation methods. For example, you might wish to secure the side-mount in Fig. 7D to the side of a building made of brick or stone, instead of wood.

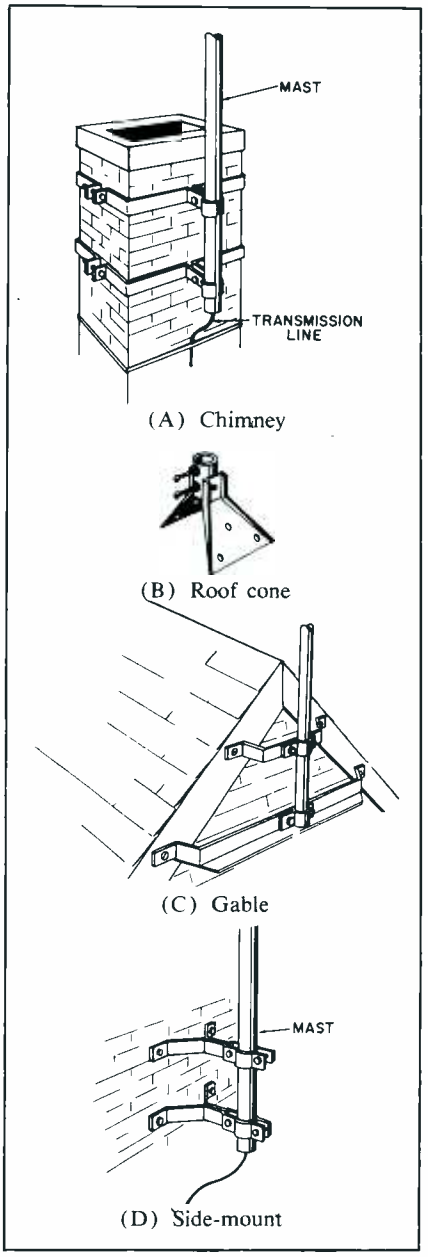


Fig. 7. Mounting brackets for buildings.

Additional tools will be required, such as an electric drill and some hard-tip masonry bits. After holes have been drilled, the mounting can be secured with special masonry

Latest Jackson Tube Test Data

JACKSON MODEL 648

Tube Type	Fil.	D.	E.	Plate Test
2AS2◆	2.5		9	42XZ
		Nor. -S switch in S position		
2D54◆	2.0	A123	A45	40V
3AT2◆	3.0		9	42XZ
		Nor. -S switch in S position		
6GF7◆	6.3	A124	AC67	50XZ
		123	AC58	22Z
10GF7◆	10.5			
13GF7◆	12.6			
15FM7◆	15	C6	AC79	19XZ
		Nor. -S switch in S position		
		C5	AC89	39YW

JACKSON MODEL 658

Tube Type	Sec.	Heater	Circuit H-K	Circuit P-G	Plate	Grid Test	Heater Current
2AS2◆	D	2.5K		0	15U	VX	
2DS4◆	T	2.0N	123	a45	42S	5WY•	A6.4P Z450
3AT2◆	D	3.0N		0	16U	VX	
6GF7◆	T	6.4L	124	ac67	34R	10XY•	
	T	"	123	ac58	18R	50VY•	
10GF7◆		10.6J	124	ac67	34R	10XY•	A18.6H Z600
			123	ac58	18R	50VY•	
13GF7◆		13.6K	124	ac67	34R	10XY•	A18.6N Z450
			123	ac58	18R	50VY•	
15FM7◆	T	18.6F	C6	ac78	15Q	10XY•	
		"	C5	a90	17R	70VY•	A22G Z450
6FM7◆	T	6.4K	C6	ac78	15Q	10XY•	
	T	6.4K	C5	a90	17R	70VY•	

SUPPLEMENT TO LATEST ROLL CHART 648-27
658-6

bolts, available at most hardware stores.

Guying

Proper guying is a very important part of the base-station antenna installation. If done improperly, the antenna may topple during high winds.

To provide maximum support for the antenna assembly, the guy wires must be properly positioned and carefully secured. Fig. 8 shows a proper guying arrangement. A common mistake is anchoring the guy wires too close to the base of the mast. The *minimum* safe distance of each anchor from the base of the mast is one-half the height. These requirements become more significant as taller masts and towers are used.

Avoid kinking the guy wire during installation, because this can weaken it considerably. Never use rusty guy wire, and make sure the guy wire has strength enough to support the load.

Just as important as the strength of the guy wire is the anchor and the manner of fastening to it. A screw eye is generally used for anchoring in a wooden structure. It must be in solid wood, such as the framework, and not merely to weatherboarding or siding, because the anchor shouldn't depend for strength on the nails holding the material. A grooved metal thimble on the end of the guy wire prevents sharp bends, which could weaken the guy wire.

"Deadman" anchors of concrete are best for antennas supported like that shown in Fig. 8. The anchor should *weigh* as much as the wind loading expected at the top of the mast. The antenna manufacturer can provide figures.

To sum up, careful planning and thorough workmanship will result in an efficient, safe antenna installation. And those are the only kind you should ever make. ▲

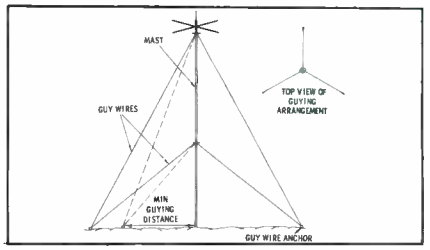


Fig. 8. Proper guying of antenna masts.

Peaks and Slumps

(Continued from page 26)

tomer — your customer! Viewing these events strategically, you could be inhibiting your business growth, limiting future profits.

Guided by an activity chart, however, you can be prepared for peak periods. Perhaps your chart indicates a 100% increase in calls last year during the back-from-vacation month of September. Based upon this experience, you can presume a similar rise in business activity and make plans to hold all of this year's incoming business.

There are a number of ways you can fortify your call-making efforts. For one, prepare your shop for maximum business activity prior to this period. Clear surplus material from your work and storage areas; in effect, you're "clearing the decks" for action. If your automobile or truck needs repair, have it done before the onslaught of service calls is expected.

Check your inventory of tubes and parts. If necessary, increase your stock to meet your anticipated demands. Excess visits to your distributor results in unproductive time that could be better spent making service calls. Waiting for components you should have in stock delays completion of repairs and turns your shop into a free warehouse for customers' sets.

Inspect your tools and equipment, too. Is your ¼" nut driver too worn to remove screws speedily? Does your tuner-slug alignment tool need replacement? How about your solder gun tips? Flashlight batteries? Ohmmeter batteries? Perhaps your tube checker has a worn socket; a piggyback socket-saver can correct it. In essence, before the heavy service period is due, correct anything that will impair service efficiency; you won't be able to spare the time once the rush hits!

Your activity chart will indicate just when to expect increased business, whether it's due to a post-vacation or pre-Christmas rush, or caused by special TV programs like the *Oscar* awards, championship boxing matches, or other television-viewing highlights.

The activity chart may also indicate that, regardless of how well you "clean house," you will still be un-

able to handle some peak periods completely. For these highest peak periods, you'll need additional help. Plan for this beforehand: Perhaps you know a service technician in your area who works for some non-servicing company — a laboratory technician, industrial or military electronics serviceman, technical writer, or the like. He might be interested in a part-time job during your rush season.

Don't overlook the possibility of hiring a service-school student to handle some of the less professional work, such as returning repaired TV sets, installing antennas, and handling the store counter. Some advanced students are quite proficient at replacing parts, or at disassembling sets.

Combatting extreme peak periods by hiring additional help may seem to sap your profits, and it may temporarily lower your profit per call. The bright side, however, is in providing fast service for customers, capturing new ones who will help increase your business activity during slump periods, and expanding your business growth over the long haul.

Combatting Slumps

The woe of all TV servicemen is the period when the telephone seldom rings. Unfortunately, TV repair slumps are part of the business, but they *can* be conquered, to a degree, through careful attention to your activity chart.

An activity chart, as you no doubt realize by now, is not simply a statistical numbers game. It must be reinforced by your alertness to possible trends that affect business. A local bowling contest may be the culprit that's stifling your telephone, as may any other activity that draws people away from their TV receivers. A state fair, Mother's Day, a football game (not televised), can all contribute to slow business days.

Your chart, however, can remind you of these slump periods before they occur, if you note such possible business killers. Accordingly, you'll be alerted to devise methods of limiting the decrease in profits.

Summertime is traditionally the worst period for depressed business activity in TV repair shops. Children

are gone to summer camps, outdoor activities are in full swing, and vacations take potential customers away. However, the very nature of the season presents an open invitation for servicemen to secure additional business.

Portable radios, for example, are used most during the summer. Consequently, there's an opportunity to cash in on their reawakened use. Consider promoting your store as a portable radio center to capture your share of portable radio business. Identify yourself as such. Use window displays and decals, many of which are available through your local parts distributor. Perhaps a sign, "Portable Radio Batteries Checked Free!" will help do the trick for you.

Auto-radio repairs are another prime source of business during warmer months, since more traveling is done. So, promote your auto-radio repair services. The successful business is one that is actively promoted.

Phonographs present servicemen with another key repair item to fill in for TV-service slumps. There are about 40 million homes with phonographs, all periodically needing service; be sure to get your percentage of this business. If you're inexperienced in the mechanical end of changer repairs, try to arrange for a phono-repair specialist to do the repairs for a special dealer price. This is an accepted practice among specialists because they can lower their costs by handling work in volume.

Another very important promotional area is the often-neglected one —your TV-radio service. Promote really hard in your "bread-and-butter" field. Be aggressive! Suggest to customers who drop in to buy batteries that now is the time to examine the antenna, to add an FM antenna or multiple-set coupler, to install a new picture tube, or to halt minor troubles before they develop into something more serious.

Review your customer service records before the slow season arrives. They add up to a direct-mail advertising list—a most valuable compilation of names and addresses that you've developed over the years. Unfortunately, many TV servicemen view these records as only a way to check guarantee

claims made by customers. Actually, they can be a vital key to your increased growth.

Use the list to prompt customers to call you, or to remind them of some annoying defect such as poor focus, a weak picture, or a scratchy volume control. You'd be surprised at how many TV sets are viewed and listened to with unbelievably poor reception quality. A simple reminder may be all that's needed to push them toward their phone—with your number in hand.

Preprinted postcards can be obtained with a choice of messages at nominal cost through your local distributor, usually in cooperation with a tube manufacturer. Or, you could have a local printer mimeograph a special sales message on postcards, such as "TV Summer Checkup Special includes: checking tubes, cleaning controls, inspecting antenna, adjusting service controls . . . all for only $XX.XX."

Your local printer can also prepare leaflets for you. These may be distributed by young boys, or by a professional distribution company that specializes in this type of work.

A sales message doesn't necessarily have to center around a "special" or general announcement of service. You may key your message to some new equipment that can provide the customer with better service, a new product that will improve reception, or some new service you offer—such as Citizens-band radio repairs, public-address system repairs and rentals, or high-fidelity sales and service.

Whatever method you use to stimulate business, it must be put in effect just before your expected slack period. If you start your promotion in the middle of your slack period, you miss conquering most of the slump. Though the longest slump period you'll experience is during the summer season, other brief slack periods should be attacked in a similar manner.

Whether you're dealing with a peak or slump period, always keep your eye on the ultimate goal: smoothing out your business load. Maintain an accurate business-activity chart, and after the first year you'll find yourself beating those peaks and slumps. And watch your business grow as a result! ▲

PRODUCT report

For further information on any of the following items, circle the associated number on the Catalog & Literature Card.

Educational Aid (47Y)

Increasing use of electronic apparatus in educational facilities is predicted by a recent survey of "language labs" used in — and planned for — American classrooms. In keeping with this trend, **Sonotone** has just developed a combination headset - microphone, designed primarily to be used in classrooms. The "Sono/Com" is a lightweight unit, equipped with ear cushions for a comfortable fit during prolonged listening.

Line-Voltage Stabilizers (48Y)

Variations in AC line voltage can be controlled with the "Powerguard" series of voltage stabilizers introduced by **Stancor.** Presently, the units are available with ratings of 30, 60, 250, 500, 1000 and 3000 volt-amperes. Containing no moving parts, they automatically correct line-voltage variations of +15% to within ±1%, acting in less than 25 milliseconds. Their design provides built-in safety factors for protection from overload due to excessive current drain.

Replacement Catalog (49Y)

A 44-page catalog listing their complete line of variable resistors, switches, and ceramic capacitors has been published by **Centralab**. The catalog contains detailed drawings and mechanical specifications of most of the parts listed, and a cross-reference chart of all types of switches for any given number of poles or positions.

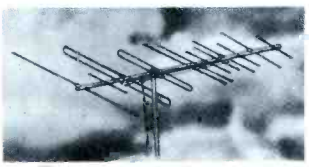
SCR Tester (50Y)

Designed to test all types of silicon controlled rectifiers, the **Seco** Model 600 Analyzer reveals gate characteristics, gate phase angle, and anode current. Incorporated in the tester is a protective circuit designed to prevent damage to the unit if the rectifier being checked is shorted; this same circuit also protects the rectifier from possible overload induced by testing. This unit operates from 117 volts AC, and has a list price of $46.95.

CRT Test Instrument (51Y)

The use of filtered DC voltage for all tests is one of the new features of the **SENCORE** Model CR125 Picture-Tube Tester and Rejuvenator. In addition to locating interelement shorts and measuring cathode emission, the unit performs a dynamic control-grid check, a life test, cathode and control-grid rejuvenation, removal of shorts, and cathode welding. Also included is an RC timing network designed to prevent over-rejuvenation, regardless of how long the control button is depressed. Each gun in a color CRT can be tested separately without the use of special adapters. The instrument sells for $69.95.

TV-FM Antenna (52Y)



Designed for stereo-FM, monochrome TV, and color TV, the **Antennacraft** Model SA-242 antenna features all-aluminum construction with a gold anodized finish. The gain of the unit best suits it for fringe-area reception. Factory pre-assembled, the antenna has positive locking snap-out construction, and a list price of $39.95.

Remote Controls (53Y)

Four new mobile transmitters, designed for remote control of traffic signals, machinery, or other equipment, were recently introduced by **Perma-Power.** Models T382 (6-volt) and T383 (12-volt) are for use when a single control signal is required; the Models T384 (6-volt) and T385 (12-volt) can each transmit two individually controlled signals. All models are intended for permanent installation in vehicles. These remote-control systems operate on any of the six Class-C Citizens-band frequencies, and offer a maximum transmission range of up to four miles.

Record Cleaner (55Y)

A single application of this **Duotone** aerosol spray cleans and protects phonograph records, leaving them static-free for a considerable length of time. Keeping records free from dirt and lint not only reduces wear on the grooves, but also prolongs the life of the needle. This cleaner, complete with a cleaning cloth, has a list price of $1.50.

Tool Kit (56Y)

Two pocket-size nut drivers (1/4" and 5/16"), two regular screwdrivers (3/16" and 3/32"), and two Phillips screwdrivers (#0 and #1) are contained in a break-proof plastic case from **Xcelite.** Designated PS7, the kit includes a "torque-amplifier" handle that slips over a nutdriver or screwdriver to give it a length and torque equivalent to the standard type. This kit sells for $6.25.

Magnifier Lamp (57Y)

The fluorescent magnifier lamp Model BBM-9, developed by **Swing-O-Lite,** is counterbalanced and completely flexible with a 45" arm reach. The magnifying glass lens is 5" in diameter with a 13" focal length. Available in brown, tan, and gray, the unit has a choice of permanent, clamp, or wall-type mountings and a list price of $30.75.

INDEX TO ADVERTISERS

CATALOG AND LITERATURE SERVICE

APRIL, 1963

ANTENNAS & ACCESSORIES

1Y. AEROGAP — Literature describing Transceptor TV/FM set coupler and Antenna, a kit including the set coupler and 25' of twin-lead.

2Y. ANTENNACRAFT — Brochure describing Model SA-242 antenna designed for fringe-area reception of black-and-white or color TV signals, and FM. See ad page 94.

3Y. CUSH CRAFT—Illustrated brochure on complete line of Citizens-band antennas and accessories, including "Blitz Bug" coaxial lightning arrester. See ad page 68.

4Y. JERROLD — Information concerning new line of TV Signal-distribution equipment for motels, hotels, apartment buildings, and hospitals.

5Y. JFD—Brochure on LPV log-periodic TV antennas and Transis-tenna; also bulletins and catalogs showing entire line of TV-FM indoor antennas and accessories. See ad pages 42-43.

6Y. WINEGARD—Complete technical data, schematic, and service tips on new *Red-Head* transistorized antenna preamplifier; also 16-page manual giving information on laying out and installing both large and small antenna systems. See ad pages 32-33.

AUDIO & HI-FI

7Y. ATLAS SOUND, Div. of American Trading & Production Corp.—Catalog and specification sheet describing new Model EC-10 paging speaker and T-4 line-matching transformer.

8Y. DUOTONE—New 1963 needle-replacement Wall Chart. *See ad page 72.*

9Y. EICO—New 32-page catalog of kits and wired equipment: stereo and monophonic hi-fi, test equipment, Citizens-band tranceivers, ham gear, and transistor radios. Also information on general construction procedures, "Short Course For Novice License," and "Visutronic Teaching Aids." *See ad page 52.*

10Y. PERMA-POWER—Catalog Sheet on Ampli-Vox Roving Rostrum, a transistorized public-address system. *See ad page 48.*

11Y. ROBERTS—Information on new head demagnetizer.

COMMUNICATIONS

12Y. CADRE—Bulletins on transistorized base-station, mobile, and portable Citizens-band transceivers.

13Y. COMMUNICATIONS COMPANY — Specifications on new *UHF-FM Ultra Fleetcom* and *Basecom* two-way communications equipment; operating on frequencies from 450 to 470 mc.

14Y. GC ELECTRONICS—Catalog FR-063L showing *Globe* Citizens-band equipment, antennas, and accessories. *See ad page 63.*

15Y. HALLICRAFTERS — Brochure giving specification data on Model CB-5 Citizens-band transceiver, including accessories.

16Y. HAMMARLUND — Sheet describing Model TM500-A Mobile Radio Frequency Meter; also sheet giving specifications on available tone-signaling equipment.

COMPONENTS

17Y. BUSSMANN—Bulletin SFUS, 12-page booklet listing the complete line of *Buss* and *Fusetron* fuses by size and type; also shows proper fuseholder and list price. *See ad pages 20-21.*

18Y. CLAROSTAT — 20-page 1963 catalog listing complete line of wire-wound and carbon potentiometers, fixed and variable resistors, other resistance devices, and switches.

19Y. SPRAGUE — Catalog C-614 showing complete listings of all stock parts for TV and radio replacement use, as well as *Transfarad* and *Tel-Ohmike* capacitor analyzers. *See ads pages 13-14.*

20Y. WORKMAN—Circuit breaker cross-reference guide (Form XB) and coil cross-reference guide. (Catalog 103). *See ad page 46.*

SERVICE AIDS

21Y. CASTLE—Leaflet describing fast overhaul service on television tuners of all makes and models; also illustrated lists of universal and original-equipment tuners. *See ad page 67.*

22Y. PRECISION TUNER—Information on repair and alignment service for any TV tuner. *See ad page 82.*

23Y. YEATS — Literature describing the Model 14 appliance dolly, featuring all-aluminum I-beam construction. *See ad page 96.*

SPECIAL EQUIPMENT & SERVICES

24Y. ACME—Specifications and applications for control-type magnetic amplifiers with capacities from 5-1000 watts and voltage ranges from 24-160 volts. *See ad page 97.*

25Y. ELECTRO PRODUCTS — 6-page brochure showing latest line of DC power supplies.

26Y. GREYHOUND — Complete information on Greyhound package express, including rates and routes.

27Y. LAFAYETTE RADIO—New 1963 catalog featuring stereo and monophonic hi-fi, Citizens-band transceivers, ham gear, test equipment, radio-TV parts, and tools.

28Y. OLYMPIC—Catalog showing complete line of stereo and monophonic hi-fi, radios, and TV receivers. *See ad page 95.*

29Y. STANDARD KOLLSMAN — Brochure supplying information on Model A UHF Converter, using new 6DZ4 oscillator and nuvistor IF amplifier; also 1953 tuner-replacement guide. *See ad 2nd cover.*

30Y. TERADO—Catalog sheet 5999 describing complete line of converters, battery chargers, and relays.

31Y. VOLKSWAGEN — 60-page illustrated booklet "The Owner's Viewpoint," describing how various business enterprises use VW trucks; complete specifications on truck line. *See ad page 61.*

TECHNICAL PUBLICATIONS

32Y. CLEVELAND INSTITUTE OF ELECTRONICS — "Pocket Electronics Data Guides" with conversion factors, formulas, tables, and color codes. Also folder "Choose Your Career In Electronics" describing home-study electronics training programs, including FCC-license preparation. *See ad page 62.*

33Y. GRANTHAM SCHOOL OF ELECTRONICS—Booklet describing resident and correspondence courses available preparing you for an FCC commercial radiotelephone operator license.

34Y. JOHN F. RIDER—Latest 1963 catalog describing complete line of technical books and servicing manuals—64 pages of items covering basic electricity and electronics, radio, TV, audio, industrial electronics, and computers.

35Y. HOWARD W. SAMS—Literature describing all current publications, audio/hi-fi, and industrial electronics, including Fall-Winter 1962 Book Catalog and descriptive flyer on 1962 *Test Equipment Annual. See ads pages 24-25, 90.*

TEST EQUIPMENT

36Y. B & K—Catalog AP20-R giving data and information on Model 850 *Color Analyst*, Model 960 *Transistor Radio Analyst*, Model 1076 *Television Analyst*, *Dynamatic* 375 VTVM, *V-O-Matic* 360, Model 625 *Dyna-Tester*, Models 600 and 700 *Dyna-Quik* tube testers, Models 420 and 440 CRT Tester-Reactivators, and Model 1070 *Dyna-Sweep* Circuit Analyzer. *See ads pages 27, 55, 59, 66, 71.*

37Y. HICKOK—Information about specifications of new Model 677 Wide Band Oscilloscope; also "Scope Facts."

38Y. MERCURY—Catalog giving information on Models 1000, 1100, and 1200 Tube Testers, Models 202 and 203 Self-Service Tube Testers, Model 301 Combination Tester, Model 501 Component Substitutor, and Model 800 CRT-Tester and Reactivator. *See ad page 88.*

39Y. SECO—Data sheet describing Model 600 SCR Analyzer, capable of checking all types of silicon controlled rectifiers. *See ad page 15.*

40Y. SENCORE—Complete information on CA122 *Color Circuit Analyzer* and PS120 *Wide-Band Scope. See ads pages 22-23, 93.*

TOOLS

41Y. BERNS—Data on 3-in-1 picture tube repair tools, on *Audio Pin-Plug Crimper* that lets you make pin-plug and ground connections for shielded cable without soldering, and on *ION* adjustable "beam bender." *See ad page 92.*

42Y. ENTERPRISE DEVELOPMENT — Literature from Endeco on improved desoldering and resoldering techniques for use on PC boards. *See ad page 80.*

43Y. EVERSOLE—Sheets decribing and listing prices of DeSod desoldering tools for removing and replacing parts on printed circuit boards, including new tip for miniature IF transformers.

44Y. UNGAR—Catalog 1-100-61 giving information on "Imperial" series of soldering irons and accessories.

45Y. XCELITE—Brochure N163 describing two double-duty tool sets PS-7 and PS-120 having pocket-size nutdrivers and screwdrivers with "piggyback" handles in a see-through plastic case. *See ad page 70.*

TUBES

46Y. AMPEREX—33-page catalog with numerical index, descriptions, and basic specifications on tube line.

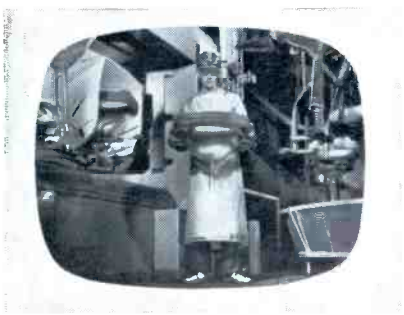
HOW RCA BAKES OUT CALLBACKS

Oven-drying Silverama® bulbs improves performance, prolongs life

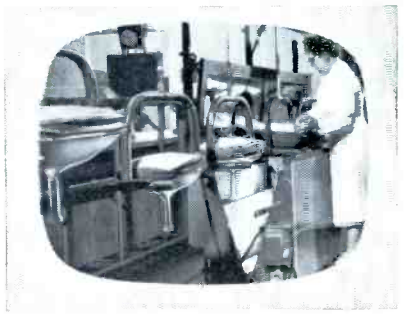
You are looking from-inside-out of a Lehr oven—a high-temperature "picture tube kiln" designed to bake potential troubles out of Silverama picture tube bulbs.

This oven—in our Marion, Indiana picture-tube plant—bakes aluminized picture-tube bulbs for 2½ hours; peak temperature during bake out: 460°C. Objective? Bake out all moisture and decompose all organic material that might shorten the life of the tube or otherwise affect its performance.

This long bake-out also produces favorable stresses in the glass itself to increase strength and long life. It is but one of many stringent manufacturing steps taken to assure the high quality standards of RCA Silverama. Result: substantial reductions in callbacks and in-warranty picture tube failures when you install RCA Silverama.



Envelope Inspection. After a series of acid baths the re-used envelope is thoroughly inspected to make sure it meets the standards of an original new envelope.



Screen Quality Inspection. After rescreening, each bulb undergoes rigorous inspection for screen quality. A strong reflected light behind the bulb reveals even the smallest flaws in the screen; even the smallest is cause for rejection of the bulb.

RCA ELECTRON TUBE DIVISION, HARRISON, N. J.

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

FASTER THAN A SHORT CIRCUIT

SUB-MINIATURE MICROFUSES

and microfuse holders for internal connection and panel mounting.

1/500 AMP. thru 5 AMPS. @ 125 volts. Will interrupt 10,000 AMPS. DC short circuit.

8AG INSTRUMENT FUSES

1/500 AMP. thru 5 AMPS.

For instrument and meter protection, Littelfuse pioneered the design and development of reliable fast-acting fuses.

LITTELFUSE

Des Plaines, Illinois