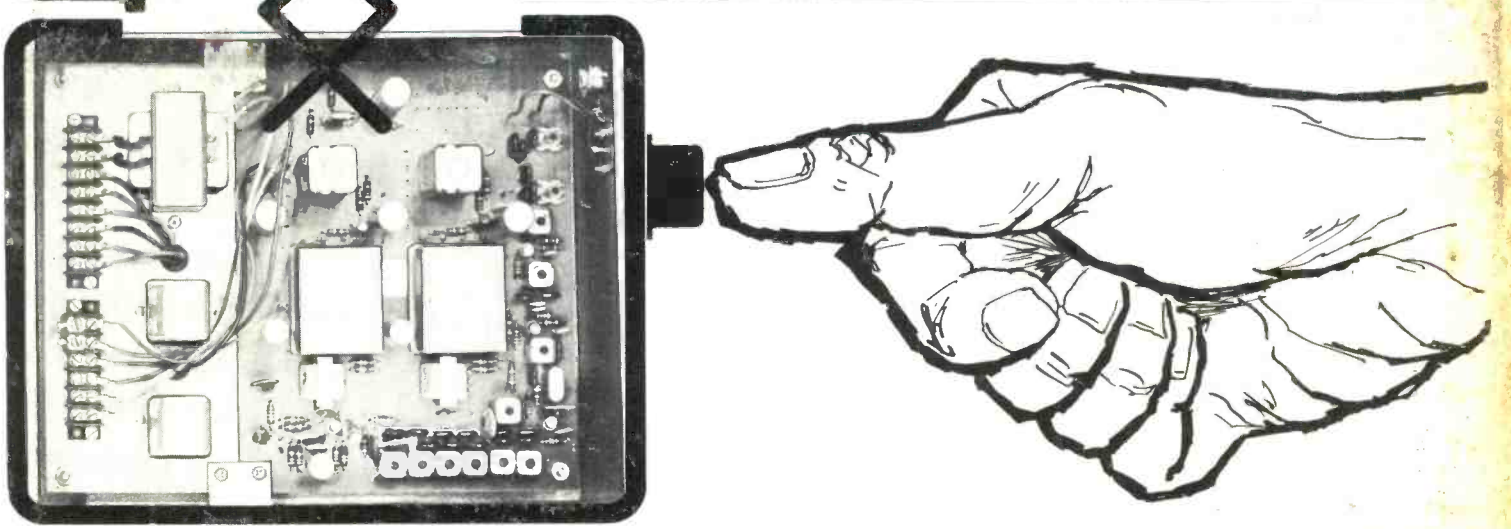
ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

RADIO REMOTE CONTROL

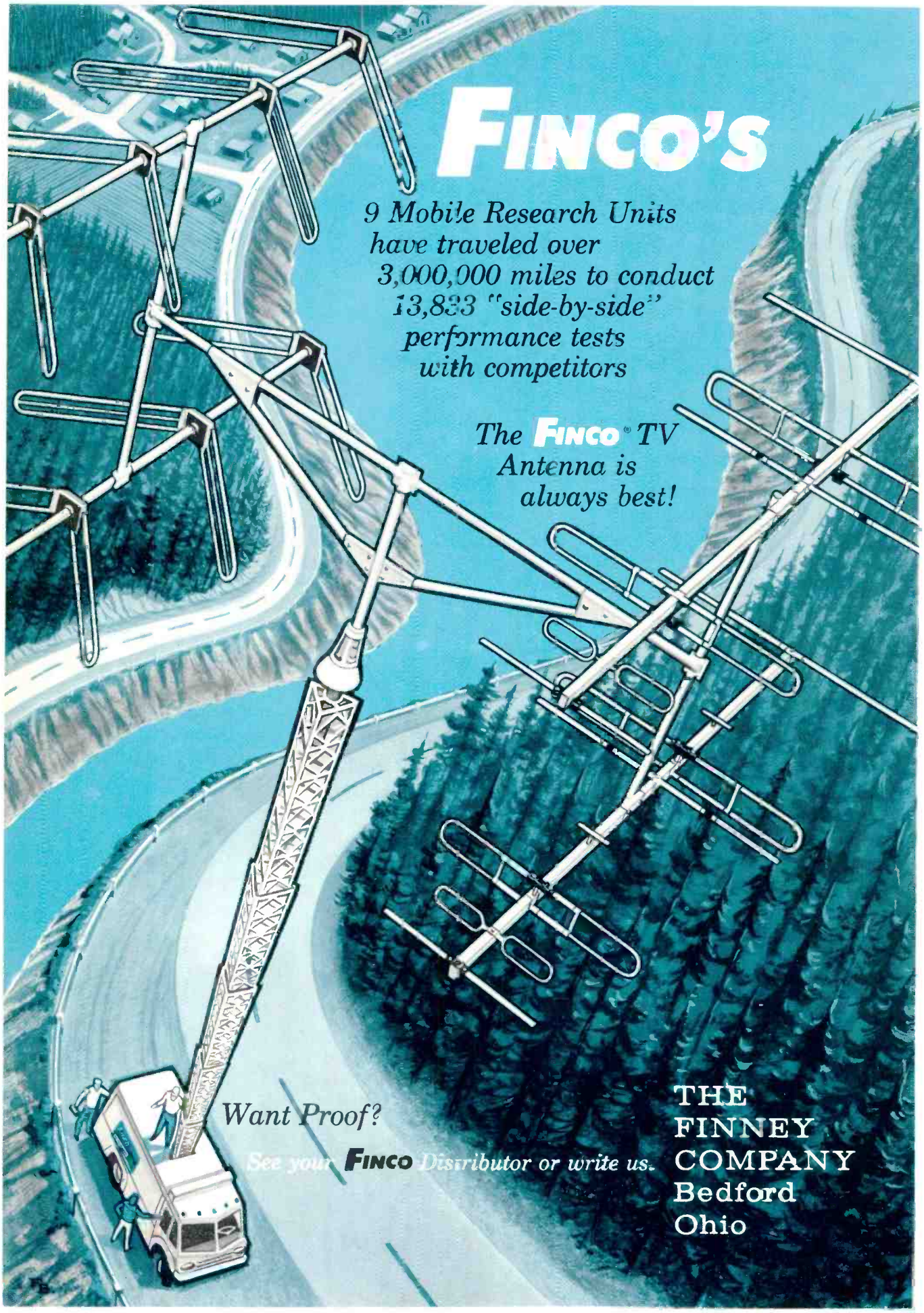
THERE'S MONEY IN CCTV

ALARM SYSTEMS PRIMER



AN OJIBWAY PUBLICATION

JULY 1964



- - - for more details circle 20 on post card

ELECTRONIC TECHNICIAN
TEKFAX
COMPLETE MANUFACTURER S' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR FIVE NEW SETS

ELECTRONIC TECHNICIAN
TEKFAX
COMPLETE MANUFACTURER S' CIRCUIT DIAGRAMS
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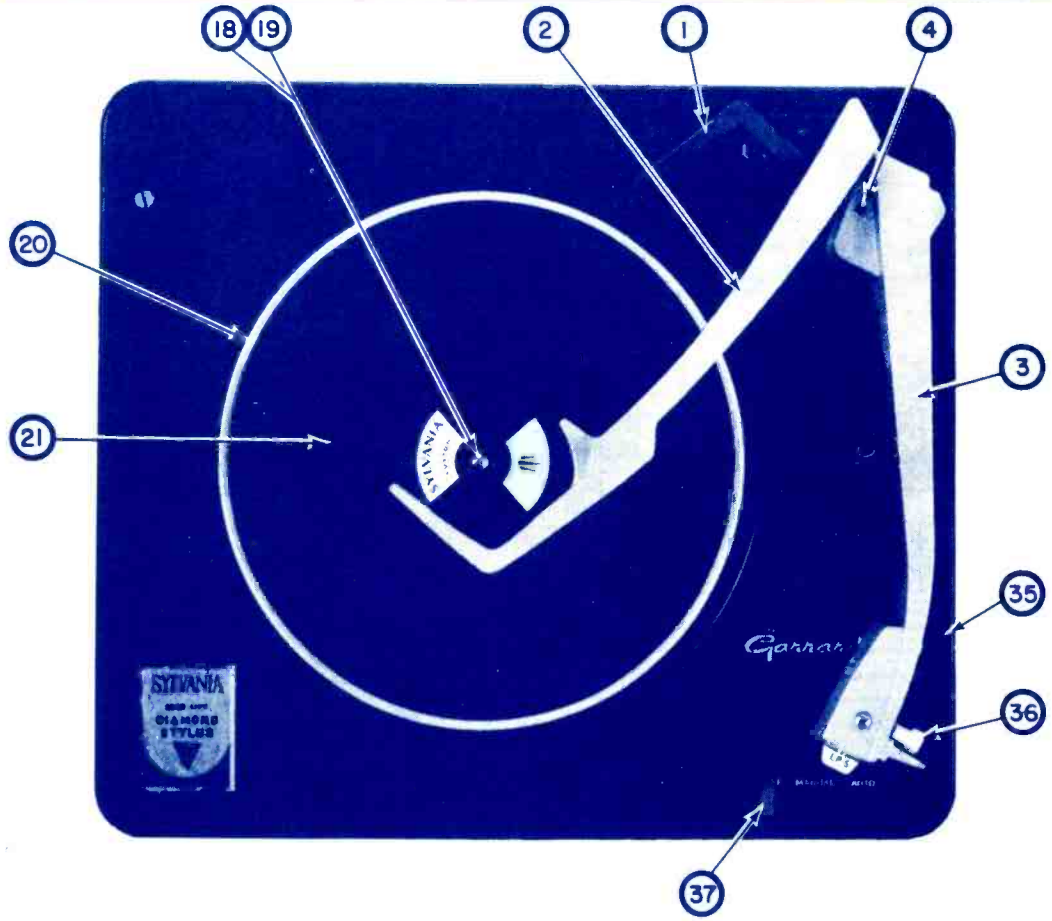
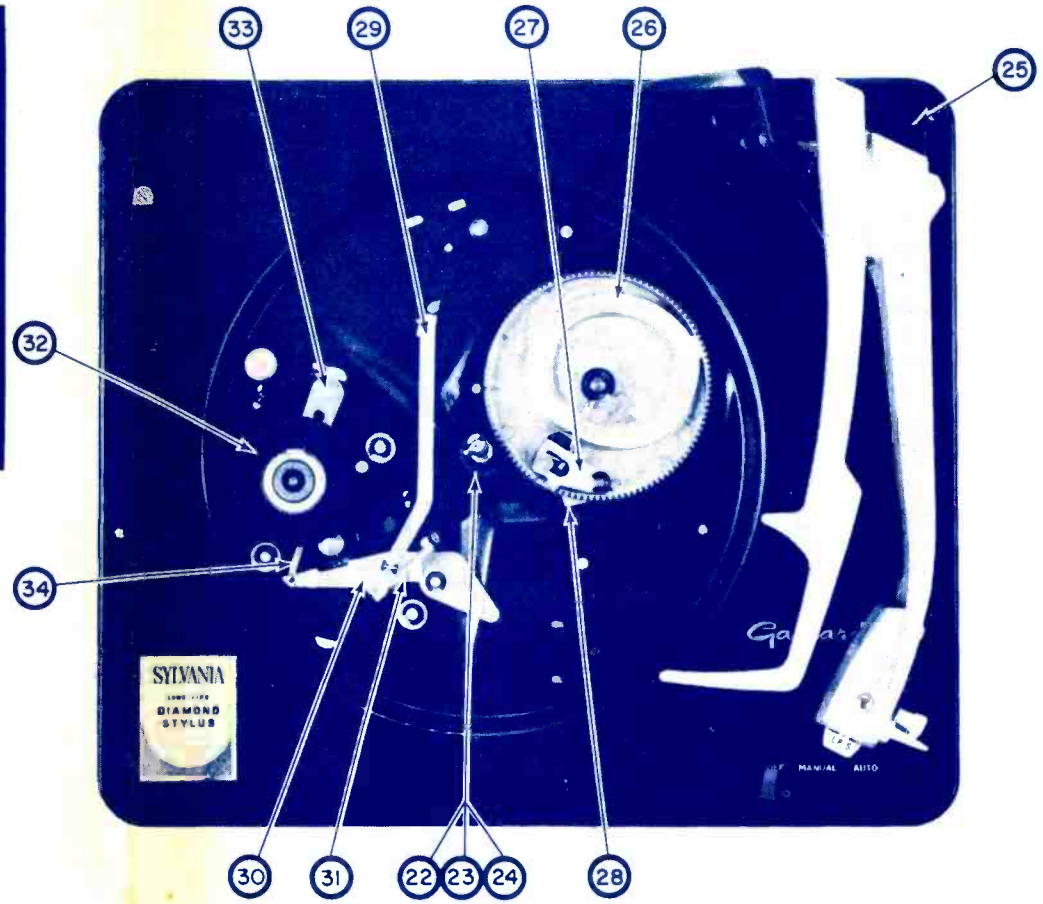
GROUP 143

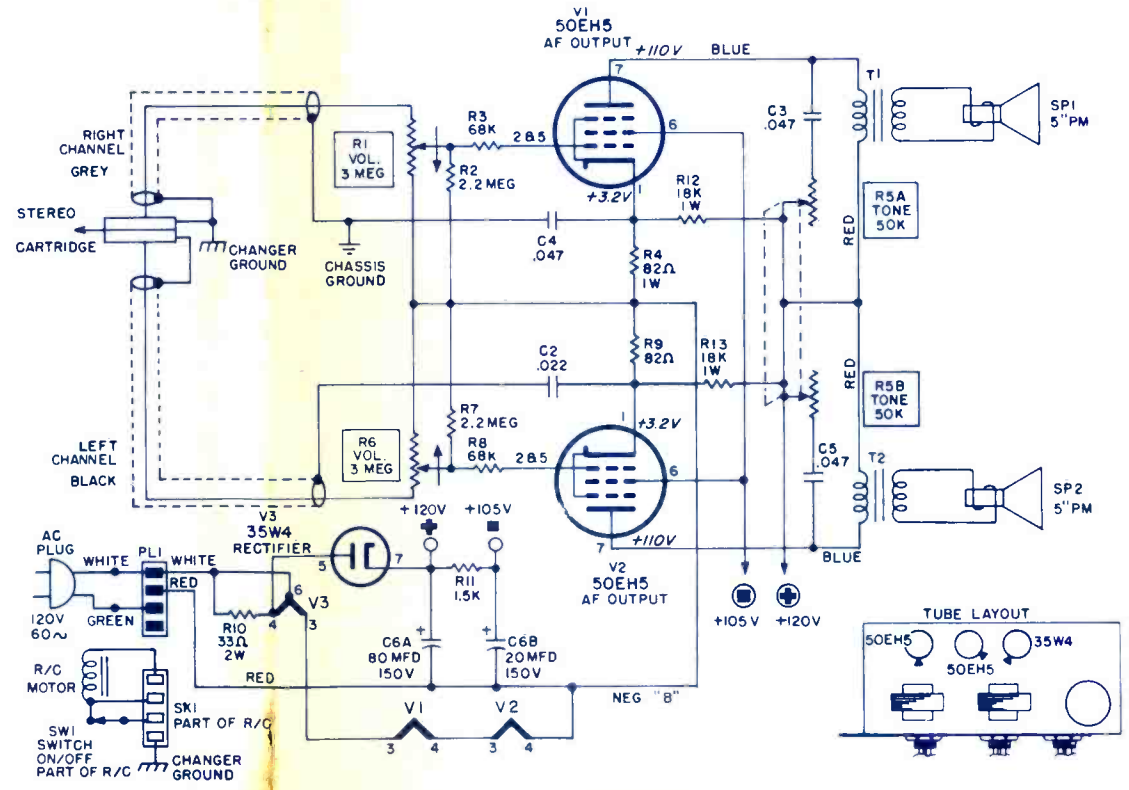
859

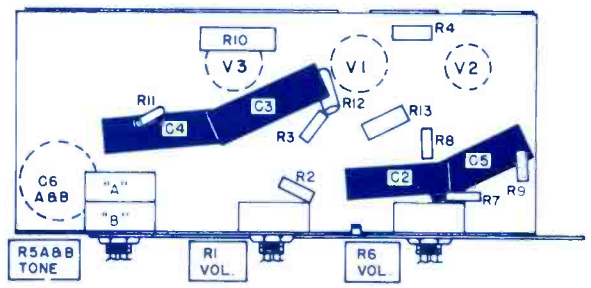
July 1964

Sylvania
Stereo Hi Fi
Chassis 406-3
Model 45P36









TO REMOVE AND REPLACE THE TURNTABLE

To remove the turntable, slide off turntable clip and lift the turntable with equal pressure on opposite sides.

LUBRICATION

The motor, turntable and idler wheel bearings are of the oil-retaining type and rarely need lubricating. When the need for oil is apparent, remove the turntable and lubricate these bearings with a fine grade of machine oil. Carefully remove all traces of surplus oil--especially from the motor pulley, idler wheel tire and inside of turntable rim.

TONE ARM HEIGHT

The tone arm height is adjusted by turning screw (4) located at the rear of the tone arm. The height should be adjusted so that the stylus point is 27/32" above the turntable mat surface at the outside edge position of a 7" record as the tone arm returns to its rest.

RECORD SPINDLE ASSEMBLY

Place the record spindle in position and rotate it until location is felt, then press firmly downwards to secure in turntable clip.

STYLUS SET-DOWN POSITION

To adjust the stylus set-down position lift the tone arm to gain access to stylus set-down adjustment screw (16). To move the tone arm away from the center of the record, turn screw (16) counterclockwise; to move the tone arm toward the center of the record, turn screw (16) clockwise.

STYLUS PRESSURE

The stylus pressure should be 5 grams ± 1 gram. It is recommended that a periodical check be made to see that the correct pressure is maintained. To adjust the stylus pressure, turn adjusting nut (9) clockwise to decrease and counterclockwise to increase stylus pressure.

MOTOR PULLEY AND IDLER WHEEL HEIGHT

The relative height of the motor pulley and idler wheel (32) must be such that, when they are in contact on either the 16, 33 or 45 rpm steps, the lower face of idler wheel (32) is about 1/64" clear of the adjacent pulley step.

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Coronado
Chassis 1197-153
Model TV17-9386A

July 1964

ELECTRONIC TECHNICIAN TEKFAX

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

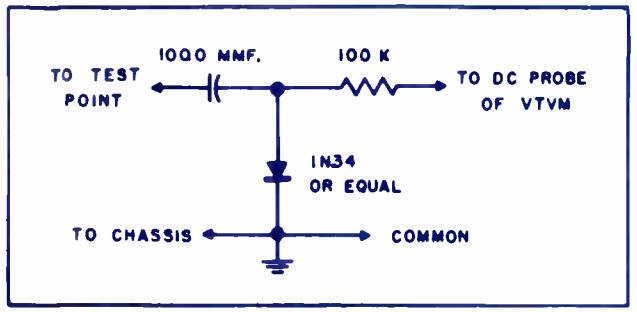


Figure 5 Diode Detector Detail

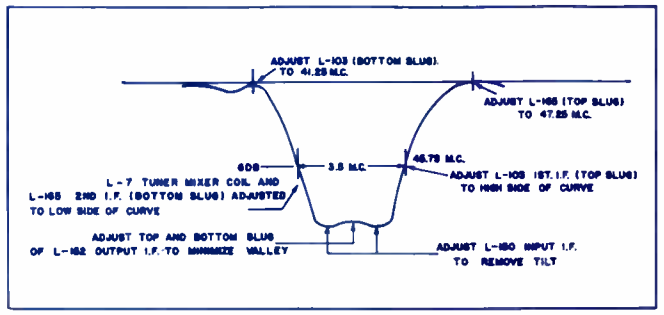
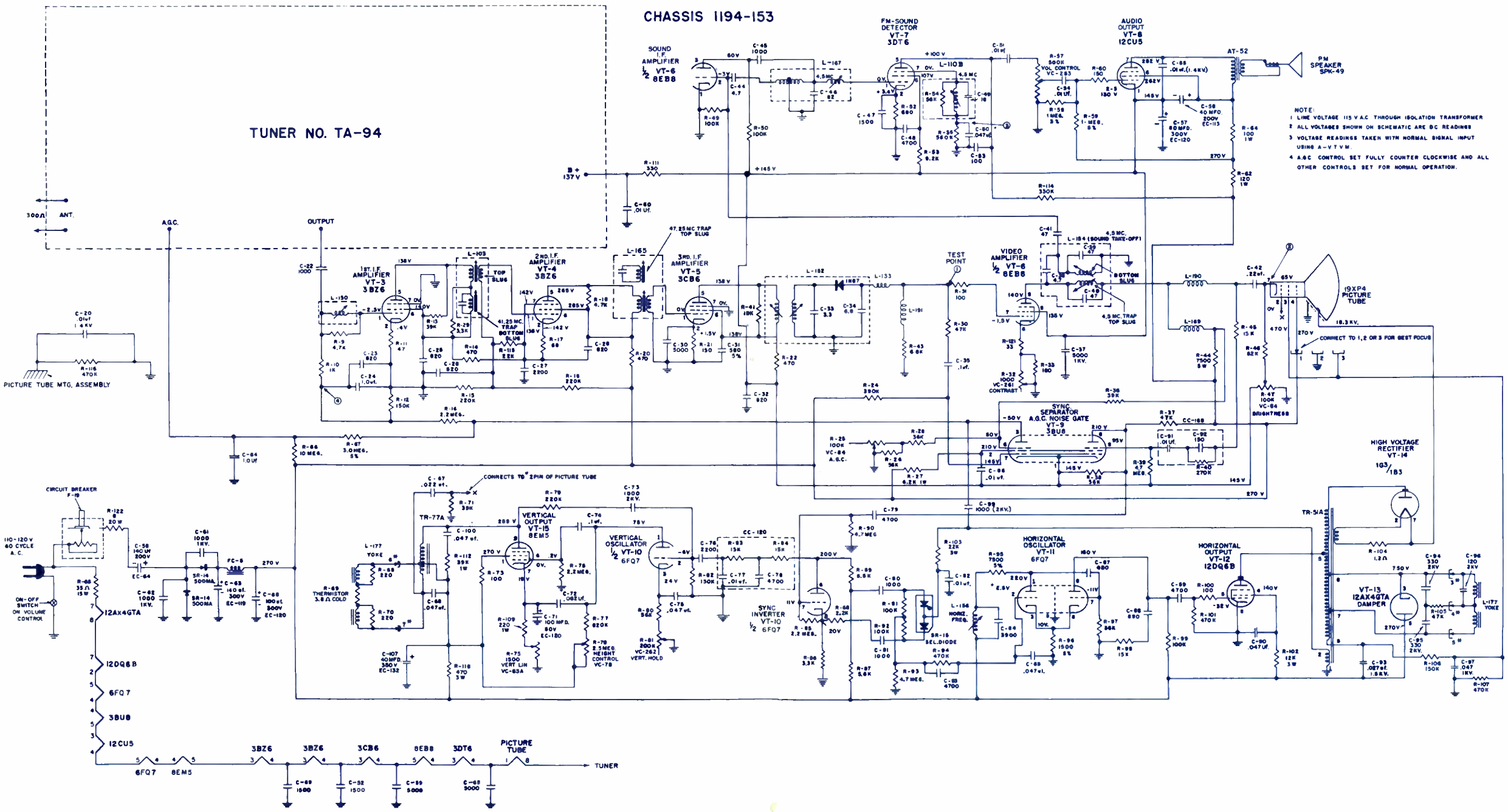
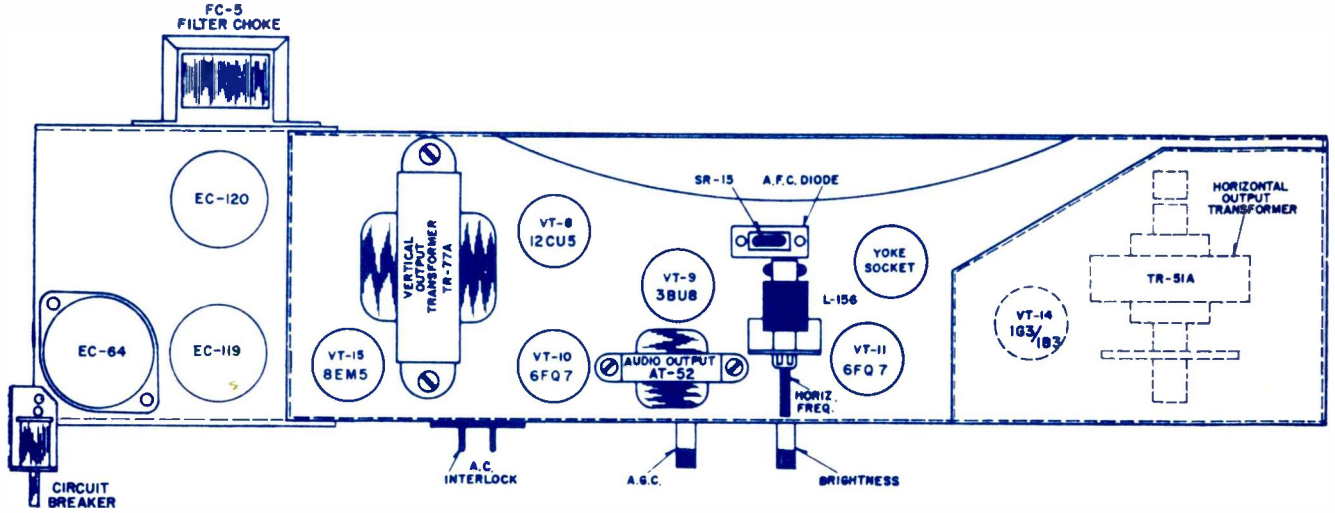
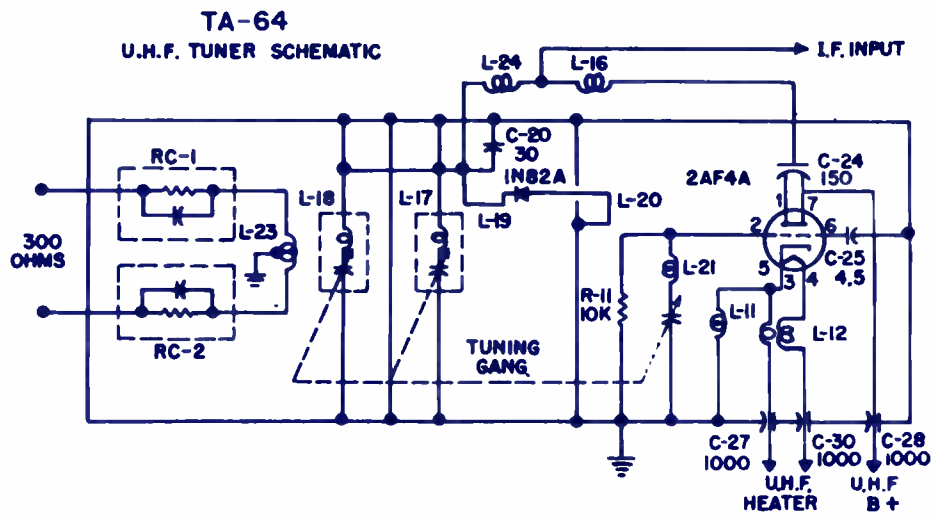
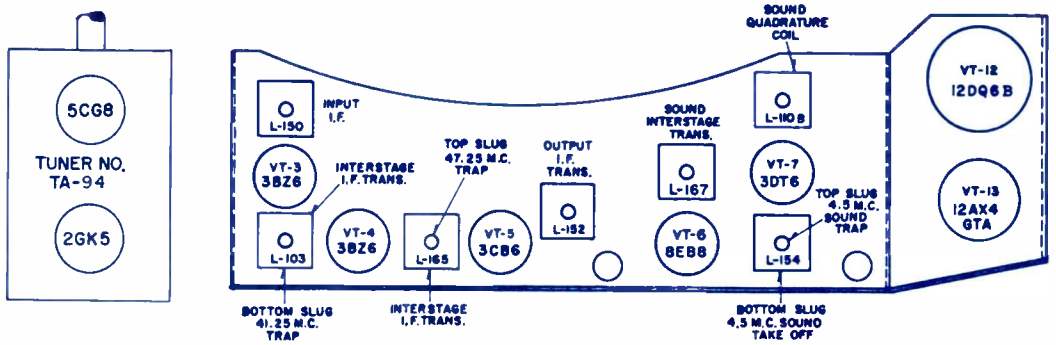


Figure 6 Video I.F. Phased Pattern



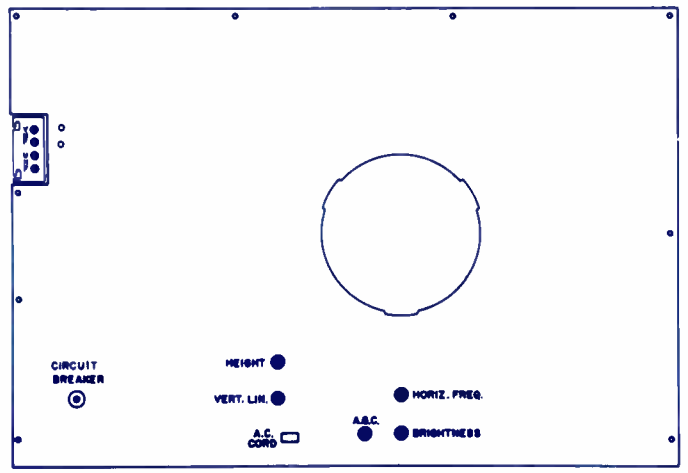


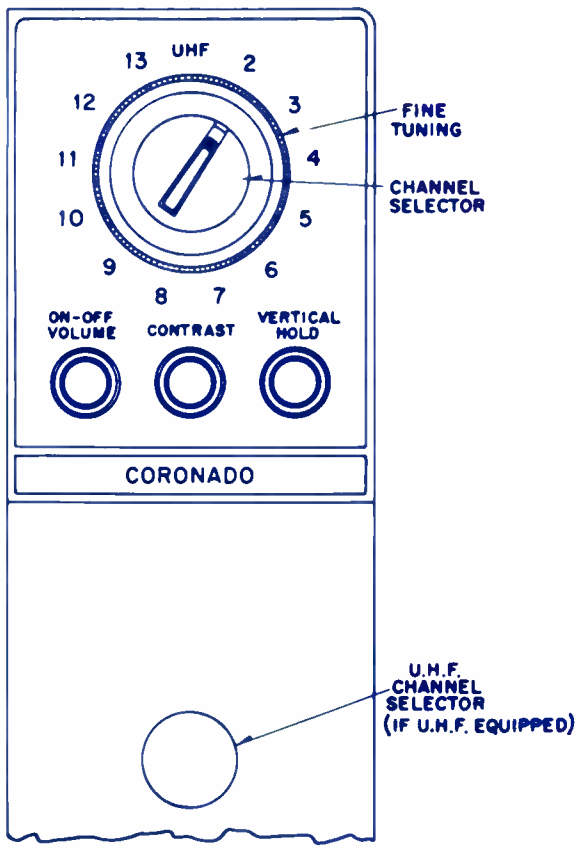




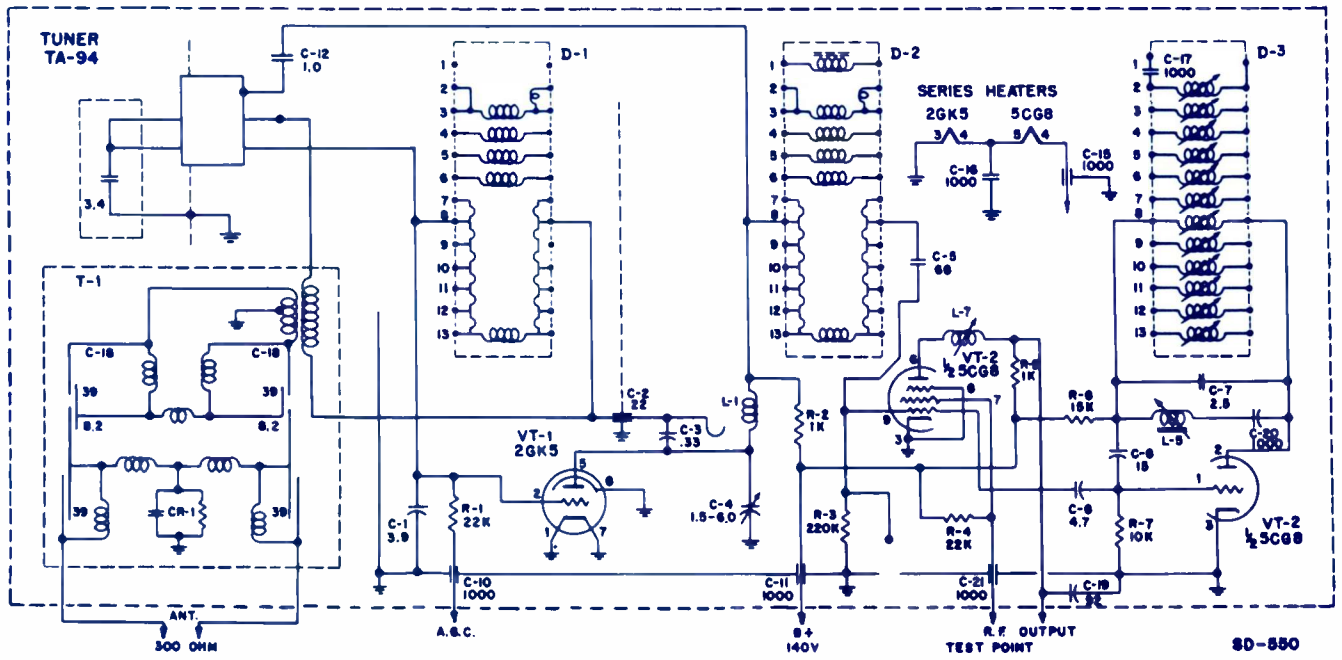
Coronado
Chassis 1197-153
Model TV 17-9386A

ELECTRONIC TECHNICIAN
TEKFAX
860





July 1964



861

General Electric
DA Chassis

ELECTRONIC TECHNICIAN TEKFAX

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

July 1964

1. ALL VOLTAGE MEASUREMENTS MADE WITH A VACUUM TUBE VOLTMETER IN RESPECT TO CHASSIS GROUND, WITH RECEIVER CONTROLS SET FOR NORMAL OPERATION.
2. WITH LINE VOLTAGE MAINTAINED AT 120V AC. MEASUREMENTS SHOWN MAY DEVIATE ±10%
3. VOLTAGES SHOWN IN BLACK MADE WITH THE SELECTOR KNOB SWITCHED TO A CHANNEL WITH NO SIGNAL AND THE ANTENNA TERMINALS SHORTED.
4. WHERE VOLTAGE IN RED IS NOT SHOWN, VOLTAGE IN BLACK IS SAME EITHER ON SIGNAL OR OFF SIGNAL.

ON-SIGNAL VOLTAGE & WAVE SHAPES SHOWN IN RED TAKEN WITH A NOISE FREE SIGNAL PRODUCING -2.5 TO -3.5 VOLTS AGC AT VHF TUNER FINE TUNING CONTROL ADJUSTED FOR MAXIMUM AGC.

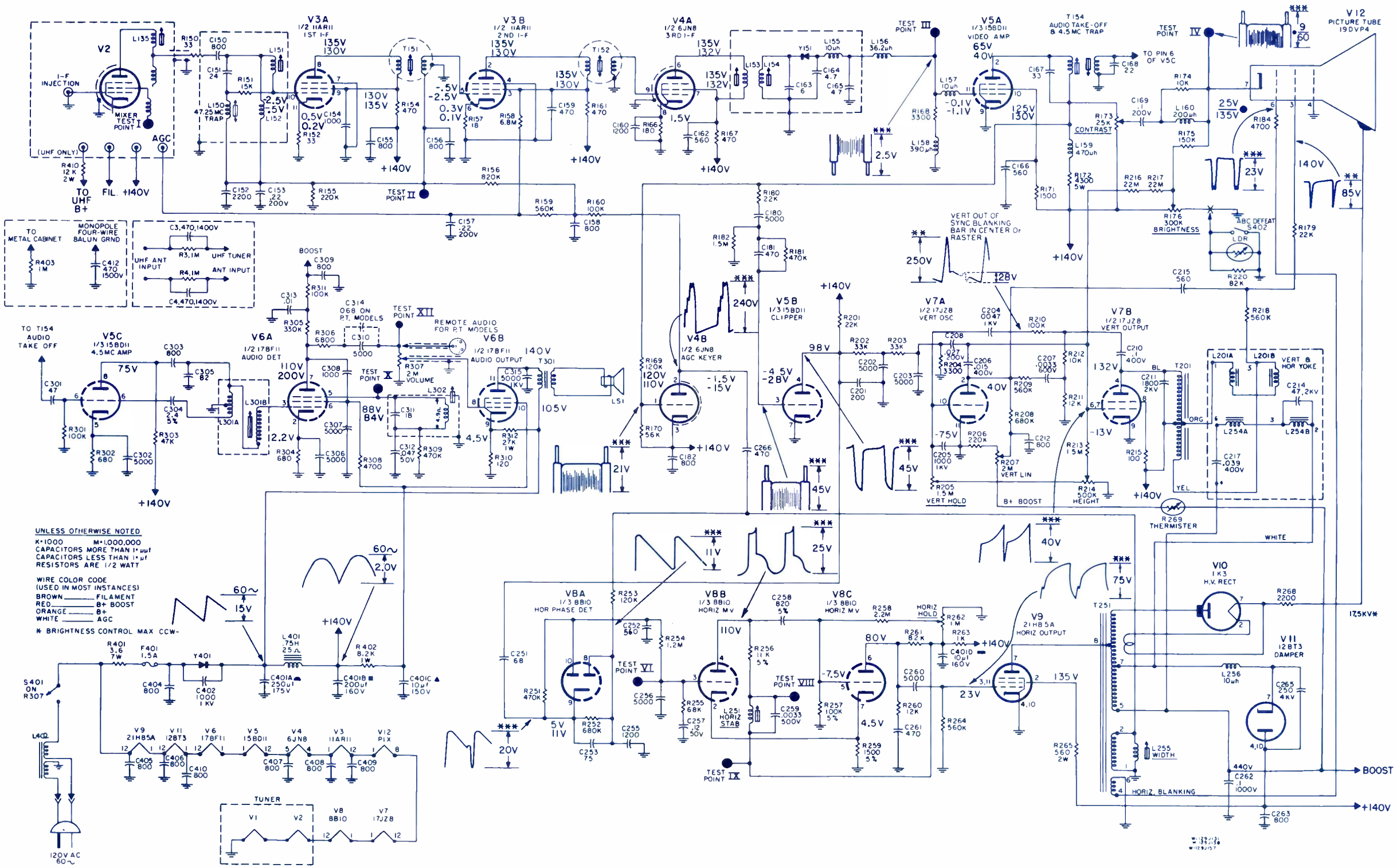
ALL OTHER CONTROLS ARE ADJUSTED FOR NORMAL OPERATION.

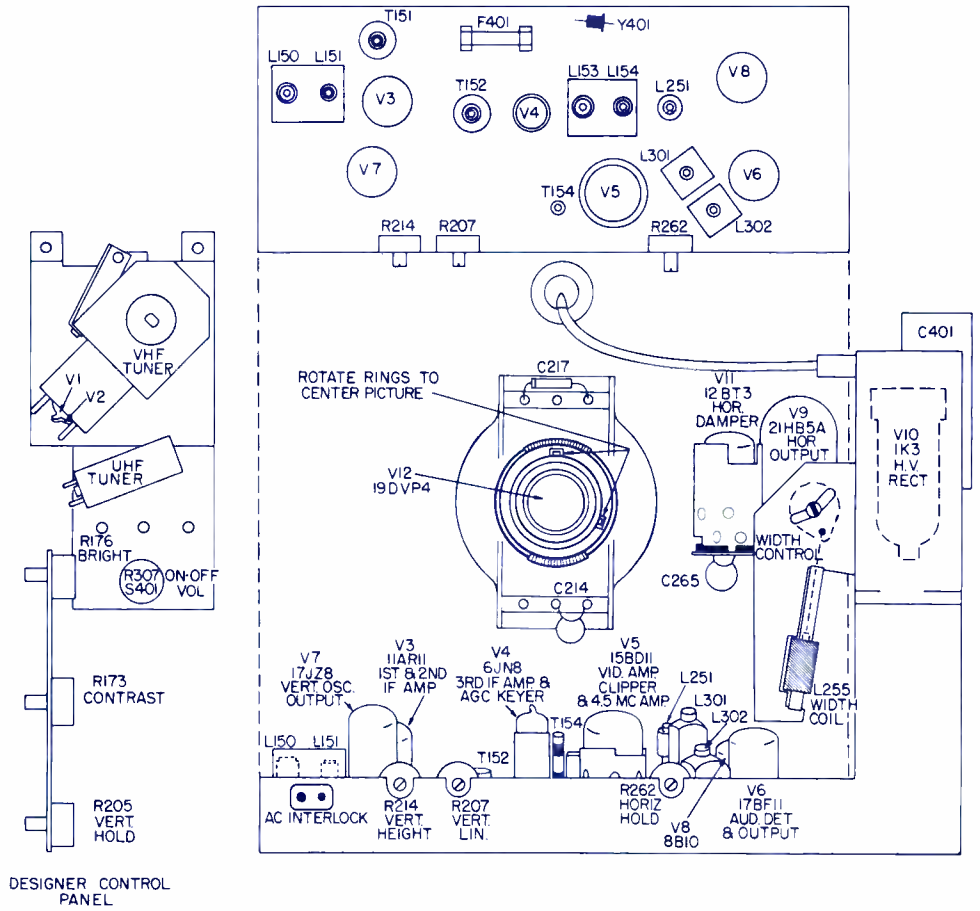
** SCOPE SYNCED AT 1/2 VERT FREQUENCY

*** SCOPE SYNCED AT 1/2 HORIZ. FREQUENCY

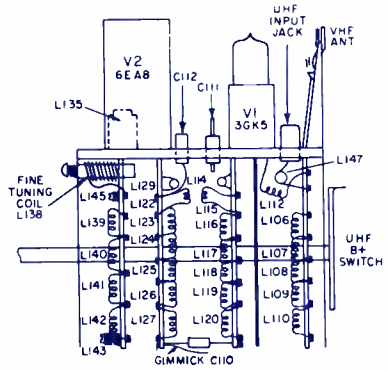
● VARIES WITH CONTROL SETTINGS

✱ INDICATES PRODUCTION CHANGE

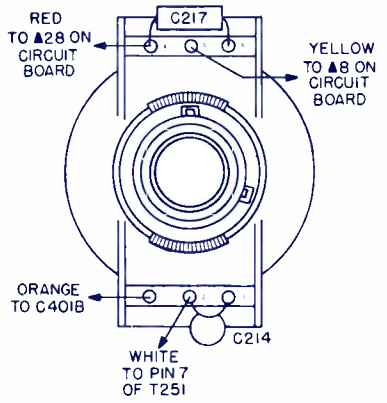




DESIGNER CONTROL PANEL



ADJUSTMENT LOCATIONS

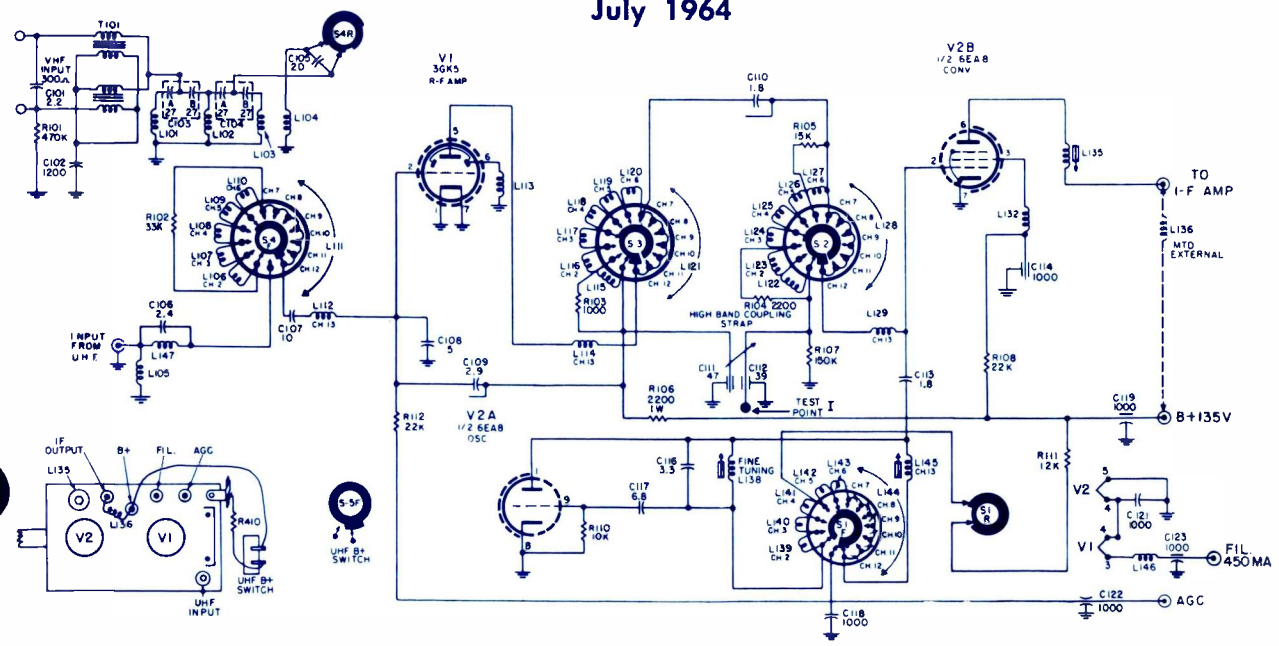


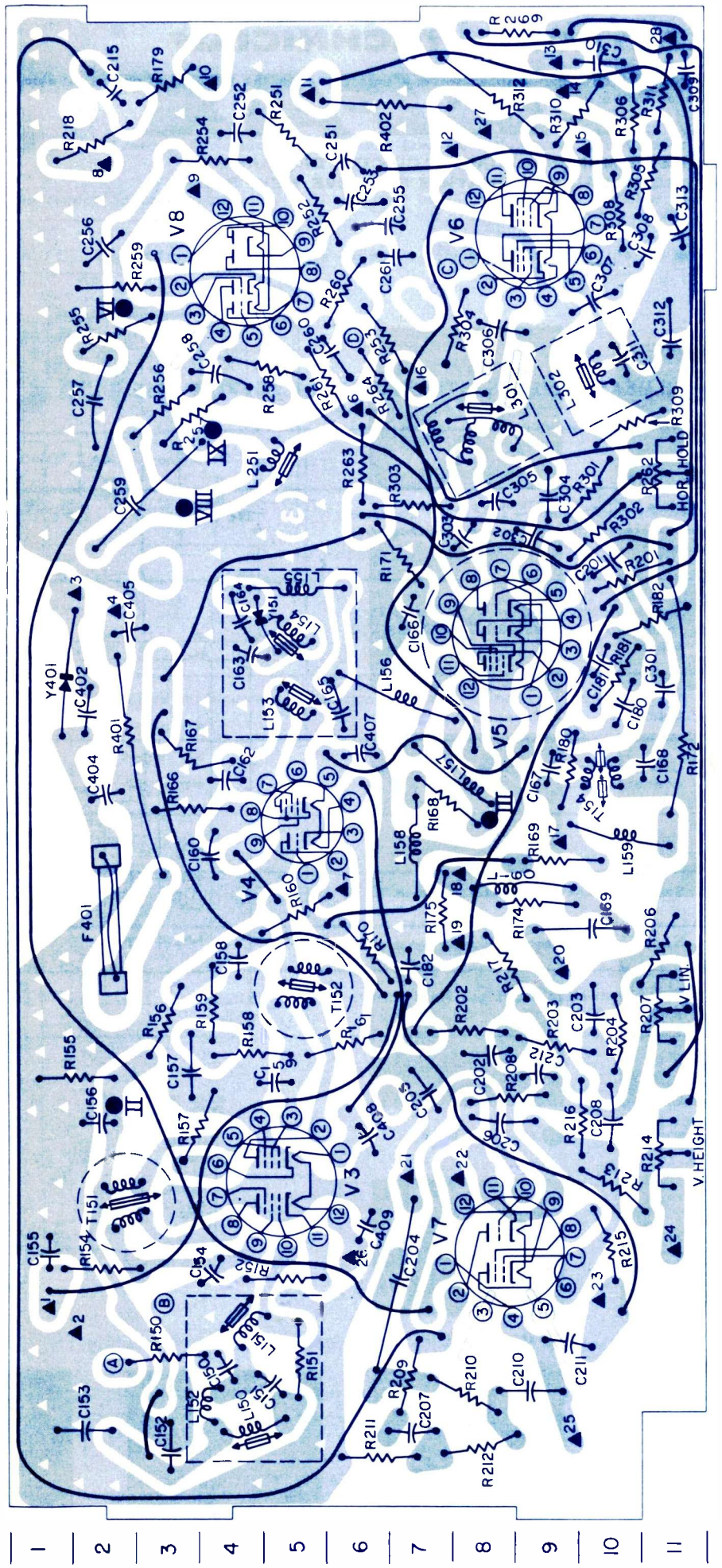
YOKE WIRING

General Electric
DA Chassis

ELECTRONIC TECHNICIAN
TEKFAX
861

July 1964





COMPONENT VIEW OF CIRCUIT BOARD

COMPONENT LOCATION

RESISTORS

R150—B3	R171—J7	R211—A6	R260—M6
R151—B5	R172—I11	R212—A8	R261—L5
R152—C5	R173—G9	R213—D10	R263—L6
R154—C2	R174—G9	R215—C10	R264—L6
R155—E1	R175—G7	R216—E9	R269—P8
R156—F3	R179—P3	R217—F8	R301—K9
R157—D3	R180—H9	R218—O2	R302—K10
R158—E4	R181—I10	R251—O5	R303—K7
R159—F4	R182—J10	R252—N5	R304—M7
R160—G5	R201—J10	R253—M6	R305—N10
R161—E6	R202—F8	R254—O3	R306—O10
R166—H3	R203—E9	R255—M2	R308—N10
R167—H3	R204—E10	R256—L3	R309—L10
R168—H7	R206—F11	R257—L3	R310—O9
R169—G9	R208—E8	R258—L5	R311—P11
R170—F6	R209—B7	R259—M2	R312—O8
	R210—B8		

CAPACITORS

C150—B4	C167—H9	C211—B9	C304—K9
C151—B5	C168—H10	C212—E9	C305—K8
C152—A3	C169—G9	C215—O2	C306—M8
C153—A1	C180—I10	C251—O6	C307—M9
C154—C4	C181—I10	C252—O4	C308—N10
C155—C1	C182—F7	C253—N6	C309—P11
C156—E2	C201—J10	C255—N6	C310—P10
C202—E8	C256—N2	C311—M10	
C157—E3	C203—F10	C257—L2	C312—M11
C158—F4	C204—C6	C258—L4	C313—N11
C159—E5	C205—E7	C259—K2	C402—I2
C160—G4	C206—E8	C260—M6	C404—H2
C162—H4	C207—A7	C261—N6	C405—J2
C163—I4	C208—E10	C301—I11	C407—H6
C164—J4	C209—C6	C302—K9	C408—D6
C165—I6	C210—B9	C303—K7	
C166—J7			

COILS

L150—A4	L159—G10	
L151—B5	L160—G8	
L152—B4	L251—L5	
L153—I5	L301—L8	
L154—J5	L302—L10	
L155—J5	T151—D2	
L156—I7	T152—F5	
L157—H7	T154—H10	
L158—H7		

MISC.

F401—G2	
Y151—J4	
Y401—I1	
V3 —D5	
V4 —H5	
V5 —J8	
V6 —N8	
V7 —C8	
V8 —N4	

TEST POINTS

II —E2	
III —H8	
VI —M2	
VIII—K3	
IX —L4	

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Philco
Chassis 14N50

ELECTRONIC TECHNICIAN TEKFAX

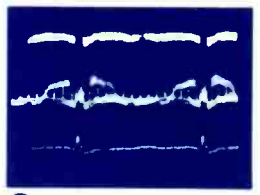
COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR FIVE NEW SETS

July 1964

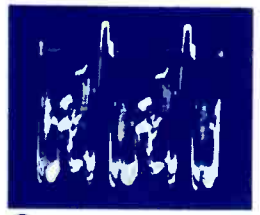
NOTES:

1. ALL VOLTAGES TAKEN UNDER NO SIGNAL CONDITIONS. ANTENNA REMOVED AND TUNER OFF CHANNEL.
2. VOLTAGES MEASURED WITH A 'PRECISION MODEL 88' VTVM FROM POINT INDICATED TO CHASSIS GROUND.
3. VOLTAGES MARKED ▲ WERE TAKEN UNDER AVERAGE SIGNAL CONDITIONS. ANTENNA CONNECTED, TUNER ON ACTIVE CHANNEL AND ALL CONTROLS SET FOR NORMAL PICTURE VIEWING.
4. COIL RESISTANCES READ WITH COIL IN CIRCUIT EXCEPT FOR: A.O.T. SECONDARY, HORZ. AND VERT. YOKE WHERE THE COMPONENTS WERE DISCONNECTED AND MEASURED INDIVIDUALLY.
5. BALLOONS 1, 2, ETC. SHOWN ON SCHEMATIC INDICATE WAVEFORM TEST POINTS.
6. CONTROL SETTINGS
   VOLUME - MINIMUM
   CONTRAST - MID-RANGE
   BRIGHTNESS - MID-RANGE
   ALL OTHER CONTROLS SET FOR NORMAL OPERATION.

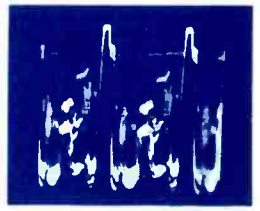
1 2.5 volts p/p, 15,750 c.p.s. (max. contrast)



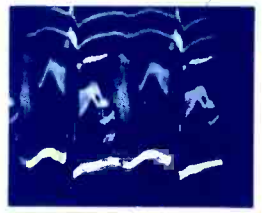
2 2.5 volts p/p, 60 c.p.s. (max. contrast)



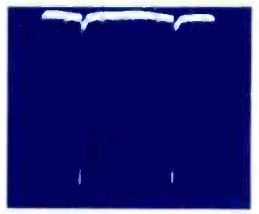
3 100 volts p/p, 15,750 c.p.s.



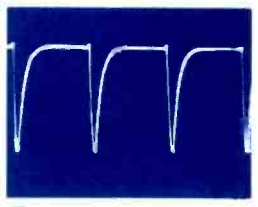
4 60 volts p/p, 15,750 c.p.s.



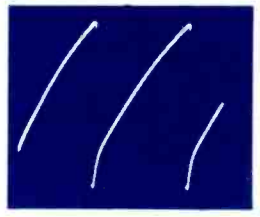
5 60 volts p/p, 60 c.p.s.



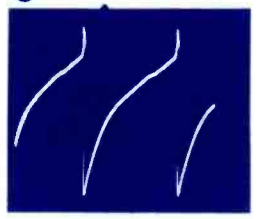
6 43 volts p/p, 60 c.p.s.



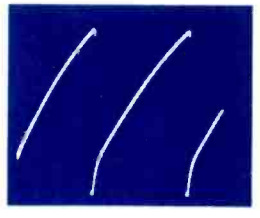
7 43 volts p/p, 15,750 c.p.s.



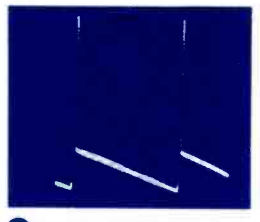
8 45 volts p/p, 60 c.p.s.



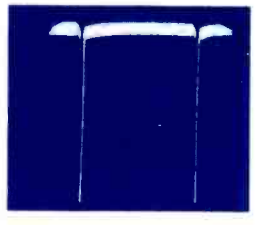
9 80 volts p/p, 60 c.p.s.



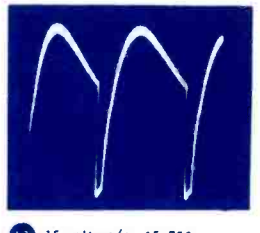
10 45 volts p/p, 60 c.p.s.



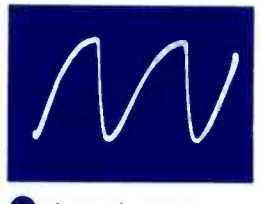
11 1000 volts p/p, 60 c.p.s. total - sawtooth 220 volts p/p



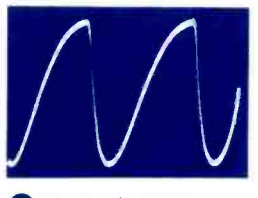
12 62 volts p/p, 60 c.p.s.



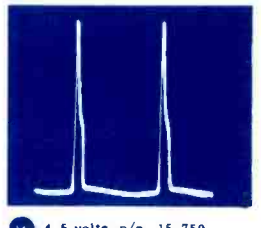
13 15 volts p/p, 15,750 c.p.s.



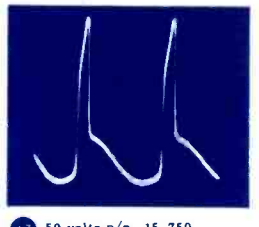
14 18 volts p/p, 15,750 c.p.s.



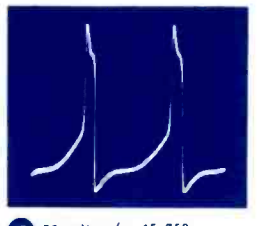
15 20 volts p/p, 15,750 c.p.s.



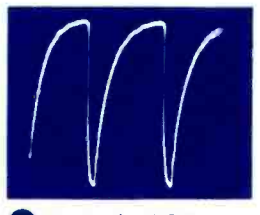
16 4.5 volts p/p, 15,750 c.p.s.



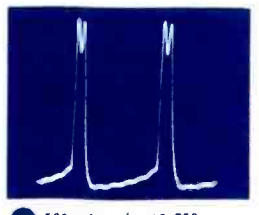
17 50 volts p/p, 15,750 c.p.s.



18 50 volts p/p, 15,750 c.p.s.

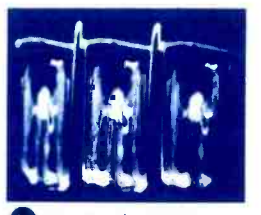


19 91 volts p/p, 15,750 c.p.s.



20 560 volts p/p, 15,750 c.p.s.

21 36 volts p/p, 15,750 c.p.s.



22 20 volts p/p, 15,750 c.p.s.

LEGEND FOR PERMA-CIRCUIT PANEL

- HORIZONTAL CIRCUITS
- SOUND I.F. DETECTOR AND AUDIO CIRCUITS
- VIDEO AND AGC CIRCUITS
- VIDEO I.F. CIRCUITS
- VERTICAL CIRCUITS
- SYNC SEPARATOR AND NOISE INVERTER CIRCUITS

Philco
Chassis 14N50

ELECTRONIC TECHNICIAN
TEKFAX
862

RESISTANCE CHART - 14N50

		PIN NUMBERS											
TUBE	USE	1	2	3	4	5	6	7	8	9	10	11	12
V1 6JZ8	Audio Out AGC Gate	FIL.	1.1 MEGΩ	10KΩ	11KΩ	11KΩ	200K	200K	14K	390Ω	28K	10K	FIL.
V2 6FQ7	Horz. Osc.	26KΩ	1.8MΩ	820Ω	FIL.	FIL.	39K	90K	820Ω				
V3 6EH7	1st VIF	24Ω	310KΩ	24Ω	FIL	FIL.	GND.	11KΩ	30KΩ	GND.			
V4 6CS6	Sound Disc	5.5Ω	560Ω	FIL.	FIL.	800KΩ	11K	3.5Ω					
V5 6JZ8	Vert. Osc. Vert. Out.	0Ω	2.6 MEGΩ	INF.	10KΩ	FIL.	1.3 MEGΩ	1.3 MEGΩ	11KΩ	GND.	250KΩ	GND.	FIL.

		PIN NUMBERS											
TUBE	USE	1	2	3	4	5	6	7	8	9	10	11	12
V6 6GY5	Horz. Out.	FIL.	INF.	10.5KΩ	GND.	INF.	10.5KΩ	10.5KΩ	10.5KΩ	680KΩ	GND.	10.5KΩ	FIL.
V7 6EJ7	2nd VIF	100Ω		100Ω	FIL.	FIL.	GND.			GND.			
V8 6GH8	Sound IF & N.I.	37KΩ	0Ω	13KΩ	FIL.	FIL.	13KΩ	220Ω	3.6KΩ	2.6MΩ			
V9 6BE3	Damper	FIL.		0Ω	10K	INF.				10K			FIL.
V10 6L88	Video Out. Sync Sep.	GND.	1.7 MEGΩ	12KΩ	FIL.	FIL.	GND.	90Ω	29KΩ	15KΩ			

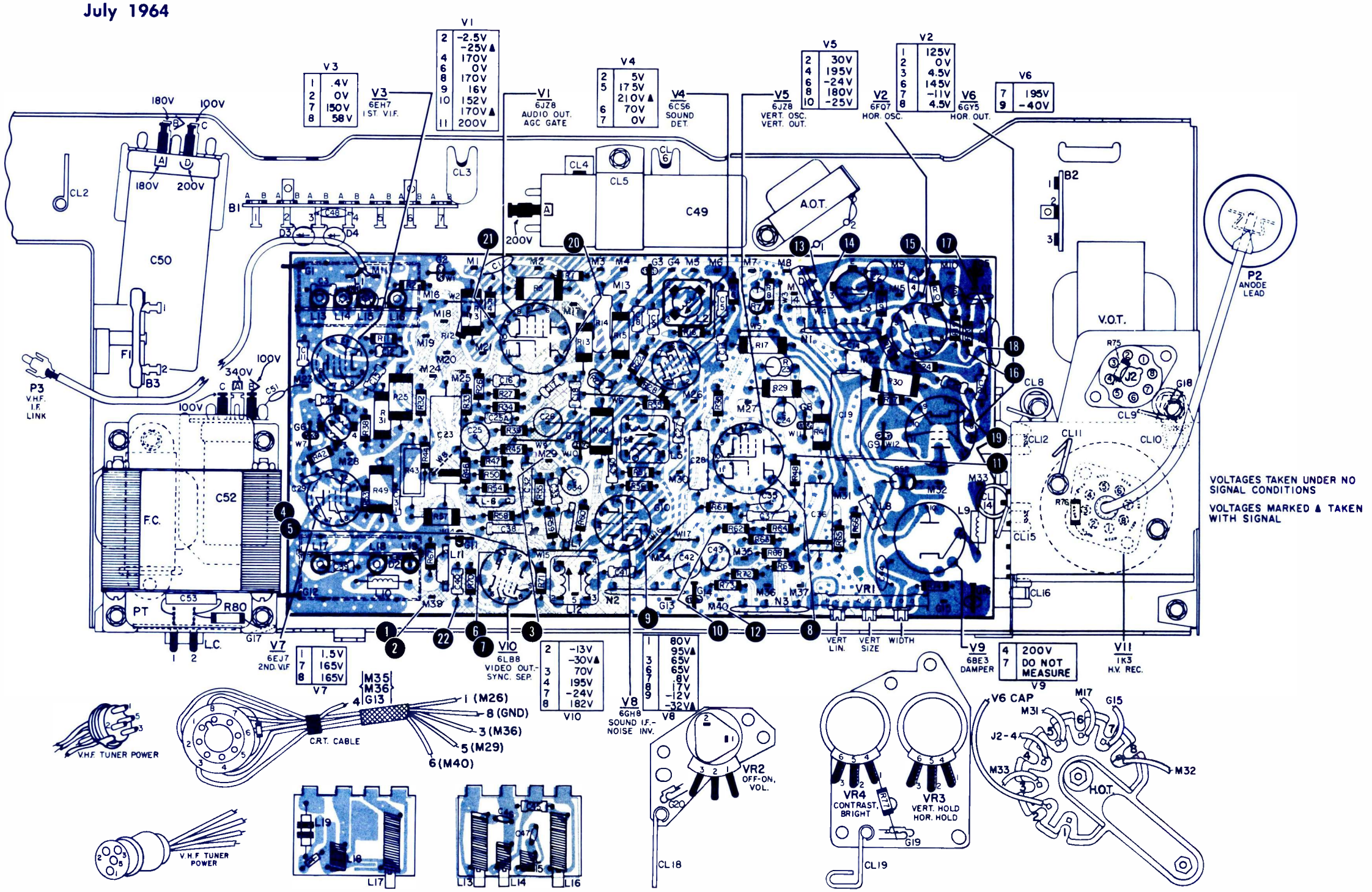
PANEL LUG CONNECTIONS - 14N50

M1 RED LEAD TO A.O.T.
M2 BLUE LEAD TO A.O.T.
M3 GREEN LEAD TO VOL. CONT. C.T.
M4 LEAD TO TUNER PWR. PLUG
M5 BLUE LEAD TO VOL. CONT.
M6 LEAD TO C52A
M7 LEAD TO VERT. HOLD CONT.
M8 RED LEAD FROM V.O.T. - LEAD TO PIN 6 OF YOKE SOCKET
M9 HORZ. OSC. TEST POINT
M10 LEAD TO HORZ. HOLD CONT.
M11 I-F INPUT CABLE
M13 LEAD TO TUNER PWR. PLUG
M14 SYNC TEST POINT
M15 LEAD TO C50A
M16 LEAD TO C50D
M17 LEAD TO PIN 6 H.O.T.
M18 LEAD TO CONTRAST CONTROL C.T. - LEAD TO C52B
M19 LEAD TO BRIGHTNESS CONTROL C.T.
M20 I-F TEST POINT
M21 LEAD TO C52C
M22 LEAD TO M26
M23 LEAD TO B1.7
M24 LEAD TO CONTRAST CONT.
M25 LEAD TO TUNER PWR. PLUG
M26 LEAD TO M22 - LEAD TO B1.7
M27 BLUE LEAD FROM V.O.T.
M28 2ND VIF TEST POINT
M29 LEAD TO CRT CATHODE
M30 LEAD TO GND. G10
M31 LEAD TO PIN 5 H.O.T.
M32 LEAD TO PIN 8 H.O.T.
M33 LEAD TO PIN 3 H.O.T.
M34 LEAD TO CRT FILAMENT
M35 LEAD TO CRT FOCUS GRID
M36 LEAD TO CRT G2
M37 LEAD TO VERT. HOLD CONT. C.T.
M39 2ND DET. TEST POINT
M40 LEAD TO CRT G1

LEADS PART OF PANEL

M19 TO R65
R41 TO VR1 (VERT. SIZE)
PIN 3 OF V10 TO N2

July 1964



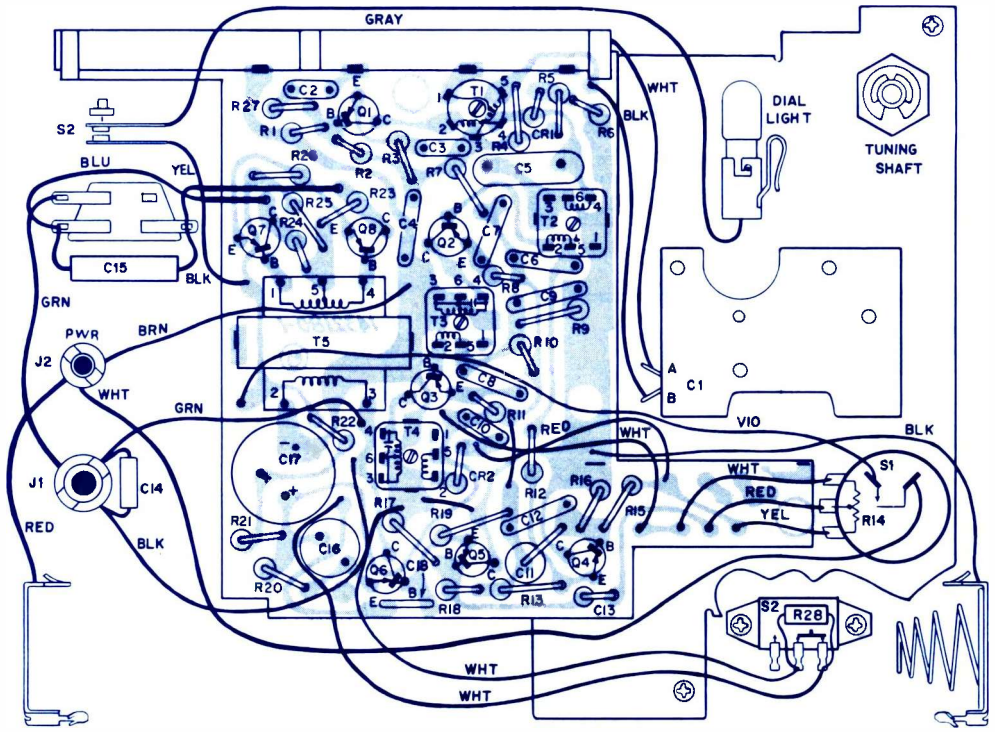
863

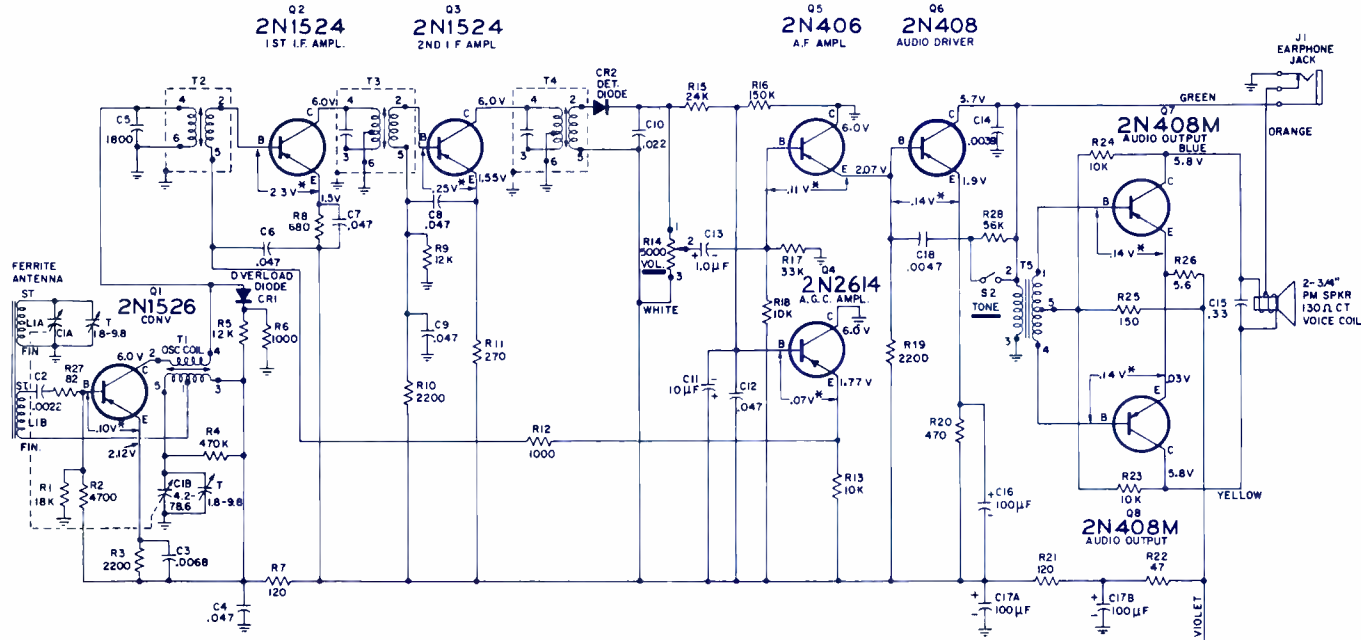
ELECTRONIC TECHNICIAN TEKFAX

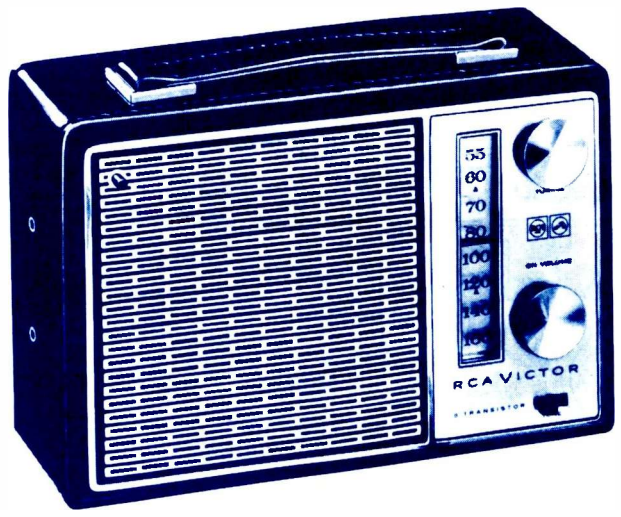
COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR FIVE NEW SETS

RCA
Transistor Radio
Chassis RC-1216
Model RFG35

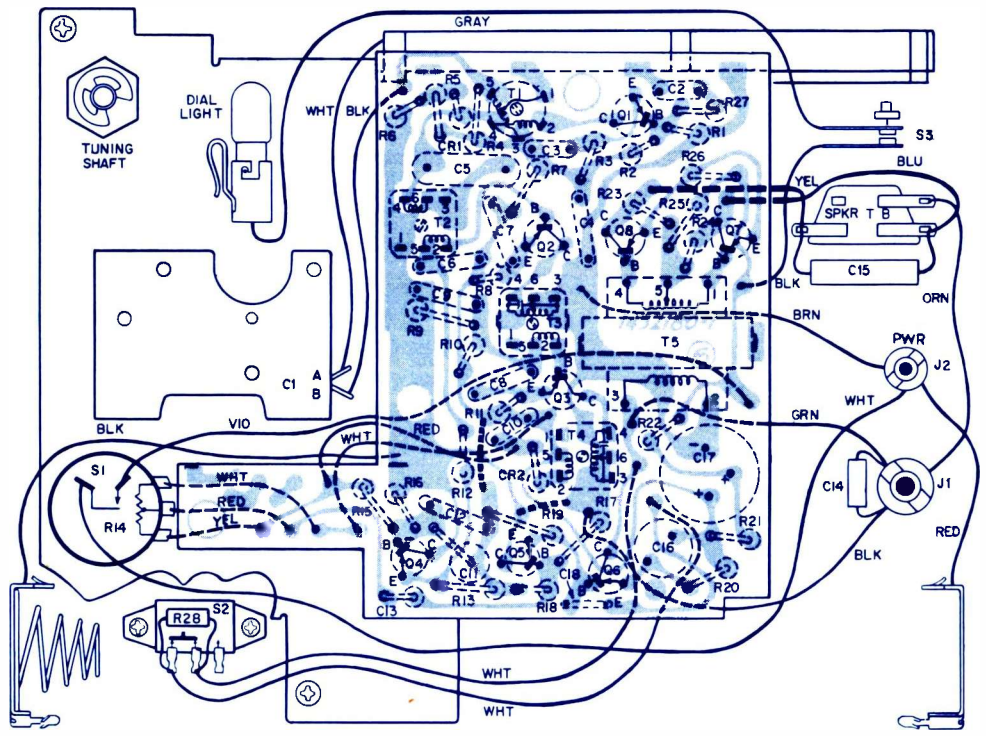
July 1964







Step	Connect Signal Generator To—	Signal Gen. Output—	Dial Setting	Adjust— for maximum
1	Loop of wire placed near antenna	455 kc	Fully Open	T4 (3rd IF)
2				T3 (2nd IF)
3				T2 (1st IF)
4		Repeat steps 1, 2 and 3		
5		1620 kc	Fully open	C1B-T (ocs. trimmer)
6		1400 kc	1400 kc (Rock gang)	C1A-T (ant. trimmer)
7		600 kc	600 kc (Rock gang)	T1
8	Repeat steps 5, 6 and 7			



Any type of TV lead-in...

BELDEN makes it!

Your BELDEN distributor has it!

PERMOHM* 8285 . . excellent for color TV. Gives stronger, clearer UHF and VHF signals under conditions of extreme salt spray, industrial contamination, rain, and snow. 300 Ohm.

WELDOHM 8230 . . resists pulling, whipping, twisting. Weldohm has two and a half times the flexing life, and one and a half times the breaking strength of ordinary 300 ohm lead-in.

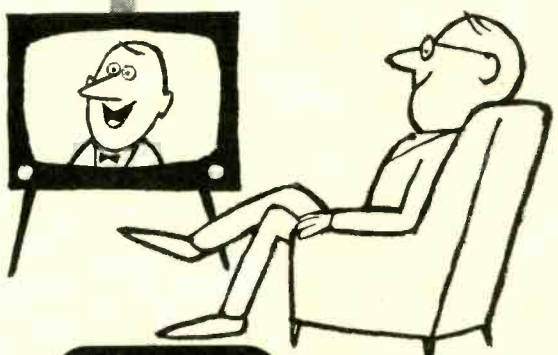
COAXIAL TRANSMISSION LINES—RG/U AND FOAM RG/U TYPES . . low-loss signal transmission for multiple TV installations such as motels.

STANDARD 300 OHM LINE 8225 . . low losses at high frequencies. Well suited for use with FM receiving antennas.

CELLULINE* 8275 . . installs easily . . no end sealing necessary. Has excellent resistance to sun, abrasion, and wind. Delivers strong UHF and VHF signals. 300 Ohm.

DECORATOR CABLE 8226 . . for interiors . . neutral color blends into decor of any room. No dark brown color to contrast with light carpets or walls. 300 Ohm.

Your Belden distributor has a complete line of Belden TV lead-in cable . . . in standard lengths for easy handling. He also carries microphone and shielded power supply cables; hi-fi, stereo, and phonograph cables; power supply cords; multi-conductor portable cordage; antenna rotor cables; hook-up wire; TV and cheater cords; aluminum ground wire . . . plus many other related items.



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WIREMAKER FOR INDUSTRY
SINCE 1902 — CHICAGO

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8-9-3

cord sets and portable cables • electrical household cords • magnet wire • lead wire • automotive wire and cable • welding cable

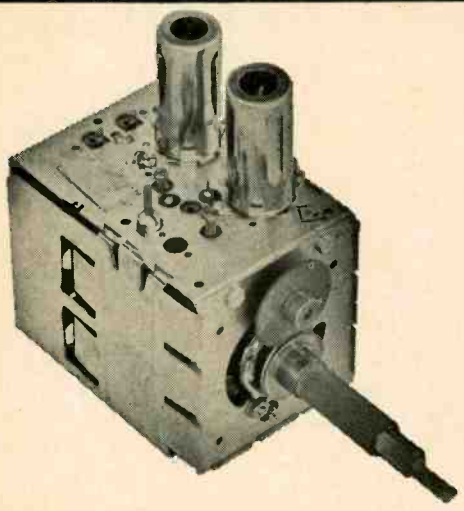
- - - for more details circle 16 on post card

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

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Bloomington, Indiana	North Hollywood, Calif.
Tel: 332-6055	Tel: 769-2720

SARKES TARZIAN, INC.

Bloomington, Indiana

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

JULY 1964
VOL. 80 NO. 1

ELECTRONIC TECHNICIAN

WORLD'S LARGEST ELECTRONIC TRADE CIRCULATION

AN OJIBWAY PUBLICATION

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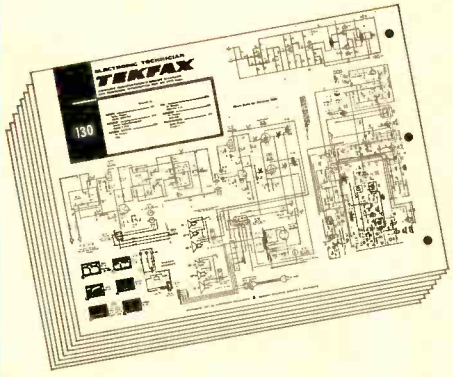
FEATURES

DEPARTMENTS

TEKFAX ..... 16 PAGES OF LATEST SCHEMATICS



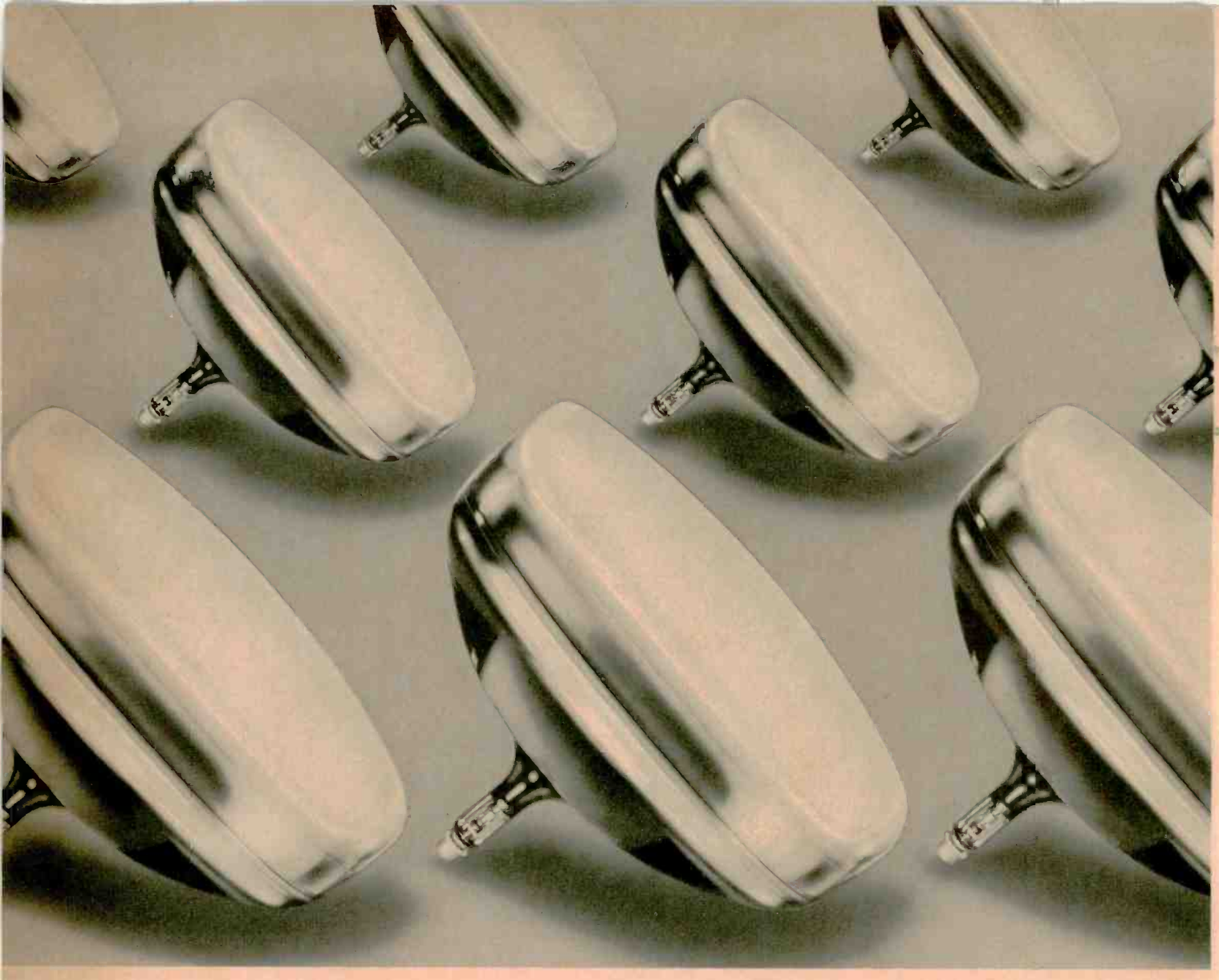
CORONADO: Chassis 1197-153, Model TU17-9386A

GENERAL ELECTRIC: DA Chassis

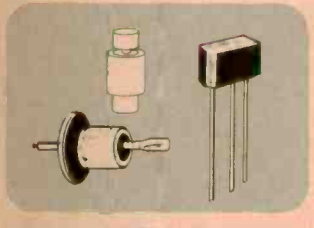
PHILCO: Chassis 14N50

RCA: Transistor Radio, Chassis RC-1216 Model RFG35

SYLVANIA: Stereo Hi Fi, Chassis 406-3 Model 45P36



THE QUALITY OF YOUR SERVICE DEPENDS ON THE PARTS YOU USE...DEPEND



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Complete variety for all makes and models.

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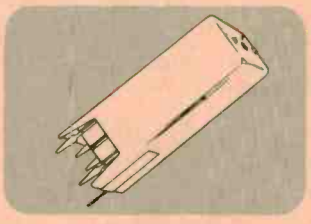
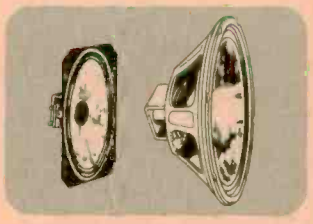


I.F. Transformers
For printed circuits, 4 lug, 5 lug or 6 lug types . . . to fit Philco or other makes. Dependable Philco Quality.



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All sizes, round, oval or rectangular types. 3.2, 8, 16, 20 ohms. From tiny 1¾" to giant 15" sizes.

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To fit any make, any model TV or radio, manufactured to exact Philco standards, thoroughly inspected. Original factory cartons.

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High gain type with 6 position switch for best possible signal selectivity. 3 section brass dipoles. Padded cast iron base.

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Philco TV and Radio Contact and Control Cleaner, Lubricant in self spray can, complete with protective cap and spray nozzle.

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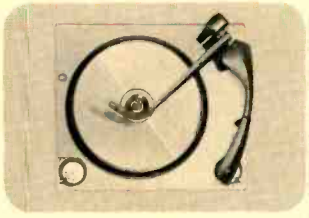
Every CR Tube you replace represents a high-dollar service sale for you . . . and your customer. Play it safe with a brand that's known for Quality . . . PHILCO. All material and parts used in the manufacture of Philco Star Bright 20/20 Picture Tubes are new except for the envelope, which prior to reuse, has been inspected and tested to the same standards as new envelopes.

ON YOUR PHILCO DISTRIBUTOR FOR ALL YOUR PARTS AND ACCESSORIES



M62A 4-speed Record Changer
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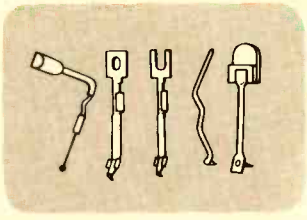

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LETTERS TO THE EDITOR

Needs Schematic

Can you tell me where I can get a schematic of an Electronamic tube tester? It is a series 910 serial No. 15049 made by the Precision Apparatus Company. I have one in for repair.

VOIL MORSE
Lincoln, Calif.

More CB

I think the magazine serves the industry well. I would like very much to see more articles on 2-way CB radio and please begin to include CB schematics in the TEK-FAX section.

ERIC W. WILDER
Needham, Mass.

Wrong Polarity

In the May, 1964 issue, page 66, on "Wrong Polarity": how can the car battery be charged on reverse polarity? Also, the car generator would discharge the battery. Something does not appear correct here.

It would appear some leads were changed to cause the radio trouble.

HAROLD A. BRANDHORST
Lynbrook, N. Y.

Actually, reverse charging a battery is possible. The voltage regulator also plays a part, so the generator does not "discharge" the battery.—Ed.

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

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

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LETTERS TO THE EDITOR

Thanks

Many thanks for your excellent magazine. This is my first subscription, and I don't see how I could have been without a copy this long.

For the money, "ET" is the best, and I enjoy reading each and every page.

GENE STATON

Kokomo, Ind.

BOOK REVIEWS

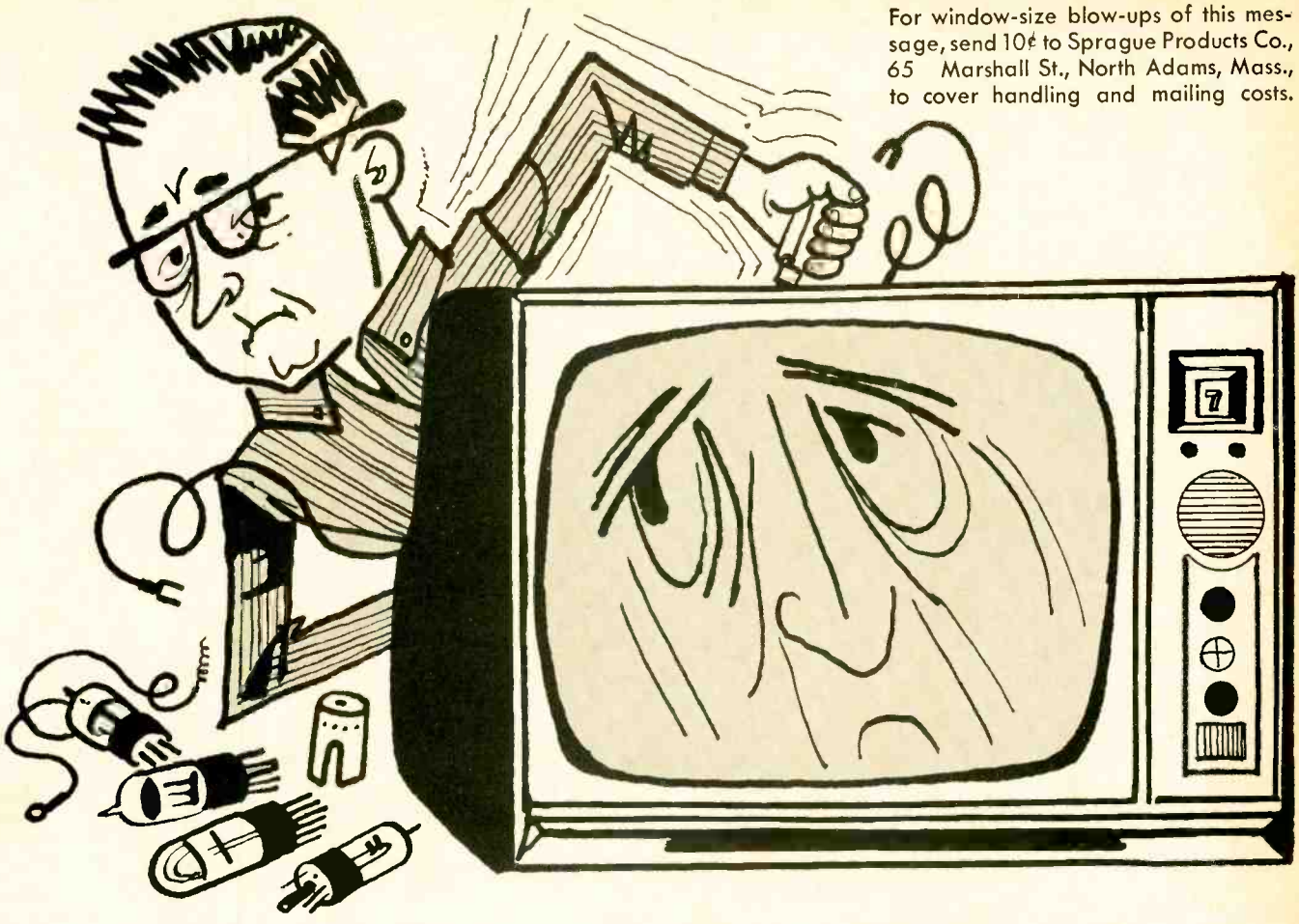
MASTER CARTRIDGE SUBSTITUTION GUIDEBOOK. *By Jack Strong. Published by John F. Rider Publisher, Inc. 86 pages, soft cover. $2.00.*

This is a handy little book which contains a phonograph cartridge cross reference guide, phonograph cartridge directory and a listing of miscellaneous phono names and their cartridges. It gives helpful introductory explanations to the cross reference guide and the cartridge directory. A final section lists equivalent trade names and manufacturers' names.

BATTERY APPLICATIONS AND ENGINEERING DATA BOOK. *Published by Battery Engineering Dept., Union Carbide Corp., Consumer Products Division, 270 Park Avenue, New York, N. Y. 10017. 500 pages, soft cover.*

This book, over 500 pages in length, is the most complete reference guide to dry batteries ever assembled. It is *free* if requested on your company letterhead. It contains basic data on carbon-zinc (Leclanche Primary); alkaline-manganese (Primary and Rechargeable); silver (Primary); nickel-cadmium (Rechargeable) and mercury (Primary) electrochemical systems. It also includes physical specifications, service life data and cross reference information on the company's complete line of batteries.

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



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

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

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

BUT HAS IT?

The self-service test instrument checks *tubes*. It can't test the *more than 500 other parts* in your set! It can't show you the *source* of the trouble that probably blew the tube. Neither can it show the damage often suffered by other parts due to the faulty tube.

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

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

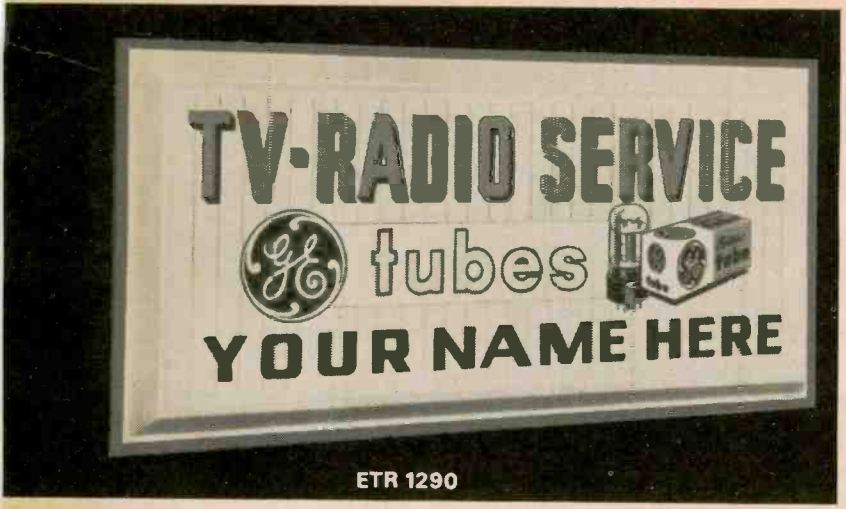
Your TV set is the most complicated device you own—far more complex than even your automobile. When you need TV service, call an expert technician—your fully trained and experienced Independent Service Dealer.

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

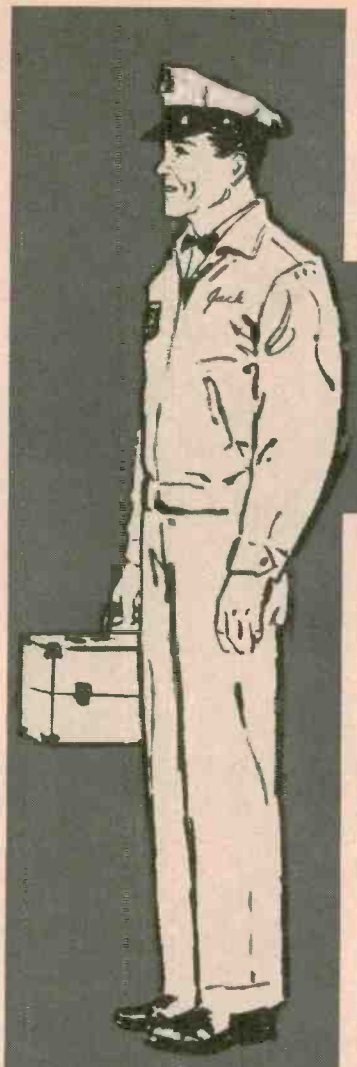
THIS MESSAGE WAS PREPARED BY SPRAGUE PRODUCTS COMPANY,
DISTRIBUTORS' SUPPLY SUBSIDIARY OF SPRAGUE ELECTRIC COMPANY, NORTH ADAMS, MASSACHUSETTS FOR . . .

YOUR INDEPENDENT TV-RADIO SERVICE DEALER

- - - for more details circle 39 on post card



ETR 1290



ALL Radio-TV service clothing

ETR 3287

ETR 1566

ETR 1291

ETR 1564

ETR 1569

ETR 3288

ETR 1565

ETR 1568

ETR 1556

G-E FIX-UP, DRESS-UP

Be "Best Dressed" at half the catalog price!

The better your shop looks, the better is the outlook for business. Customers prefer to do business at a shop that has a neat, "careful" look. It gives them confidence in your work. But time and use *can* and *do* affect appearance.

It may be just that time—when your outdoor signs are looking a bit under the weather, or perhaps you could use a display clock or thermometer to functionally dress up your shop. Need a new service hat or jacket?

For a limited time, General Electric is sponsoring a "Fix-up, Dress-up" campaign to make you, the dealer, "best dressed" at half price. Choose from over 25 items, including signs and display materials, clocks and thermometers, and a complete selection of wearing apparel—hats, shirts, pants, caps, jackets—ALL AT 1/2 THEIR CATALOG PRICE. All special-priced display and clothing items may be obtained on a cash basis by mail or directly from your distributor with the purchase of G-E tubes.

CHOOSE FROM THESE ITEMS:

		Catalog Price	Special Price
ETR 1290	SIGN, outdoor, illum., 2 face, 24″ x 48″	$168.75	$84.37
ETR 1566	SIGN, nameplate, outdoor, 2 face, 48″ x 36″	27.00	13.50
ETR 1565	SIGN, flange, outdoor, 2 face, 15″ x 12″	2.25	1.13
ETR 1564	SIGN, tack-on, outdoor, 14″ x 42″	2.70	1.35
ETR 1556	SIGN, indoor, with changeable letter kit (37″ x 14″)	27.50	13.75
ETR 1291	CLOCK, indoor, illum., 16″ dia.	14.95	7.48
ETR 1568	THERMOMETER, indoor/outdoor, 12″ dia.	5.95	2.98
ETR 1569	BACKDROP, corrugated, 36″ x 24″ (2 per carton)	2.00	1.00
ETR 3288	TUBE CARTON, giant, 7 1/8″ x 17 5/8″	.35	.18
ETR 3287	DECAL, 1 side, back stick, 16″ x 12″	.25	.13

AND

You may use form ETR 1499B for ordering *any* radio-TV service clothing at half price. Obtain this form from your local distributor or complete and mail the coupon below. Please check the box requesting ETR 1499B.

Send To: General Electric Co., Dept. B
3800 N. Milwaukee Ave.
Chicago, Illinois 60641

*Name*_____

*Address*_____

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

I enclose $_____ in check or money order for the following half-price items, including applicable local and/or state sales/use taxes:

- ☐ ETR 1290
- ☐ ETR 1291
- ☐ ETR 1566
- ☐ ETR 1568
- ☐ ETR 1565
- ☐ ETR 1569
- ☐ ETR 1564
- ☐ ETR 3288
- ☐ ETR 1556
- ☐ ETR 3287

☐ Please send me service clothing order form ETR 1499B.

Progress Is Our Most Important Product

GENERAL ELECTRIC

- - - for more details circle 21 on post card

NEW LITERATURE

CAPACITORS 300

A revised catalog lists all types of aluminum electrolytic (both tubular and can) and Paper-Mylar capacitors. Special interchangeability section included. General Electric.

ANTENNAS 301

A professional base station catalog, designed for easy reference, lists a complete line of base station antennas. The Antenna Specialists.

PHOTOELECTRIC CONTROLLER 302

This four-page bulletin describes model RC-16 photoelectronic controller which operates in conjunction with any combination of many standard light sources and photo units. Photomation Inc.

CB MICROPHONES 303

A brochure features citizens band microphones. Turner.

SERVICE PUBLICATIONS 304

A four-page bulletin describes newly released 1964 "most-often-needed" radio and TV service manuals. Supreme Publications.

MASONRY TOOLS 305

A 14-page booklet, No. PL200A, contains detailed information and many illustrations on austempered steel fasteners, drop-in masonry anchors, industrial cartridges, fixtures, accessories, tools and tool kits. Ramset.

PHOTOELECTRIC CONTROLS 306

Catalog B provides complete technical details of a line of transistorized photoelectric controls including conveyor controls, 3-in-1 relay chassis (general-purpose, high-speed impulse, and time delay plug-in logic modules), and photoelectric 6-digit counter. Farmer Electric.

CAPACITORS 307

Capacitor assortments are described in this brochure for service technicians. Cornell-Dubilier.

OSCILLATORS 308

This four-page brochure describes low frequency tuning fork oscillators. Accutronics.

ANTENNAS 309

A catalog and informative literature describes a full line of TV/FM antennas. FINCO.

TOOLS 310

16-page catalog, specially created to assist engineers, and plant managers, includes a complete line of tools for servicing, adjusting, testing, trouble shooting, assembly and production-line work. Jonard.

SNIPS 311

An illustrated product bulletin contains description, photo and price information on electronic snips for cutting fine wire and filaments and stripping insulation in electronic assembly and service work. Xcelite.

MOVING?

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

fast, accurate, never lets you down . . .

NEW

IMPROVED

MIGHTY MITE!

New Burn-out, stick proof meter!

NEW

Lower voltage checks for Nuvistors and all new frame grid tubes, as demanded by tube manufacturers, but not found on other tube checkers.

NEW

Speedy indexed set-up cards to reduce "look-up" time. No more cumbersome booklets, or incomplete charts.

NEW

Simplified panel layout reduces set-up time — prevents set-up errors.

NEW

Streamline styling with rounded corners and rubber feet, prevents marring Furniture — presents that "Professional look".

NEW TC 130

only $74.50

Checks them all . . . including Novars, Compactrons, Nuvistors, 10 pin tubes — plus Picture Tubes!

Only 7 Lbs. . Smaller Than A Portable Typewriter

Here's the famous MIGHTY MITE, America's fastest selling tube checker, with an all-new look and many new exclusive features. MIGHTY MITE III brings you even greater portability, versatility and operating simplicity beyond comparison. Controls are set as fast and simply as A-B-C right from the speedy set-up cards in the cover. The new functional cover can be quickly removed and placed in a spot with more light for faster reading of the set-up data or "cradled" in the specially designed handle as a space saver as shown above. New unique design also prevents cover from shutting on fingers or cutting of line cords as in older models.

In a nut shell . . . the MIGHTY MITE III is so very popular because it checks for control grid contamination and gas just like the earlier "eye tube" gas checkers (100 megohm sensitivity) and then with a flick of a switch, checks the tube for inter-element shorts and cathode emission at full operating levels. Sencore calls this "*the stethoscope approach*" . . . as each element is checked individually to be sure that the tube is operating like new. User after user has helped coin the phrase "*this checker won't lie to me*". Most claim that it will outperform large mutual conductance testers costing hundreds of dollars more and is a real winner in finding those "tough dogs" in critical circuits such as color TV and FM stereo.

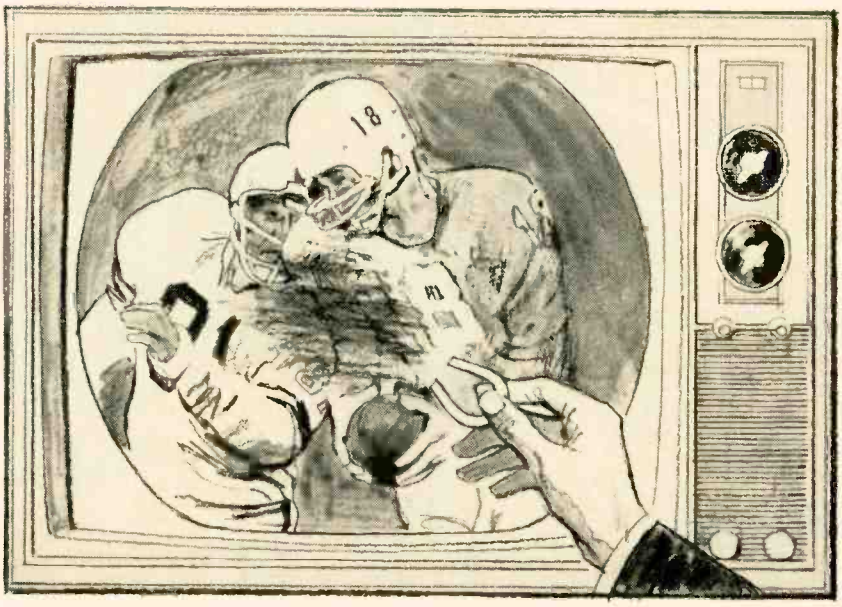
See Your Parts Distributor--And See The Mighty Mite III For Yourself!

SENCORE 426 SOUTH WESTGATE DRIVE ADDISON, ILLINOIS

- - - for more details circle 36 on post card

Available Now

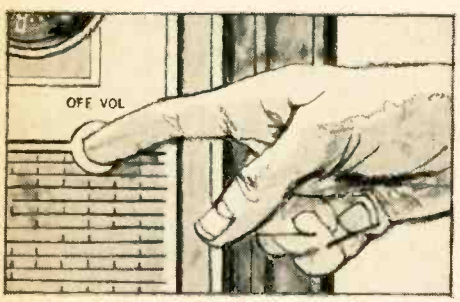
RCA Victor Color TV



Magnetism can cause impurities...

in the color picture—a weak pocket magnet can easily demonstrate this effect. In the home, as you know, magnetic distortions may be caused by moving the set in relation to the earth's magnetic field or they can sometimes be caused by nearby electric appliances.

To "cancel" the magnetism and restore natural color...



simply turn off the set, let it cool 4 or 5 minutes, then turn it back on. That's all—no more need for a separate degaussing coil! The RCA Victor Automatic Color Purifier acts *every time the set is turned on* from a cool start. Color is bright, sharp, true—free of impurities caused by magnetism. The RCA Victor Automatic Color Purifier also removes unwanted color areas from the black and white picture. Here's another major "first" from RCA Victor that can give you a profitable advantage in extra sales . . . and in service savings!

SEE WALT DISNEY'S "WONDERFUL WORLD OF COLOR," SUNDAYS, NBC-TV NETWORK

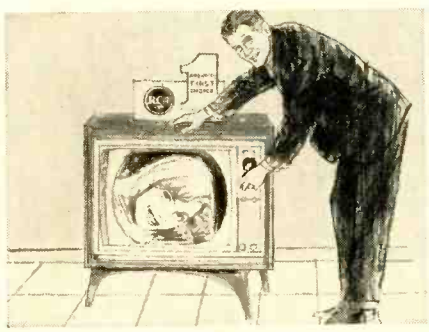
degausses itself!

Gives you 3 big advantages!

1

Floor models always ready for best color picture!

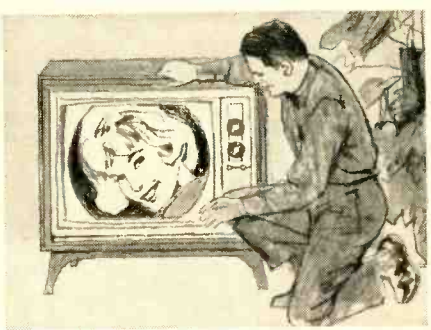
Ever lost a sale because your floor demonstrator needed degaussing? The RCA Victor Automatic Color Purifier cleans up that problem . . . the set always shows unsurpassed natural color. And with a swivel or caster model, you can quickly demonstrate how color TV can now be moved about without worry of magnetic distortion!



2

Faster, easier setup in customer's home!

The RCA Victor Automatic Color Purifier eliminates the need for you to perform time-consuming degaussing when you deliver the new Mark 10 color TV set. This makes setup faster, easier . . . freeing you for more profitable TV servicing. The Automatic Color Purifier is standard on all Mark 10 models except the price leaders.



3

Reduces unprofitable callbacks!

The RCA Victor Automatic Color Purifier will end those degaussing "nuisance" calls that can eat up service time and profits. They're a nuisance to customers, too! Increased customer satisfaction is sure to follow from this new RCA Victor "first"—and remember, a satisfied customer is very often your best salesman.

"HIS MASTER'S VOICE"

Make sure you get your share of the big Color TV sales forecast for '65...get with RCA Victor!

RCA The Most Trusted Name in Television

Tmk(s)®

SEE THE RCA COLOR TV CENTER AT THE WORLD'S FAIR

...for servicing and upgrading hi-fi and
stereo phonograph, radio and television sets

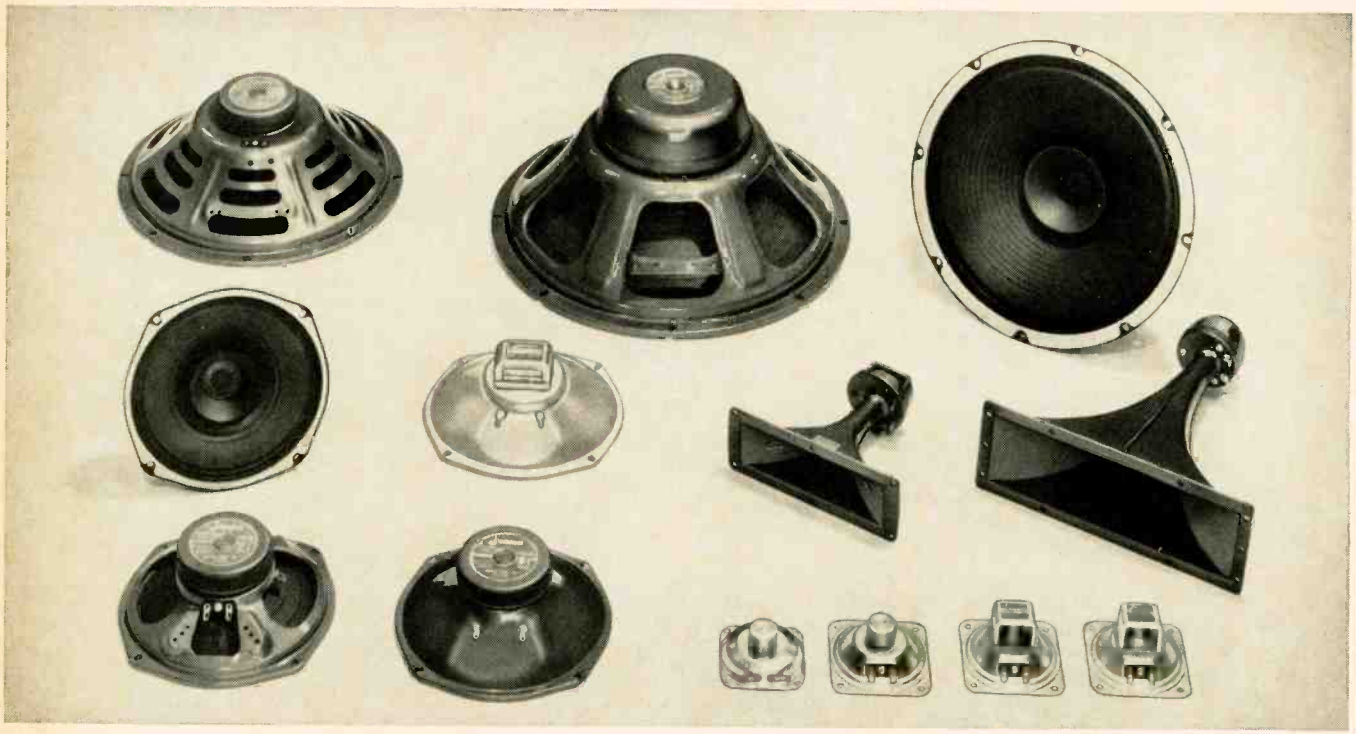
Here's the **NEW** Jensen
Concert Hi-Fi Replacement Series

Everything we have learned from years of engineering the world famous JENSEN High Fidelity loudspeakers . . . all of our design and production experience as suppliers of superior hi-fi speaker systems to makers of fine home entertainment equipment . . . all of this know-how has been brought to the new Jensen Hi-Fi Replacement Series.

This series offers for the first time full-range, woofer, midrange and tweeter units in sizes and types that simplify the service problem; many are available nowhere else.

It will pay to concentrate on Jensen, the most experienced producer of high fidelity loudspeakers. And the customers will be pleased, too.

Get the full story—send for Catalog 1090 today.



MODEL NO.	TYPE	SIZE	FREQUENCY RANGE	IMPED. OHMS	POWER RATING†	LIST PRICE
D-8R8	Full Range, Dual Cone	8"	50–14,000	8	12	$14.65
D-12R8	Full Range, Dual Cone	12"	40–13,000	8	14	18.25
W-8R8	Woofer	8"	45–2,000	8	20	13.65
W-12R8	Woofer	12"	35–2,000	8	25	17.75
W-15N8	Woofer	15"	30–2,000	8	30	56.25
M-8U8	Midrange, Closed-Back	8"	600–4,000	8	25	7.65
M-8R8	Midrange, Closed-Back	8"	600–4,000	8	30	14.00
T-3K78	Direct Radiator Tweeter	3"	2,000–15,000	8	15	4.95
T-35K78	Direct Radiator Tweeter	3½"	2,000–15,000	8	15	5.25
T-35W8	Direct Radiator Tweeter	3½"	2,000–15,000	8	15	5.50
T-35V8	Direct Radiator Tweeter	3½"	2,000–15,000	8	15	5.95
T-107	Compression Horn Tweeter	—	2,000–16,000	8	25	16.50
T-109	Compression Horn Tweeter	—	1,000–16,000	8	25	18.50

†Program rating. Peak power is twice the indicated figures.

JENSEN LOUDSPEAKERS

JENSEN MANUFACTURING COMPANY / DIVISION OF THE MUTER COMPANY / 6601 SOUTH LARAMIE AVENUE, CHICAGO 38, ILLINOIS
Canada: Radio Speakers of Canada, Ltd., Toronto • Argentina: Ucoa Radio, S. A., Buenos Aires • Mexico: Fapartel, S. A., Naucalpan, Mex.

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TECHNICAL DIGEST

GENERAL ELECTRIC

All Sets—Shorted Yokes

Although some chassis must be removed and taken to the service shop, most technicians prefer to repair a TV set in the customers home whenever possible. One service technique which works well without removing the chassis is determining whether the horizontal windings of the deflection yoke are defective.

Quite often a TV set will be encountered which has little or no high voltage. Through routine checks it is discovered that the set has no B+ boost voltage. Through experience you know that this can be caused by a shorted horizontal winding in the deflection yoke. Now if you could only determine in the customer's home that the yoke is the culprit, you wouldn't have to pull the chassis.

There *is* a way to tell if the yoke is defective. Remove the yoke from the neck of the CRT and with it still electrically connected to the set, lay it down beside the chassis where it will not accidentally short against the chassis or component. Plug the power cord into the chassis and let it warm up for two or three minutes. Now remove the power plug and feel around on the inside of the yoke windings. If a definite hot spot is found, the yoke has internal shorted turns and needs to be replaced.

CAUTION! Never touch the yoke or any high voltage component with power applied to the chassis.

Now you may wish to go one step further to definitely prove that the yoke is defective. Disconnect one of the wires going to the horizontal yoke windings to remove these windings from the circuit. Measure the B+ boost voltage and you will find that it has returned to normal or possibly higher since the deflection yoke has been removed from the circuit and normally is a load on the high voltage transformer.

This is just another simple method of performing service in the customer's home with the least inconvenience to the customer and a minimum of work for you.

MAGNAVOX

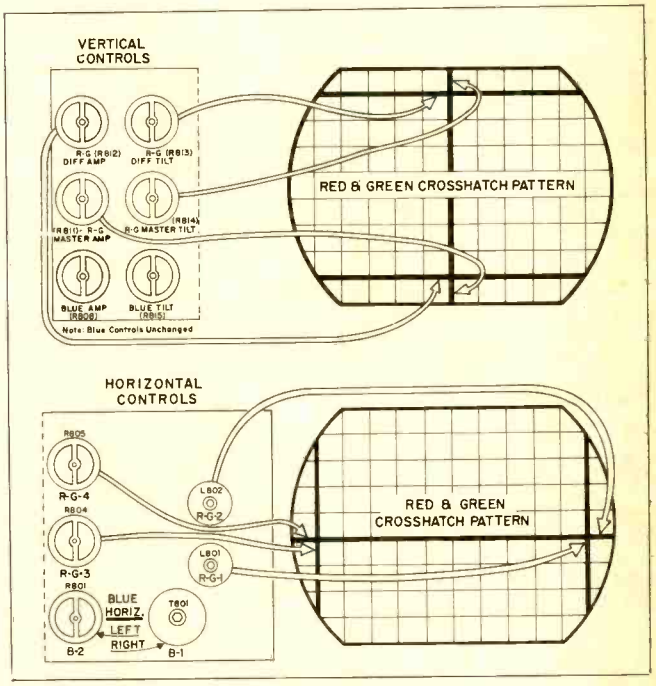
Combination, Model 1MV/U381 — AM radio Interference In TV Sound

Some comments have been received from the field indicating that the AM radio is not being completely disabled when the function switch is set to TV on this model. Technical service bulletin No. 63.11, November 1963 called attention to a production change made in the 75-09 radio chassis (used in the 381, Run 2) to insure cut-off of the B+ supply to the AM oscillator with the bandswitch in the TV position. Evidently a small quantity of these instruments were shipped prior to the change. This change in the 75-09 radio chassis can be made by transposing two leads at the bandswitch as follows: 1) The yellow lead coming from P609 on the FM stereo board must be removed from terminal 9 on section 2 of the bandswitch and connected instead to the terminal between 9 and 8. 2) The +135 v lead must be removed from the terminal between 9 and 8 on section 2 and connected instead to terminal 9.

RCA

Color TV Chassis CTC 15—Convergence

The CTC 15 convergence controls operate in a manner very similar to the previous CTC 12. Two improvements have been incorporated in this area, however. One is the addition of a clamp diode which gives better action to the vertical RG controls, and the other consists of a change in the placement of the



Convergence controls on RCA's CTC 15 color TV receiver and adjustment procedure with crosshatch pattern.

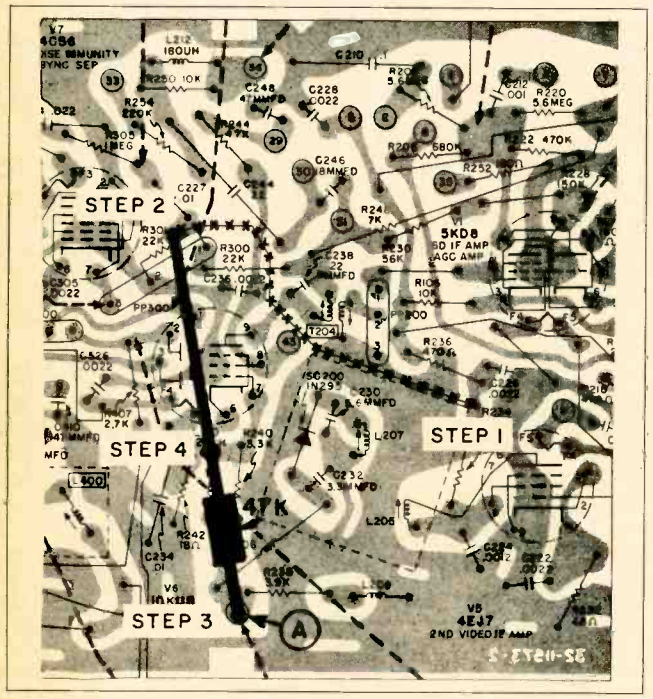
TECHNICAL DIGEST

horizontal RG 3 and RG 4 controls. With this layout the entire top row of controls are adjusted on the basis of horizontal lines of a crosshatch pattern and the entire second row are adjusted on the basis of vertical lines on the crosshatch pattern. The effect of the other controls remain the same as in the previous CTC 12 color TV chassis.

SYLVANIA

TV Chassis 573 19 in. Portable—Revisions in High Noise Impulse Areas

Some TV reception areas have sufficiently high noise impulse levels to cause the picture to momentarily pull down from the top of the CRT screen. This type of action on portable TV receivers incorporating



Step-by-step revisions made on Sylvania's chassis 573 in high noise impulse reception areas.

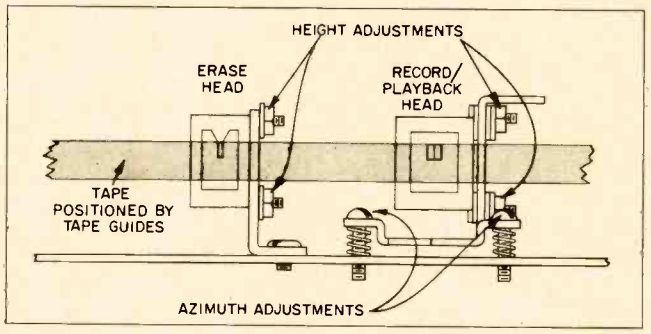
the 573 chassis can be cured by the following steps:

1. Unsolder the wire from R234 of the second IF amplifier.
2. Dress the wire through the hole adjacent to C227.
3. Solder one end of a 47K ¼ w resistor to point "A".
4. Connect the wire to the 47K ¼ w resistor and solder.

WESTINGHOUSE TAPE RECORDERS

H-21R, H-22RS, H-24RS, H-25R—Head Height and Azimuth Alignment

Every mechanical part of a tape recorder must work smoothly and at the correct speed. It will be up to service technicians to determine if adjustments



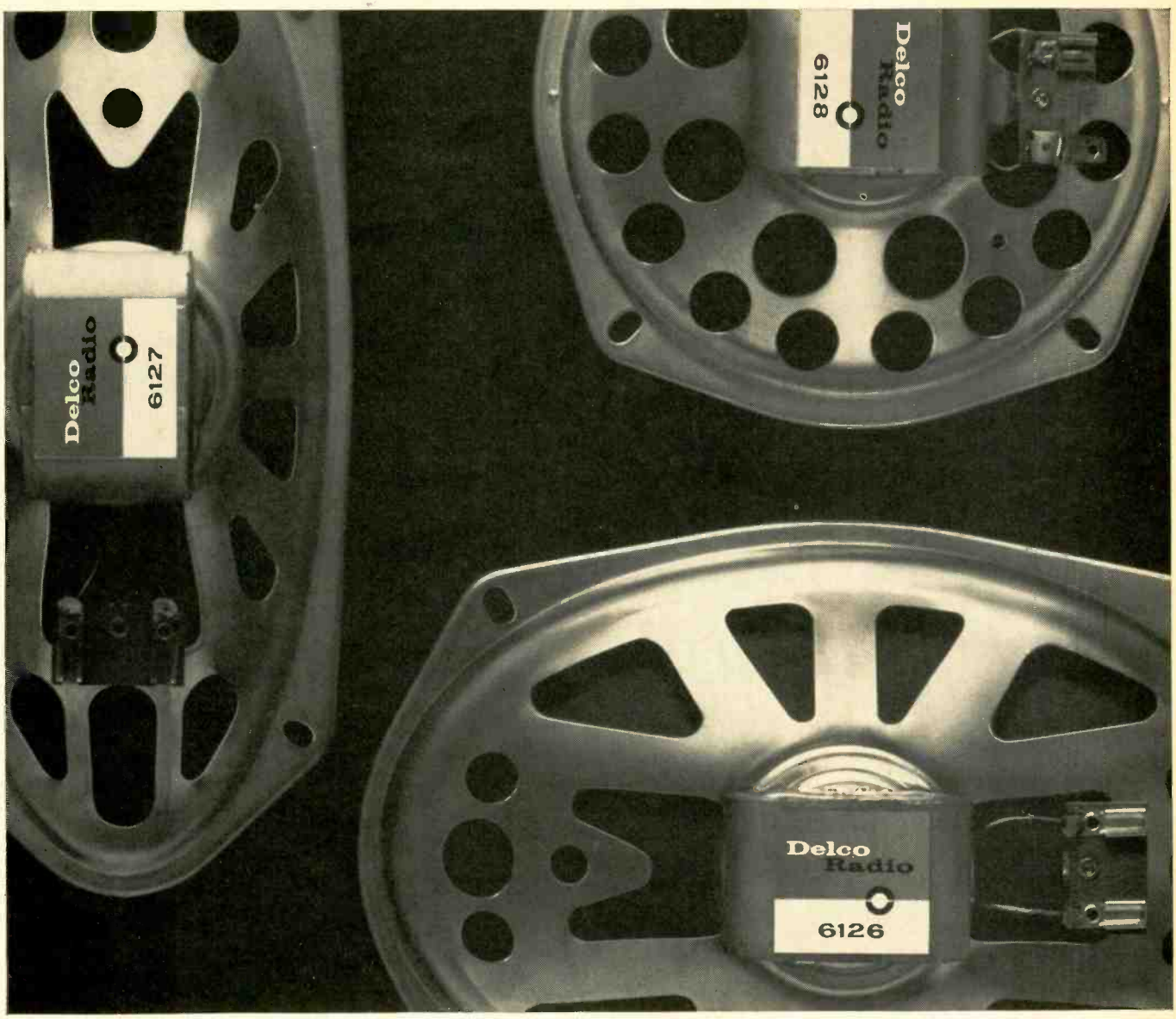
Head height and azimuth alignment points on Westinghouse tape recorders.

are to be made on components. Two adjustments are especially critical—head alignment and take-up clutch adjustment.

The head height and azimuth alignment do not have to be performed unless the heads or the brackets have been tampered with or they have been replaced. For head height, adjust the nuts as shown until the top edge of the pole is even with the top of the tape.

For azimuth alignment, play a test tape that contains a 5,000 cps test frequency. Adjust the three azimuth screws for maximum output.

If the take-up clutch adjusting screw is too tight the take-up reel will turn too fast. This may produce wow in the output and tape breakage. When the adjusting screw is too loose, there will be less tension on the tape and it may spill. The clutch assembly may be taken apart for cleaning or replacement of the clutch felt.



3 SPEAKERS REPLACE 23

These three Delco Radio 8-10-ohm replacement speakers permit you to cut your speaker inventory. They replace most units in current General Motors cars and many competitive makes. They install easily and quickly, take a "tip jack," "blade," or solder connection. Excellent for home hi-fi and TV sets, too! Speak up for the latest in replacement speakers. Call your United Delco supplier today.

Delco Radio Automotive Radio Service Parts and Electro-Mechanical Devices are distributed nationally through **United Delco**

THREE SPEAKERS, ALL WITH SLOTTED MOUNTING HOLES			
Number	Size	Magnet Wt.	Mounting
6126	6 x 9″	1.6 oz.	front/rear
6127	4 x 10″	1.6 oz.	front/rear
6128	6″ round	2.5 oz.	rear-seat

simply say Delco

DELCO RADIO, Division of General Motors, Kokomo, Indiana

United Delco

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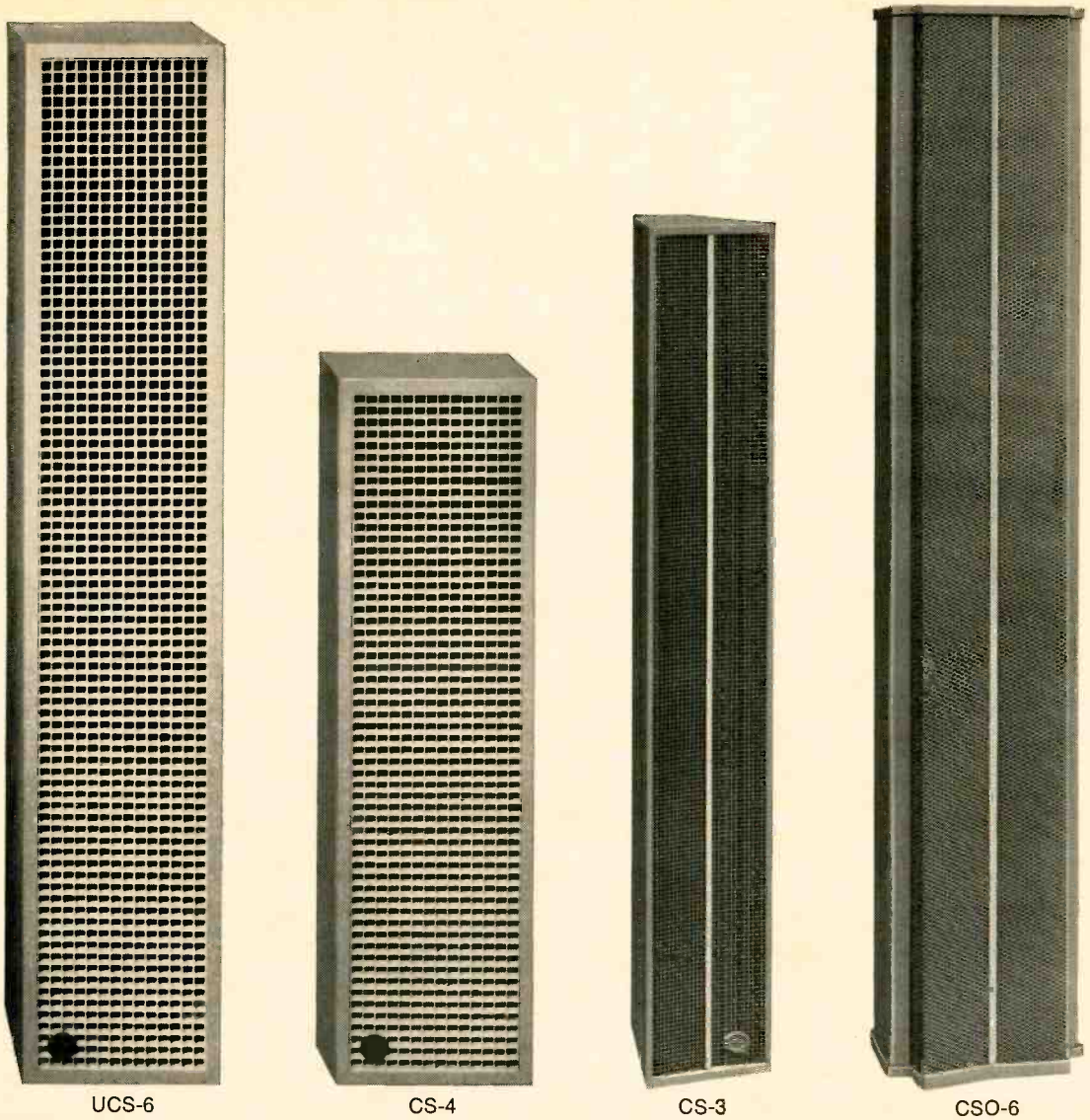
U-21

NEW!



UCS-6 CS-4 CS-3 CSO-6

The Big Plus—Uniline Sound Columns

Performance is the big plus when you install University Uniline Sound Columns. Unlike conventional columns, Uniline employs specially-designed speakers with higher power handling capacity. "Acoustic-Tapering — *another University exclusive,* prevents excessive high frequency beaming and assures a uniform sound volume within its fan or beam. The result—higher intelligibility, optimum sound dispersion at all frequencies, greater listening comfort. All individuals hear the same sound! The table below shows complete specifications for all Uniline Sound Columns, including the new weatherproof model CSO-6 for outdoor installation. For complete PA Loudspeaker Catalog, write Desk ET-7

	UCS-6 Full Range Music and Speech	CS-4 Full Range Music and Speech	CS-3 Music and Speech	CSO-6 Full Range Music and Speech
speakers	6 extended range 8"	4 extended range 8"	8 special multi-design	6 extended range 8"
frequency range	55—17,000 cps	70—17,000 cps	150—10,000 cps	55—17,000 cps
power capacity	120 watts IPM*	80 watts IPM*	25 watts IPM*	120 watts IPM*
impedance	16 ohms	8 ohms	16 ohms	16 ohms
vertical angle	16°	22°	22°	30°
horizontal angle	120°	120°	120°	120°
dimensions	59¼" x 10⅞" x 9⅛"	40⅜" x 11" x 9⅛"	48" x 7½" x 8¾"	60¼" x 11⅞" x 7¾"
shipping wt., lbs.	61	46	33	61

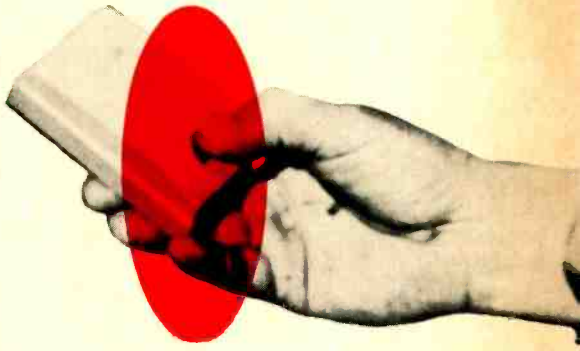
*Integrated program material.

LTV UNIVERSITY
9500 West Reno, Oklahoma City, Oklahoma

ELECTRONIC TECHNICIAN

JULY 1964

Opportunities In REMOTE CONTROL SWITCHING



Expand your business with easy to sell and install commercial and industrial systems

by Richard Goldstein

Chief Engineer, Perma-Power Co.

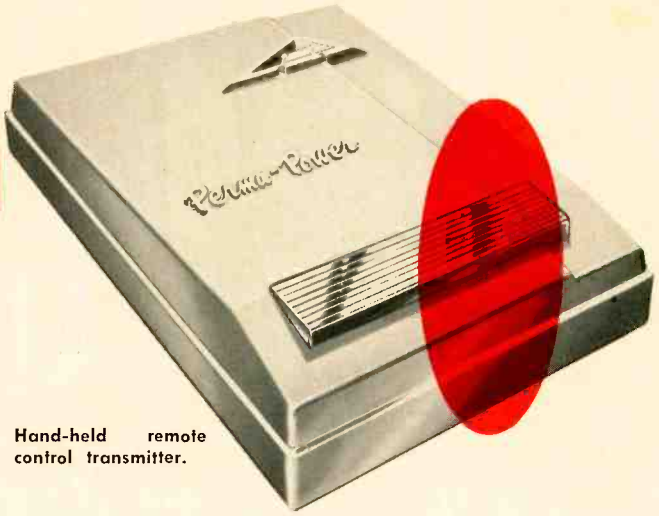
■ All TV-radio, Hi Fi technicians are familiar with the operating principle of electronic garage door operators. The same basic remote operation idea can be applied to hundreds of other remote radio controlled applications.

Selling and installing radio remote controls is a relatively simple job for anyone familiar with electronic equipment sales and servicing; and it provides an excellent opportunity to expand your service business operation from a strictly residential market to encompass a multitude of commercial and industrial customers.

Applications

Remote control switching by radio not only pro-

REMOTE CONTROL SWITCHING



Hand-held remote control transmitter.

vides increased efficiency, greater safety, and economy, but it also frequently eliminates the need for costly wiring or phone lines. As a typical example, the motel which has a vacancy-no vacancy sign five miles down the highway can install a radio remote control system to turn the light on and off for a cost that is not much more than one month's rental of a phone line for the same purpose.

With remote control switching, you can control anything from anywhere. By pushing a pocket-size portable transistor transmitter, doors, gates, hatches, valves, machines, lights, and bells can be operated at considerable distances. The user has full mobility; whether he is at his desk, in his car, or on his feet, he can work his equipment with assurance and efficiency.

A simple, inexpensive remote control system will include a portable pocket-size transmitter with self-contained antenna and battery and a receiver which contains a switching relay. Utmost versatility of application becomes available when the receiver contains both momentary and sequence load switching relays. With the receiver permanently connected to a 115 vac power source, and to the equipment that the system is designed to operate, a push on the transmitter button actuates the device as desired.

Systems of this kind may be purchased for under $100. These simple systems generally provide operation over distances as great as 500 ft when used outdoors in unobstructed areas. Indoors, operating distances will vary, depending on the way the building is constructed, but the radio system should still provide operation from at least 50 ft, possibly up to several hundred.

Control Methods

The most versatile radio remote control systems offer four basic types of control, designed to cover a wide range of commercial and industrial applications. These are as follows:

Momentary operation. The controlled device operates during signal transmission only. A buzzer sounds, a light stays on, a conveyor belt moves, only while pushing the button.

On-off operation. The first signal might turn a light on. The light then remains on until a second signal is sent to turn it off.

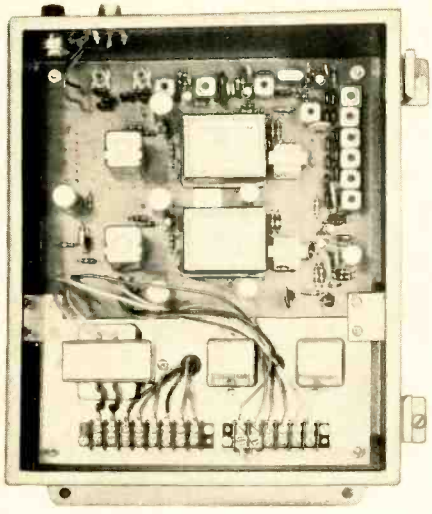
Combination operation. The system can also be designed to provide combination operation. Typically, it may be necessary to control a bell and light simultaneously. This can be set up so that during signal transmission, the bell rings and the light goes on. The light then stays on, but without the bell ringing, until the next signal is sent.

Auxiliary system. The fourth basic type of operation is as an auxiliary system. Here again, a great many arrangements and applications are possible. A popular one is the auxiliary start and safety stop used in many car wash establishments. Here, the magnetic motor starter buttons remain operational. However, when the conveyor is stopped by radio control, it can not be restarted by the manual wall button. The restart must be made by radio control. The manual stop is effective at all times. This kind of emergency or master control provides a vital safety-plus if someone is repairing equipment along the line. When the system has been stopped by radio, it is impossible for anyone who may not be aware that repairs are in process to restart the system by pushing the wall starters.

These four basic types of control obviously can cover a multitude of applications. One important executive carries the portable transmitter in his pocket so that he can signal unobtrusively and discreetly when he wants a meeting to be interrupted. Another executive uses such a system to notify the switchboard, from wherever he is in the plant or office, that he has heard a page call but is unable to answer at the moment.

Although such applications are interesting, they are of course less prevalent than some of the more straightforward uses for radio control. As mentioned, radio can be used to ring bells, sound buzzers or turn on lights from anywhere. It can be used to turn motors on or off, to operate conveyors, or to open doors or gates.

Many companies have found it worthwhile to experiment with a low-cost system for remote control



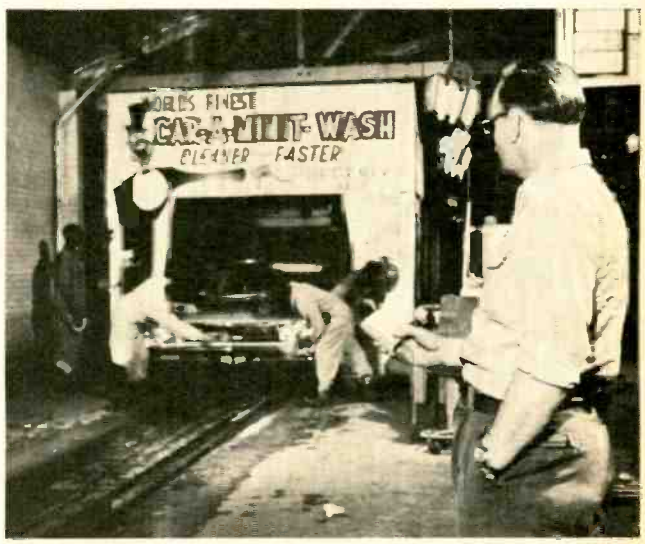
Inside view of remote control receiver.

Remote control receiver (left top) mounted on wall in car washing establishment.

switching to prove the value of more complex systems which are under consideration. Our company has devised systems for controlling as many as 36 separate functions from a single transmitter!

One seeming problem that can arise when radio remote control is used is really not a problem at all. When a company discovers the benefits of controlling a given operation by radio, they frequently start looking for other situations where they can use the same convenience. The question is then asked, "How can we be sure that one system won't interfere with the other?"

As noted, this is really not a problem, because even inexpensive remote control switching systems are coded to provide as many as 72 operating channels. These are achieved by a combination of six crystal controlled RF frequencies and 12 audio-tone combinations. Plug-in audio-tone selectors provide for rapid field changes and no tuning is required. The systems can thus operate independently with no danger of mutual interference.



Car wash track is stopped by remote control from hand-held radio transmitter.

When you are working with radio transmission of any kind, you must always be certain that the operation meets FCC requirements. Look for radio control system components that operate within the frequency band of 26.97 to 27.27 Mc, to be sure that transmitters are certified for operation without license.

Track can be restarted only by radio transmitter, preventing accidents while repairs are being made.

Radio control systems range

Continued on page 86

VERTICAL LINES

PART II*

by Joseph A. Hayes

■ "Scoot," Bob said, "I wasn't trying to evade your question last Saturday. I said I'd answer it today. You wanted to know if I remembered that set with horizontal linearity trouble and why I ended up replacing the flyback after measuring the line voltage and doing other things that looked strange to you.

"I remember the set well. The yoke/flyback tester and the square wavescope test both failed. That tester has been a real good investment for us, too. I wish I'd kept track of all the hours it's saved us.

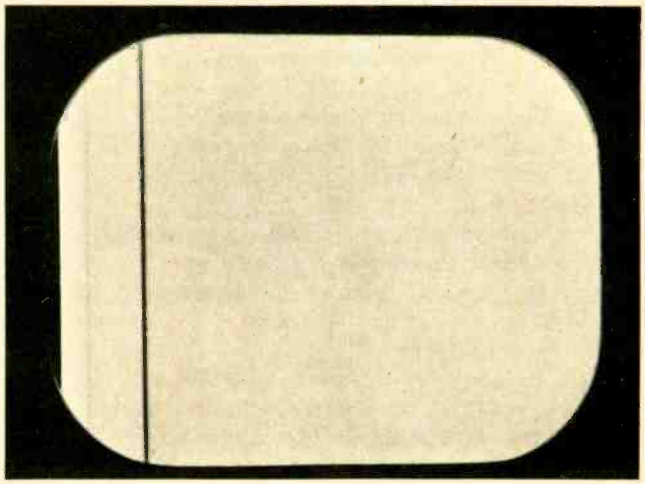
"If you'll recall, Scoot, that set not only had a bad nonlinearity condition, it also had a vertical line down the center of the screen. I had a lot of trouble with that set, so after I licked it I did some research. I found this problem is most prevelant in sets where the transformer has the wrong step-down ratio with the width control set at minimum and when the line voltage is high.

"Once you know what the symptoms mean it is really easy to troubleshoot a problem like that. All you do is check the horizontal output tube's signal. If the scope shows a normal input signal, the next thing you do is replace the flyback and if you've diagnosed the problem correctly, that'll fix the trouble."

"I'll admit that it sounds pretty easy," Scoot said. "I may even remember most of it."

"Not so fast," Bob continued. "there's more to vertical lines than that. Remember I also mentioned

**Last months installment of "Vertical Lines" was erroneously marked Part II instead of Part I*



Barkhausen oscillations are usually not too severe when video information is on the CRT and are often overlooked.

Barkhausen oscillations. That's another one technicians have trouble diagnosing.

Barkhausen Oscillations

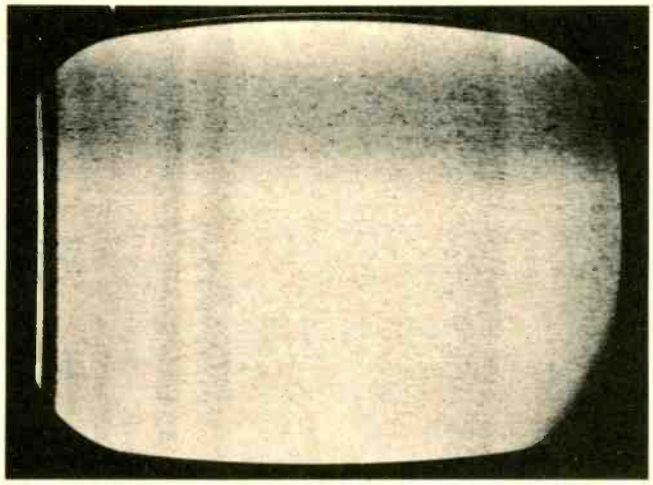
"Barkhausen oscillations tend to be tough because many technicians just ignore them. They are rare and when they do show up they are not usually too severe."

"Well, I think I've seen them before," Scoot said. "Don't they show up as a bunch of black lines down one side of the screen?"

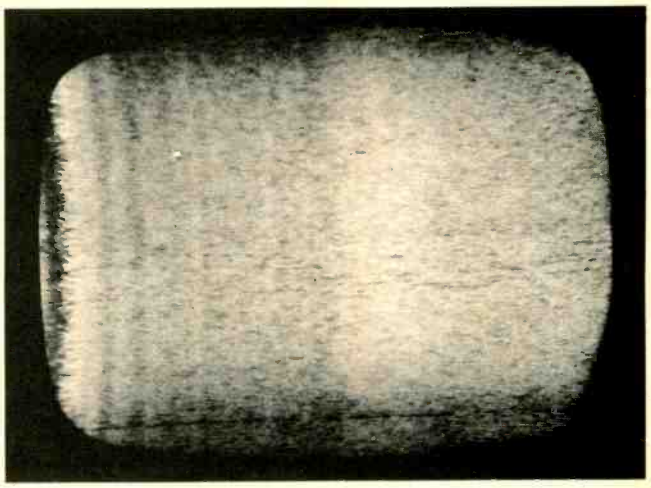
"Yes, Scoot, that's true. But they're always on the *left* side of the screen. They can range in number from one to more than half a dozen—just like the snivets—and they are very well defined, not rough like the snivets. Most of the lines produced by Barkhausen oscillation vary in width and intensity. They have another pecularity, too. The lines are most noticeable on high frequency channels and when the brightness control is set at a minimum. The city boys may never see a set with Barkhausen oscillations unless they tune the set to an unused channel. These oscillations tend to be destroyed by a strong signal. We're kind of out in a fringe area here so we see more of this than the average technician. Once in a while a case of really strong oscillation will show up in spite of a strong signal and on all channels, so don't base your diagnosis entirely on factors I've indicated as typical."

"Well, I can see what causes some problems you've mentioned, but what causes Barkhausen oscillations?"

"Barkhausen lines result from oscillations in the horizontal output tube plate/screen circuit. In fact, just changing the tube eliminates them in many cases. The signals causing the lines are picked up by the tuner. These oscillations within the HO tube generate harmonics that fall within the tuner's bandpass. The tuner picks up the oscillations and processes them just like video. And in many cases, the horizontal sync may even be upset by the 'interference.' "



Diodehausen is much like barkhausen but lighter lines can be seen to the right of the dark lines.



Spook interference has a very ragged appearance. It gets its name from early TV days when no one knew what caused it.

"Is there a sure way to tell if this interference is really Barkhausen?" Scoot asked.

"Sure. There are two real easy ways. The easiest way is to make a loop from a few feet of the slack section of the antenna feedline and hold it near the horizontal output tube. If the lines increase in number, intensity, or change size, you've found that it *is* Barkhausen oscillations. Another way, one that is also frequently used as a cure, is to place an ion trap on the tube and adjust it until the lines are no longer present on the screen. This is not usually critical. In fact, the magnet usually stops the oscillation or shifts its frequency to a point outside the tuner's bandpass."

"You know any other easy cures?" Scoot inquired.

"Oh, boy! Always looking for the easiest way out. Well, a couple of other tricks are just about as easy. We've already mentioned one—that's changing the output tube. One thing you should know, however—if you change the tube—the set should be 'cooked' for several hours to make sure the symptoms don't return. Also, be sure to check the set on all channels.

"Another pretty easy way out is to dress the antenna leadin well away from the horizontal output tube. In cases where the oscillations are weak, this may be all that's necessary to kill the interference.

"Another thing you should check is the horizontal drive and width control settings. A slight adjustment of either control may kill the oscillation. One more caution along these lines, though. Proper width and drive control settings are both dependent on the line voltage. You know that line voltage in the average home varies considerably from one time of the day to another. What does that mean to you?"

"It seems like Barkhausen may show up only at special times of the day—maybe even different times on weekends—depending on the power company load, the house load and so on—and they might also depend on the channel being watched at these critical times. I can sure see how it would be hard to figure this one out in some cases."

"You're right, Scoot. All this gives you another advantage, however. You can change the line voltage in the shop, the leadin can be purposely dressed near the output tube and all channels can be tried under varying conditions."

"All the cures you've come up with for this one seem pretty simple. I suppose you've got a couple of more difficult ones too, haven't you?"

Bob laughed at Scoot's attempt to be funny. "As a matter of fact, Scoot, there are times when Barkhausen seems impossible to kill off.

"Here's a few more recommendations for your notebook when all else fails. Put 100Ω carbon resistors in series with the output tube's control and screen grid. Check the tuner shielding—cases have been found where the tuner filament chokes were picking up the signal and re-radiating it. Of course, repositioning the chokes may help this in most cases.

"The next thing you might try, at least in this area, is coaxial antenna leadin. In areas where 'rabbit ears' are used, this suggestion isn't much good.

"Finally, change the flyback transformer. A faulty flyback or one that's not up to specs, can cause Barkhausen. If this doesn't do it, change the yoke. If you're still stuck, you diagnosed it wrong. You couldn't have Barkhausen oscillations! This is another one where the flyback and yoke tester leaves you out in the cold. You just have to know what you're doing—with or without test equipment."

Sparkhausen and Diodehausen

"Bob, is Sparkhausen just another name for Barkhausen?"

"Not at all, Scoot, though I suspect it got the better part of its name from Barkhausen. Sparkhausen is also a type of interference. It shows up as vertical lines of various widths. If you inspect the lines carefully, you'll see they are made up of little specks—both black and white dots. Both the fine tuning and the brightness may affect the symptom and may even eradicate it at some control settings.

"Shielded cable is often helpful in eliminating

VERTICAL LINES

Continued

Sparkhausen, but another cure for the trouble is to insert a 10 K to 100 KΩ resistor in series with the high voltage lead. Most modern sets already have this resistor in place and this is why we rarely see Sparkhausen interference. Corona can also give Sparkhausen symptoms. I think you know most of the cures for corona, so we'll skip it.

"Another one is brother 'Diodehausen.' "

"Aw, come on now Bob, you're kidding!"

"No, I'm dead serious, Scoot. It's pretty much the same thing as Sparkhausen but it's caused by oscillations that take place between the elements in the high voltage rectifier. A lot of the shielding used in the average TV set is simply to protect from Diodehausen radiations.

"Usually, the symptoms will show up as one or more dark vertical lines almost anywhere on the screen. The cure for this one is the simplest of all: a new high voltage rectifier tube. By the way, along these lines (that's a joke) some high voltage rectifiers develop an internal arc-over that causes similar oscillations. Usually, however, the lines generated are very dark and are located at the extreme left of the screen. You can spot these because the line edges will be slightly rough, and a purplish glow can be seen at the discharge point in the rectifier."

Spooks

"I never realized there were so many different things that could cause vertical lines in the picture, Bob. I notice you haven't said anything about damper trouble, though, and I know for a fact that the damper circuits can cause lines in the picture."

"True. These are called Spook TV interference lines, for the most part, though some other damper malfunctions can cause vertical lines. The name spook arose in early TV days when the industry was plagued by "Spook" and no one knew what caused it."

"And what does spook interference look like?"

"Scoot, that one will have to wait for our next Saturday session. I promised my wife I'd take her to a show in the City tonight. See you next week."

"So long Bob," Scoot said, diving out the front door with a sudden social idea of his own in mind. ■

CC-TV Systems Combat Billion Dollar Losses From Industrial Theft and Vandalism

■ Losses from thefts in industry is a billion-dollar problem. A packaged closed circuit TV surveillance system, tailored to fill modern industrial needs for efficient, cost-saving security measures, has been developed. It has been designed to simplify the selection, application, and operation of gate surveillance equipment, according to H. E. Smith, marketing manager of General Electric's Visual Communication Products Section.

"Industry statistics show that management spends over $250,000,000 a year to combat theft and vandalism," Smith says, "yet thieves still make off with four times that amount."

"We studied the problem and saw the need for reliable, rugged equipment, requiring only routine maintenance. . . . It can help industry avoid a great share of these losses, and cut the cost of plant protection."

The surveillance TV package consists of a basic group of closed-circuit products, with a wide selection of modifications and accessories. These alternatives make it adaptable to most personnel and vehicle gate security applications.

The basic package includes a transistorized vidicon camera with a weather-proof housing, defroster, heater, universal camera mount, and lens. A 17-in. industrial monitor is supplied. Also included is a floodlight which matches the lens, 50 ft of cable, and connectors for hooking up the camera to the monitor.

Available modifications include: longer cable runs; two-way audio system for conversing with individuals at gate entrances; custom consoles (when more than one gate is TV-equipped); automatic gate openers and locks; remote camera controls; and engineering services for custom surveillance systems.

The basic gate surveillance TV package sells for $2937.80. The price includes two days of installation supervision, plus certification of the installation. ■

Alarms systems are not only a must for TV stores but can turn a handsome profit for owner doing installation and service work

INTRUSION PROTECTION

by F. S. Buckley

Walter Kidde & Company, Inc.
Alarms Division
Vice President and General Manager

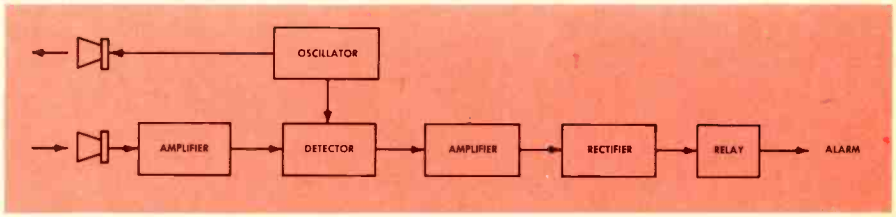
■ Modern science is making use of inaudible sound, invisible light and electronics to develop tamper-proof, fail-safe intrusion detection and alarm systems to protect building areas, inside and out. These modern protection systems have played a successful part in intruder-apprehension. Major users with installations covering a number of buildings have in some cases found them a completely effective deterrent to break-ins. The primary reason for sharp decreases in burglary rates and vandalism in protected locations is that the new devices are so highly reliable. They cannot be fixed, jammed, jimmied, or turned off. They suffer no human weaknesses, and if any part of a system fails to operate, alarms are sounded immediately.

Some of these devices are relatively new, such as those based on high frequency sound wave transmission and reception. Others are special applications of familiar devices like the photoelectric eye and the electric relay.

Ultrasonic System for Zone Protection

Of all intrusion protection devices available to the building owner, perhaps none is as tamper-proof and fool-proof in operation as the system based on high-frequency sound waves. Ultrasonic devices literally saturate the protected area from wall to wall and floor to ceiling including doors, windows and skylights, filling the air with inaudible sound waves, transmitted at a pitch above the range of human hearing. As long as everything is motionless within the protected area, the pitch remains constant, but movement—no matter how silent an intruder may be—changes the pitch. Audible sound from either inside or outside a protected room has no effect on an ultrasonic system.

An attache-size ultrasonic alarm provides protection to such areas as doorways, display cases, small rooms, closets and safes.



Block diagram of the basic ultrasonic intruder detection system.

These disruptions of the standard pitch are sensed by compact receivers connected to a master control unit which instantly sends an electrical signal over direct telephone line to a monitor unit located in a local guard house, a police station or a central alarm company. The monitor actuates visual and audible alarms which continue until the cause has been determined and corrected.

Ultrasonic systems offer many protection advantages. They are especially suited for protection of either complete spaces or zones such as small, broken-up areas. They are completely silent and unobtrusive. Transmitters and receivers—six-in. diameter metal domes—can be "blended" with the background by painting or other decorative treatment to match the decor of the protected area.

The monitor in the system, in addition to detecting intrusion, also flashes and sounds alarms if the power has been turned off, if any part of the system has been tampered with, either deliberately or un-

intentionally, or if any part of the system is not in proper working order. The operator at the monitor can at any time, if necessary, simply flip a switch to test the entire system's working order.

The ultrasonic waves utilized in such a system do not penetrate walls, floors, or ceilings and so are not affected by outside movement any more than they are by audible noise. Sensitivity of the ultrasonic waves can be varied to suit conditions within the protected area.

Versatile Ultrasonic Systems Nearly 100 Percent Effective

Ultrasonic systems are applicable to practically all types of buildings or enclosed spaces. One of the largest ultrasonic detection systems in the country is installed in a California manufacturing plant with 130,000 sq ft of office and factory floor space. The difficulty of protecting the plant was increased by the fact that operations varied around the clock, involving multiple work shifts, and occasional return of executives at night or on a weekend. These problems were solved by zoning the plant and setting up three separate systems tied to a central alarm station which, in turn, transmits alarm signals to the city police department.

Ultrasonic detection and alarm systems protect nine out of ten high schools in Dayton, Ohio, against vandalism and illegal entry. Effective coverage is obtained by ultrasonic surveillance of areas adjacent to outside doors, in stairwells, and at corridor intersections. In a year and a half, school authorities reported 47 break-ins. In 24 cases the alarms resulted in the capture of 81 people. In the other 23, prompt arrival of investigating officers held damage to a minimum or no loss whatever.

Ultrasonic systems also are used by one of the nation's largest electrical manufacturers to protect both office buildings and warehouses. The firm combines ultrasonic detection with photoelectric devices to cover large open areas which would have to be crossed by an intruder.

Photoelectric Devices Are Improved

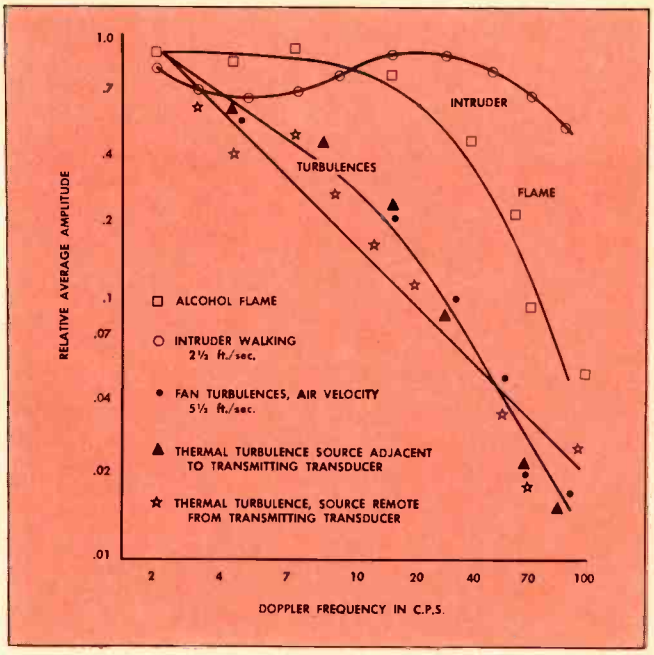
Photoelectric detection and alarm systems consist of two major parts, a projector and a receiver. The projector, located on one side of the protected area, transmits a beam of invisible, electrically modulated light across the area to a receiver. Any interruption of this light beam will trigger an alarm.

These devices are designed so that any tampering with the system —even when the system is not in operation—will set off the alarm. Also, since the beam is modulated, it cannot be "jammed" with a flashlight or another light source.

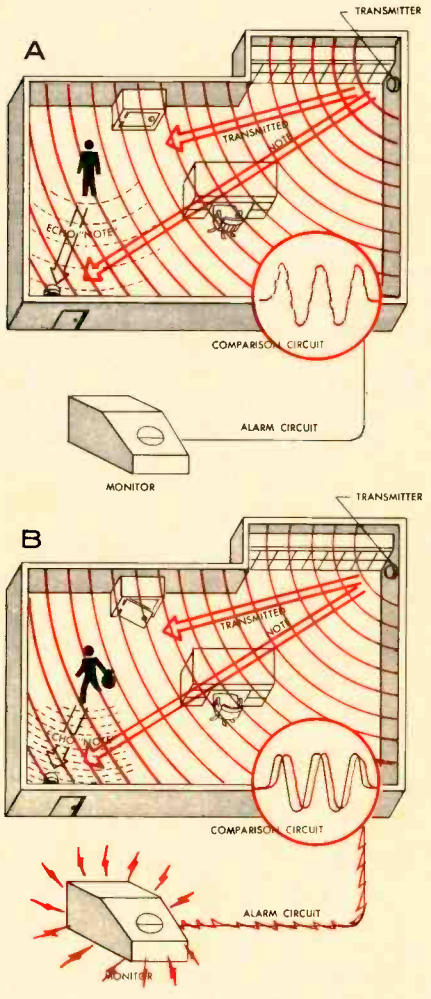
Photoelectric detection systems are versatile. They may be used indoors or outdoors. With the use of mirrors, the light may be "bent" up to 90 deg to allow one beam to guard more than a straight path. Effective range is 700 ft. For indoor use only, there is also a stationary or a compact portable transistorized unit having a range of 250 ft.

Proximity Alarms Protect Records

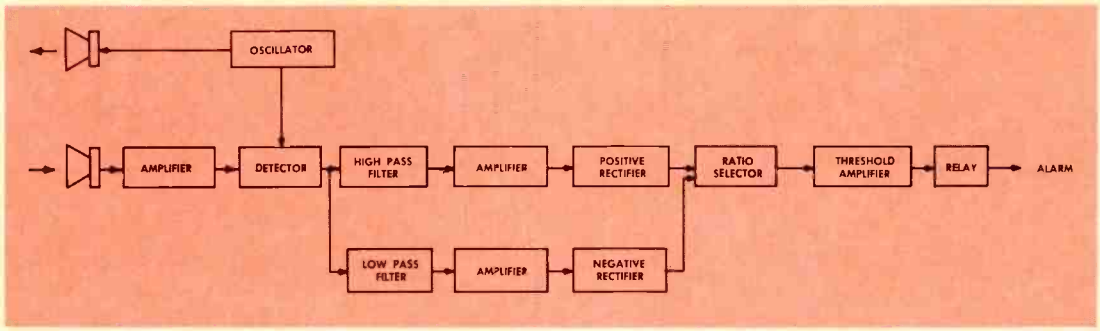
Another electrical type detection system which is being used quite often in office buildings is the capacitance or proximity alarm. These devices are designed to protect metal containers, such as safes, file cabinets, lockers, tool cribs and fences, such as are used to protect areas within a warehouse. Touch-



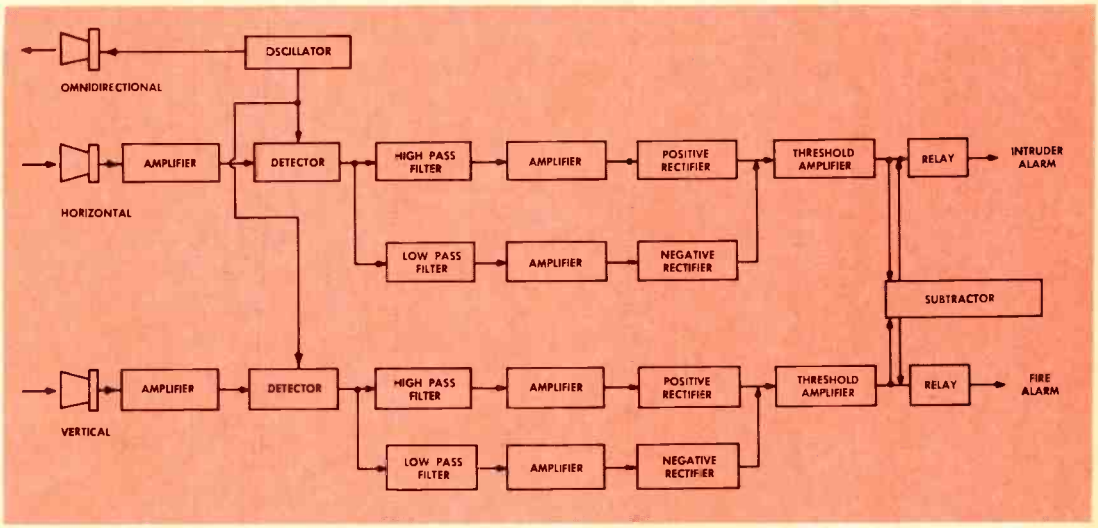
Amplitude vs. Doppler Frequency of Turbulence, Flame and Motion.



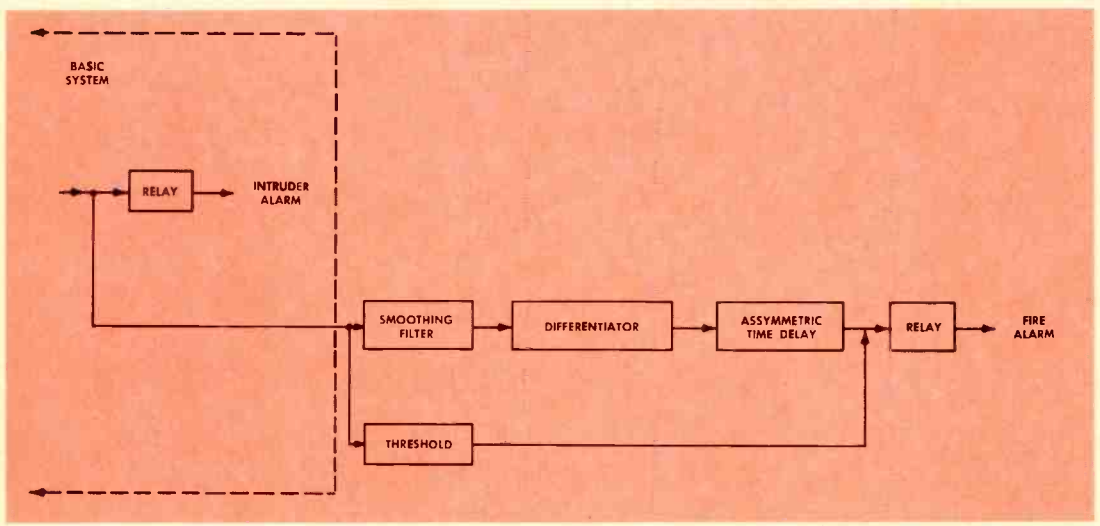
(A)—Stationary figure reflects ultrasonic wave at the same frequency of transmitter. (B)—Moving figure changes frequency and comparison circuit triggers alarm.



Block diagram of the turbulence compensated ultrasonic intruder detection system.



Block diagram of a horizontal — vertical doppler ratio ultrasonic fire & intruder detection system.



Block diagram of a size & growth type ultrasonic fire & intruder detection system.

ing or even closely approaching the protected objects changes the electrical capacitance of the system and sets off the alarm. The alarm signal may sound locally or be sent over telephone lines to a remotely located monitoring unit. One noteworthy feature of the capacitance-type alarm is that, after detection sensitivity has been adjusted, the device will automatically compensate for changes in temperature and humidity and retain the required sensitivity.

These devices illustrate the extent to which industrial science and technology has perfected intrusion detection. In the case of the ultrasonic system, sensitivity—if desirable—can be adjusted to a point where even the slightest movement of a hand or the dropping of a handkerchief can trigger the alarm.

Applications and costs of an intrusion protection system vary with plant needs and type of system. The engineers of a competent manufacturer of such devices should be called in for a survey of the space requiring protection. Resulting recommendations should be studied from the viewpoint of how well they fit protection needs, how effectively they perform, how they assist and supplement police and guard forces, and how much cost or savings accrue from installing and operating them.

In addition to their on-the-job effectiveness, these reliable and

Continued on page 81

A Glossary of CC-TV Terms

Terms commonly used in industrial closed circuit and broadcast television

AMBIENT TEMPERATURE The temperature of the surrounding medium, such as air, gas or liquid, which comes into contact with the apparatus.

ASPECT RATIO In television, the ratio of the frame width to the frame height, usually 4 to 3.

AUTOMATIC BRIGHTNESS CONTROL The self-acting mechanism which controls brightness of the display device as a function of ambient light.

AUTOMATIC LIGHT CONTROL Automatic Light Control is the process by which the illumination incident upon the face of the pickup device is automatically adjusted as a function of scene brightness.

AUTOMATIC PEDESTAL CONTROL A process by which pedestal height is automatically adjusted as a function of input or other specified parameter.

AUTOMATIC SENSITIVITY CONTROL The self-acting mechanism which varies system sensitivity as a function of the specified control parameters. This may include Automatic Target Control, Automatic Light Control, etc., or any combination thereof.

AUTOMATIC TARGET CONTROL Automatic Target Control is the self-acting mechanism which controls the Vidicon target potential as a function of the scene brightness.

BLACK COMPRESSION (Black Saturation) The reduction in gain applied to a picture signal at those levels corresponding to dark areas in a picture with respect to the gain at that level corresponding to the midrange light value in the picture.

Note: The gain referred to in the definition is for a signal amplitude small in comparison with the total peak-to-peak picture signal involved. A quantitative evaluation of this effect can be obtained by a measurement of differential gain.

The over-all effect of black compression is to reduce contrast in the low lights of the picture as seen on a monitor.

BLACK LEVEL That level of the picture signal corresponding to the maximum limit of black peaks.

BLACK PEAK A peak excursion of the picture signal in the black direction.

BLANKED PICTURE SIGNAL The signal resulting from blanking a picture signal.

Note: Adding sync signal to the blanked picture signal forms the composite picture signal.

BLANKING LEVEL That level of a composite picture signal which separates the range containing picture information from the range containing synchronizing information.

Note: The setup region is regarded as picture information.

BLEEDING WHITE (Beam Starved) An overloading condition in which white areas appear to flow irregularly into black areas.

BLOOMING An increase in the (spot) size caused by an increase in signal intensity.

BOUNCE Sudden variations in picture presentation (brightness, size, etc.) independent of scene illumination.

BREATHING Variations similar to "bounce" but at a slow, regular rate.

BURNED-IN IMAGE An image which persists in a fixed position in the output signal of a camera tube after the camera has been turned to a different scene.

CLAMPING The process that establishes a fixed level for the picture level at the beginning of each scanning line.

COMPOSITE PICTURE SIGNAL The signal which results from combining a blanked picture signal with the sync signal.

COMPRESSION (in Television) The reduction in gain at one level of a picture signal with respect to the gain at another level of the same signal.

Note: See also black compression and white compression.

The gain referred to in the definition is for a signal amplitude small in comparison with the total peak-to-peak picture signal involved. A quantitative of this effect can be obtained by a measurement of differential gain.

DENSITY A measure of the light-transmitting or reflecting properties of an area. It is expressed by the common logarithm of the ratio of incident to transmitted or reflected light flux.

DETAIL CONTRAST The ratio of the amplitude of video signal representing high-frequency components with the amplitude representing the reference low-frequency component, usually expressed as a percentage at a particular line number.

DISPLACEMENT OF PORCHES Refers to any difference between the level of the front porch and the level of the back porch.

FOOTCANDLE A unit of illuminance when the foot is taken as the unit of length. It is the illuminance on a surface one square foot in area on which there is a uniformly distributed flux of one lumen, or the illuminance at a surface all points of which are at a distance of one foot from a uniform source of one candle.

FOOTLAMBERT A unit of luminance equal to 1/candle per square foot, or to the uniform luminance of a perfectly diffusing surface emitting or reflecting light at the rate of one lumen per square foot.

Note: A footcandle is a unit of incident light and

a footlambert is a unit of emitted or reflected light. For a perfectly reflecting and perfectly diffusing surface, the number of footcandles is equal to the number of footlamberts.

FREE-RUNNING FREQUENCY The frequency at which a normally synchronized oscillator operates in the absence of a synchronizing signal.

GAMMA CORRECTION The introduction of a nonlinear output-input characteristic for the purpose of changing the effective value of Gamma.

GEOMETRIC DISTORTION Any aberration which causes the reproduced picture to be geometrically dissimilar to the perspective plane projection of the original scene.

GLITCHES A form of low-frequency interference appearing as a narrow horizontal bar moving vertically through the picture. This is also observed on an oscilloscope at field or frame rate as an extraneous voltage pip moving along the signal at approximately reference-black level.

HIGHLIGHTS The maximum brightness of the picture, which occurs in regions of highest illumination.

IMAGE DISSECTOR TUBE (Dissector Tube) A camera tube in which an electron image produced by a photoemitting surface is focused in the plane of a defining aperture and is scanned past that aperture.

IMAGE ICONOSCOPE A camera tube in which an electron image is produced by a photoemitting surface and focused on one side of a separate storage target which is scanned on the same side by an electron beam, usually of high-velocity electrons.

IMAGE ORTHICON A camera tube in which an electron image is produced by a photoemitting surface and focused on one side of a separate storage target which is scanned on its opposite side of an electron beam, usually of low-velocity electrons.

IMAGE TUBE (Image Converter Tube) An electron tube which reproduces on its fluorescent screen an image of an irradiation pattern incident on its photosensitive surface.

INTERLACED SCANNING A scanning process in which the distance from center to center of successively scanned lines is two or more times the nominal line width, and in which the adjacent lines belong to different fields.

LAG (Camera Tubes) A persistence of the electrical-charge image for a small number of frames.

LAMBERT A unit of luminance equal to 1/candle per square centimeter, and, therefore, equal to the uniform luminance of a perfectly diffusing surface emitting or reflecting light at the rate of one lumen per square centimeter.

LUMEN The unit of luminous flux. It is equal to the flux through a unit solid angle (steradian) from a uniform point source of one candle, or to the flux on a unit surface all points of which at unit distance from a uniform point source of one candle.

MOIRE A wavy or satiny effect produced by convergence of lines. Usually appears as a curving of the lines in the horizontal wedges of the test pattern and is most pronounced near the center where the lines forming the wedges converge. A moire pattern is a natural optical effect when converging lines in the picture are nearly parallel to the scanning lines. To a degree this effect is sometimes due to the characteristics of color picture tubes and of image-orthicion pickup tubes (in the latter termed "mesh beat").

ORTHICON A camera tube in which a beam of low-velocity electrons scans a photoemissive mosaic capable of storing an electrical-charge pattern.

PHOTOCATHODE An electrode used for obtaining photoelectric emission.

POLARITY OF PICTURE SIGNAL The sense of the potential of a portion of the signal representing a dark area of a scene relative to the potential of a portion of the signal representing a light area. Polarity is stated as "black negative" or "black positive."

PROOF (used as a suffix) Apparatus is designated as splashproof, dustproof, etc., when so constructed, protected, or treated that its successful operation is not interfered with when subjected to the specified material or condition.

RANDOM INTERLACE In random interlace there is no fixed relationship between adjacent lines and successive fields.

RASTER BURN (Camera Tubes) A change in the characteristics of that area of the target which has been scanned, resulting in a spurious signal corresponding to that area when a larger or tilted raster is scanned.

REFERENCE BLACK LEVEL The picture signal level corresponding to a specified maximum limit for black peaks.

REFERENCE WHITE LEVEL The picture signal level corresponding to a specified maximum limit for white peaks.

RESISTANT (used as a suffix) Apparatus is designated as moisture-resistant, fume-resistant, etc., when so constructed, protected, or treated that it will not be injured readily when subjected to the specified material or condition.

RESOLUTION (Horizontal) The amount of resolvable detail in the horizontal direction in a picture. It is usually expressed as the number of distinct vertical lines, alternately black and white, which can be seen in a distance equal to picture height.

This information usually is derived by observation of the vertical wedge of a test pattern. A picture which is sharp and clear and shows small details, has good, or high, resolution. If the picture is soft and blurred and small details are indistinct, it has poor, or low resolution. Horizontal resolution depends upon the high-frequency amplitude and phase response of the pickup equipment, the transmission medium, and the picture monitor as well as the size of the scanning spots.

RESOLUTION (Vertical) The amount of resolvable detail in the vertical direction in a picture. It is usually expressed as the number of distinct horizontal lines, alternately black and white, which can be seen in a test pattern.

Vertical resolution is fundamentally limited by the number of horizontal scanning lines per frame. Beyond this, vertical resolution depends on the size and

(Continued on page 83)

Get started by acting as the service arm of an established national distributor

THERE'S MONEY

■ Switching into closed circuit television can be discouraging, frustrating—and rewarding. Here's how one service company used organization and hard work to build a profitable closed circuit TV business.

A Case History

Apartments were hard to find in Chicago in 1948, especially for a man with four children. So, when TV technician Vern Bertrand saw a newspaper classified ad that offered to sell a TV repair business office with an apartment back of the shop, he made a quick decision. He would buy the business, Loyola Radio, to get the apartment and, if he found time, he would operate the business on a part-time, after-hours basis. Bertrand carefully hedged his quick decision to buy a service business by keeping his service representative post at North Shore Television.

Within a short time Loyola Radio started to occupy more of Bertrand's time and he began to farm out repair work to another firm. Most of Bertrand's work was handled by Marshall Ruehrdanz, an ex-Marine electronics specialist just getting his start in the repair field. It didn't take Ruehrdanz and Bertrand long to decide there might be a good future for them working together, and, within a short time, they each left their regular jobs and began devoting full time to Loyola Radio.

Business was good for Loyola Radio and soon the company began to earn a modest profit. At the same time, the old firm, North Shore Television, decided to call it quits and offered to sell the firm to Loyola Radio.

Bertrand and Ruehrdanz jumped at the opportunity, feeling that although North Shore business was not good, the potential was excellent. The two reasoned that North Shore had a quality reputation and with more aggressive sales efforts North Shore could grow.

It did. Hard work, long hours, and careful attention to the best available management techniques paid off.

Between 1950 and 1957 North Shore showed steady profitable growth. But Ruehrdanz and Bertrand were not completely happy. More, rather than less, of their time was being spent on North Shore business.

They decided to evaluate their position and capabilities before charting possible alternate directions they would turn.

They realized they possessed a strong natural customer acceptance franchise in the North Shore area. A television repair service from another part of Chicago would face hard times in North Shore territory. And they felt the opposite would be true for North Shore if the young firm attempted expansion into neighboring territories.

"We had accumulated capital to invest," comments Ruehrdanz, "but we were reluctant to invest further in the TV repair business.

"At this time both Vern and I were well acquainted with several top Chicago-area manufacturers representatives, not on a business basis, but simply because we were located in the same area and would run into each other during lunch. The more we talked with the reps we knew in which direction North Shore Television would turn: we would use our electronics experience and offer our facilities as the service arm of local manufacturers' representatives.

Getting Started

In 1957 Bertrand and Ruehrdanz started Illinois Electronic Systems to provide repair and maintenance on a variety of products that included oscilloscopes and counters—and closed circuit TV.

"Business grew slowly," Bertrand says, "and the profits just weren't there. At the end of the first full year, which was 1958, we lost money, but decided to keep going another year by plowing our TV repair profits into the electronics service business.

"At the end of 1959, IES business was better, but we were still running at a loss, and unless something was done soon we felt we would kill the still profitable repair business.

"We felt we were getting the maximum amount of business we could expect from the representatives we knew."

Expanding

At the same time IES was thinking about ways to expand, one of the reps IES knew was recommending the firm to Mr. N. M. Marshall,

IN CLOSED CIRCUIT TV

by Richard G. Farrell
General Precision, Inc.

General Manager, Industrial Marketing of General Precision's GPL Division—who was looking for ways to expand his Chicago operations.

A pioneer in closed circuit TV, GPL Division was rapidly outgrowing its technical representative organization and was in the process of establishing a group of nationally franchised distributors.

Both firms were impressed with each other. "GPL was the kind of company we were looking for," Ruehrdanz explained. "They were young like we were; they had a broad line of TV equipment; they provided good factory back-up and they had a good reputation in the electronics industry for quality work."

Speaking for GPL, Marshall says, "IES was ideal. They were young, aggressive, with good television capability."

IES' first sale was in late 1958 to a pipe grouting firm. In 10° cold, Ruehrdanz and Bertrand demonstrated how a CCTV camera could be pulled through a sewer line, detecting trouble spots and "supervising" the grouting operations.

Turning the Corner

Bertrand laughs heartily when he describes how future business looked up after his first sale in the sewers of Northwest Chicago.

"Not everything was gold at first," says Ruehrdanz. CCTV takes time to sell. Selling it was discouraging and, at times, we were ready

Continued on page 87

Modern office facilities of Video Systems

A section of the service, repair and test facilities of Video Systems.

Plan your troubleshooting approach before you enter the car and you'll give top-quality service in minimum time

Auto Radio Tools and Repair

PART II (Conclusion)

by Jack Brayton

■ Last month we discussed setting up your shop for servicing auto radios. But a well tooled-up shop is only half the battle. Your "service image" is important too.

Many auto radio owners form an image of your shop mainly by what you do while in their car—not by what you do to their radios on the repair bench. If you're the best benchman around but slow or sloppy in the customer's car, this is how you will be remembered. Trying for 15 or 20 minutes to wiggle a hard-to-reach tube into its socket doesn't impress the owner favorably —especially when you finally give up and pull the entire radio in five minutes flat! Somehow, the owner feels, he's paying for the wasted time. Because of this, *speed* is a must. At the same time *top quality* service must be provided.

Planning Ahead

The easiest way to give rapid, top quality service is to organize your work—know what you're going to do *before* you step inside the customer's car. Since your plan cannot be the same for every situation, we've got to break the overall approach down into sections. Each section will determine what you are to do for a specific fault—before you go into the car. Once in the car, you carry out the plan boldly, decisively and rapidly.

The Dead Set

With the completely dead radio of course, the fuse is checked first. If it's good, check for power at the hot side of the lead connected to the fuse. If there's power at this point, pull the set immediately without "horsing around." Don't try to fix it in the car. The trouble is inside the radio (either a broken wire or a defective switch), and the set can be properly repaired only on the bench.

If the fuse is bad and the set has a vibrator, then it should also be pulled. Even though plugging in a vibrator and changing a fuse will usually make it play, the buffer capacitor should be changed. The reason is, a small resistance leak across the capacitor can damage the new vibrator causing a callback or a dissatisfied customer.

If the set has a blown fuse and is not a vibrator type, simply replace the fuse. The fuse in a transistor powered radio is frequently overloaded when the set is first turned on and for this reason it may blow in many models on an average of every 5 or 6 months. Always ask the customer to bring the radio back if the fuse blows again within a short time. Incorrect transistor bias can cause the fuse to blow.

If the new fuse blows immediately, pull the set.

No Sound — Tubes Lit

For this problem pull the tubes in succession (if they are easy to reach), and listen for a click in the speaker. When you come to a dead stage, replace the suspected tube. If sound isn't restored remove the radio to the bench.

Weak — Distorted

Many technicians lose precious time with this trouble by "playing" with the radio in the car instead of getting the radio out of the car and on the bench. There are only two times when the set shouldn't be pulled when it has distortion. (1) If the distortion is caused by a warped or loose speaker cone. (2) If the set is weak because of a poor antenna connection. When this happens, a loud rushing noise is heard even on local stations.

Even though a weak and distorted radio may be caused by a single defective tube, too often it's caused by a combination of faults that show up only through a careful stage-to-stage check.

Intermittent

The vibrator type radio can cut in and out. This can be caused (and often is) by the OZ4 rectifier tube. When the OZ4 is faulty, the radio usually comes on and off *at a regular rate;* almost as though a capacitor is charging and discharging. Once you've heard this trouble it's easy to spot. Of course, if the OZ4 is bad, simply replace it.

If the OZ4 isn't at fault and the radio goes on-and-off with or without vibration, check the antenna, power supply and speaker leads. If this doesn't reveal the fault, the

Techniques

radio is taken to the bench for a thorough check. Although this fault can be caused by a single tube, it hardly ever is. Even if it is, it takes a signal tracer or a scope to localize the trouble; otherwise there is no way to be *absolutely* sure you've corrected it. IF cans are also a much more common cause of cutting in and out.

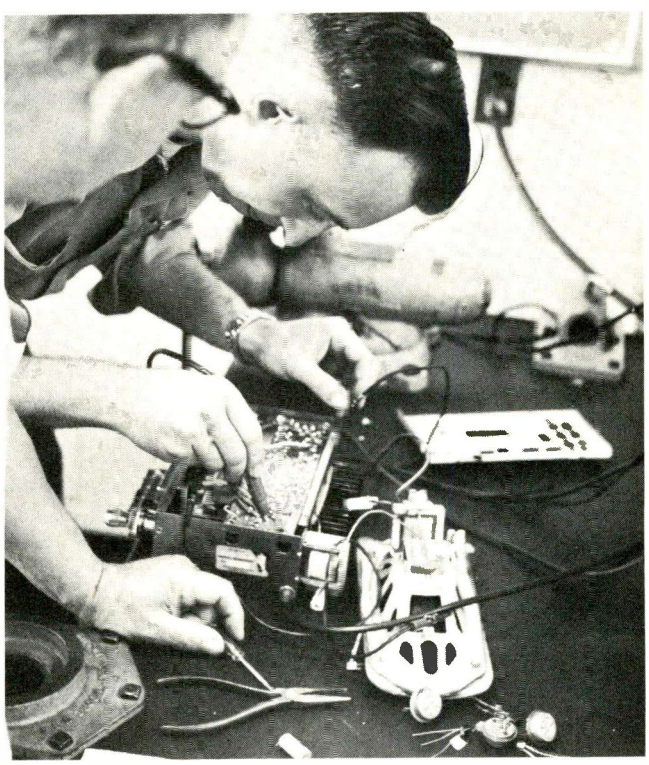
Automatic Tuning

While in the automobile, replace only the relay control tube (12AU7, 12AL8, etc.). About the only other trouble that you will have with the automatic tuning is a defective gear train. To replace this will frequently take the major part of an hour on the bench.

Ignition Noise

This doesn't require that the radio be removed since it's hardly ever caused by the radio itself.

Take particular note that this plan allows only one or two minutes to be spent working in the car to determine if it will be necessary to remove the radio to the work bench. Also notice that heavy stress is put on pulling the radio instead of trying to repair it in the car. With the proper tools (see Part I of this article in the May, 1964, issue of ELECTRONIC TECHNICIAN), a car radio is not difficult to remove. It's usually faster, more satisfactory to the customer and to yourself to pull the radio rather than "play" with it. ■



Incorrect transistor bias in transistorized type auto radios can cause a fuse to blow frequently. Check the bias carefully with a VTVM.

Solve your major problems with a graph and straightedge

INSTALLING AUDIO DISTRIBUTION SYSTEMS

PART I

by Chuck Overstreet
University Loudspeakers, Inc.

■ Many TV-radio specialists feel technically unequipped to handle the average PA installation. Actually, the job is not as difficult as it may appear. And it is simplified by first determining the audio power required to properly reproduce the program material in a specified area. To accomplish this, only three things must be taken into consideration: Cubic volume of area, ambient noise level and the type of program material to be used in the system.

How Much Power?

This may at first sound complicated but the graph shown in Fig. 1 calculates all of this for you; all you do is feed in the basic information. Let's take an example: Suppose you have been asked to install a PA system in an auditorium where speech reproduction is the primary requirement but some music will also be played. High fidelity is not required.

The total volume of our hypothetical auditorium is about 100,000 cu ft (H x W x L). Typical functions are held in the auditorium so we can assume that the normal background noise is average. Now, let's look at the graph. We look under Average Typical Application and about half way down the list we find AUDITORIUM (Average). As a double check, we can look to the Background Noise Characteristic column at the extreme right—here, we see that the voice must be raised to be understood. If a db level meter is available, we can check still further by measuring the average sound level when the auditorium is being used. Of course, this last check is the most accurate.

Assured that we have found the proper background level, we can proceed to the next step. Use a straightedge to find the point on the diagonal closest to the room volume. Now, travel downward from this point at a right angle to the REFLECTION-ABSORPTION ADJUSTMENT line.

Each space on the adjustment line represents one db. The type of program material and the amount of reflective material in the auditorium will determine the amount of adjustment necessary and the direction of the adjustment if any is necessary. For example, if the auditorium has been acoustically treated the power must be increased so the adjustment is made by moving the point one or two db to the right on the adjustment line. If, on the other hand, the auditorium has a good deal of highly reflective area in it, the power may be adjusted to the left one to three db.

Adjustment for the type of program material is made on the VOICE-MUSIC ADJUSTMENT line in a similar manner. If the only requirement for the system is speech reproduction, we can reduce the adjustment by moving the point on the adjustment line one to four db to the left. If the system is to reproduce high quality music, we must adjust the point to the right one to four db. When speech and only incidental music are required, no adjustment is necessary.

Following these steps, let's see where we are in our hypothetical case. So far, we have moved over from the average auditorium level to the 100,000 cu ft diagonal; if you go to the extreme left, you can see that this coincides with 79 db in the AVERAGE SOUND LEVEL IN DB DELIVERED BY SOUND SYSTEM. We then progressed to the first adjustment line; leaves us at 35. Let's say our auditorium has moderately reflective surfaces and make our adjustment to the left one db or down to 34. Since we need to produce mostly speech and only incidental music, we do not need any adjustment on the speech music adjustment line.

If we had decided beforehand, that we need a speaker which has medium efficiency characteristics, we proceed straight down with our straightedge until it crosses a diagonal even with MEDIUM EFFICIENCY. Then, follow the diagonal down to the number at the bottom of the chart; this gives us total amplifier power. If we've stuck together on this, the answer is eight watts. This is the total power to be divided among the total number of speakers used.

That was easy enough wasn't it? But if you're thinking, you should be wondering how we decided on the type of speaker to use. So let's examine that aspect.

Selecting A Driver

Absence of industry-wide standards for evaluating the performance of loudspeakers makes the comparison of driver unit specifications difficult for the uninitiated. Power handling capacity is an indication of the ability of a driver to withstand an amount of electrical input power, *of a certain nature,* for some length of time, without danger of driver breakdown. But, the power handling capacity is not necessarily an indication of sound output. It is possible, for example, to design a driver rated at 40 or 50 watts in-

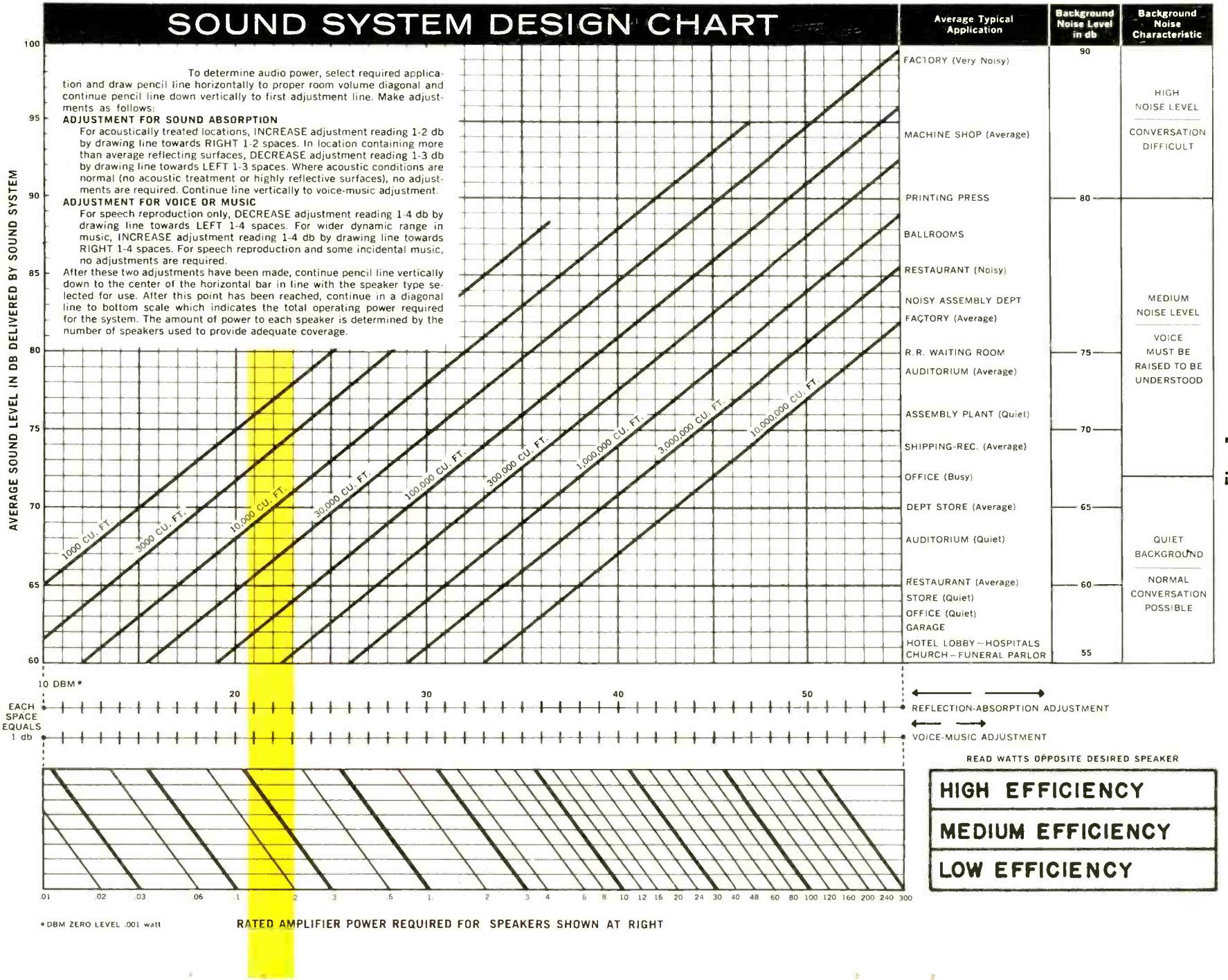

SOUND SYSTEM DESIGN CHART
To determine audio power, select required application and draw pencil line horizontally to proper room volume diagonal and continue pencil line down vertically to first adjustment line. Make adjustments as follows:
ADJUSTMENT FOR SOUND ABSORPTION
For acoustically treated locations, INCREASE adjustment reading 1-2 db by drawing line towards RIGHT 1-2 spaces. In location containing more than average reflecting surfaces, DECREASE adjustment reading 1-3 db by drawing line towards LEFT 1-3 spaces. Where acoustic conditions are normal (no acoustic treatment or highly reflective surfaces), no adjustments are required. Continue line vertically to voice-music adjustment.
ADJUSTMENT FOR VOICE OR MUSIC
For speech reproduction only, DECREASE adjustment reading 1-4 db by drawing line towards LEFT 1-4 spaces. For wider dynamic range in music, INCREASE adjustment reading 1-4 db by drawing line towards RIGHT 1-4 spaces. For speech reproduction and some incidental music, no adjustments are required.
After these two adjustments have been made, continue pencil line vertically down to the center of the horizontal bar in line with the speaker type selected for use. After this point has been reached, continue in a diagonal line to bottom scale which indicates the total operating power required for the system. The amount of power to each speaker is determined by the number of speakers used to provide adequate coverage.
AVERAGE SOUND LEVEL IN DB DELIVERED BY SOUND SYSTEM
100
95
90
85
80
75
70
65
60
1000 CU. FT.
3000 CU. FT.
10,000 CU. FT.
30,000 CU. FT.
100,000 CU. FT.
300,000 CU. FT.
1,000,000 CU. FT.
3,000,000 CU. FT.
10,000,000 CU. FT.
Average Typical Application
FACTORY (Very Noisy)
MACHINE SHOP (Average)
PRINTING PRESS
BALLROOMS
RESTAURANT (Noisy)
NOISY ASSEMBLY DEPT
FACTORY (Average)
R.R. WAITING ROOM
AUDITORIUM (Average)
ASSEMBLY PLANT (Quiet)
SHIPPING-REC. (Average)
OFFICE (Busy)
DEPT STORE (Average)
AUDITORIUM (Quiet)
RESTAURANT (Average)
STORE (Quiet)
OFFICE (Quiet)
GARAGE
HOTEL LOBBY—HOSPITALS
CHURCH—FUNERAL PARLOR
Background Noise Level in db
90
80
75
70
65
60
55
Background Noise Characteristic
HIGH NOISE LEVEL
CONVERSATION DIFFICULT
MEDIUM NOISE LEVEL
VOICE MUST BE RAISED TO BE UNDERSTOOD
QUIET BACKGROUND
NORMAL CONVERSATION POSSIBLE
10 DBM*
EACH SPACE EQUALS 1 db
20
30
40
50
REFLECTION-ABSORPTION ADJUSTMENT
VOICE-MUSIC ADJUSTMENT
READ WATTS OPPOSITE DESIRED SPEAKER
HIGH EFFICIENCY
MEDIUM EFFICIENCY
LOW EFFICIENCY
.01 .02 .03 .06 .1 .2 .3 .6 1. 2 3 4 6 8 10 12 16 20 24 30 40 48 60 80 100 120 160 200 240 300
*DBM ZERO LEVEL .001 watt
RATED AMPLIFIER POWER REQUIRED FOR SPEAKERS SHOWN AT RIGHT

Fig. 1

AUDIO DISTRIBUTION SYSTEMS

Continued

put which would produce no more sound output than a more *efficient* driver rated at 25 or 30 w.

The frequency response of a driver unit is another important consideration in evaluation. Studies in the composition of ambient noises reveal that over-all low frequency noise encountered under average industrial conditions has a tendency to mask intelligibility. Fortunately, it has been found that the higher frequencies are of major importance for articulation in speech. Thus, even if a driver were to reproduce very low frequencies, in a particularly noisy location those tones would probably be masked by the general level of noise. On the other hand, if the same driver were incapable of extended range response, the "highs" which are so sorely needed under such conditions would be lacking, and intelligibility would suffer.

A speaker or a trumpet/driver combination selected for its specific ability to work efficiently in high ambient noise and designed to penetrate noise with maximum intelligibility should be judged for tonal "quality" only under *operating conditions*. When listened to in relative quiet, the speaker will naturally have a rather high pitched quality.

With the variety of driver units available, many with valuable exclusive features, full consideration can be given to over-all response, required sound pressure, versatility and cost. Once the differences between drivers are understood, it is easy to see how various combinations provide tremendous flexibility. A typical driver is shown in Fig. 2.

Fig. 2—Typical driver unit.

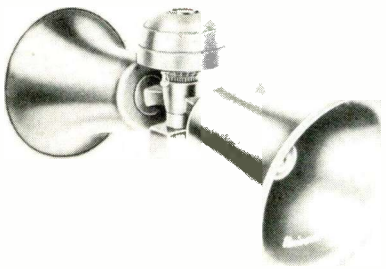


Fig. 3—Bidirectional paging speaker with single angle projectors.

Impedance

When the transmission lines are connected *directly* to one or more speaker voice coils, they are referred to as low impedance lines. In general, where the distance between the amplifier and speakers is less than 200 ft, lines run at voice coil impedances are satisfactory.

High impedance lines are used when the distance between the amplifier and the load is greater than that indicated for a given wire size (a power loss in the transmission line of less than 15 percent is required). Where the number of speakers used is so large that low impedance connections would be impractical high impedance lines are also indicated. High impedance lines also facilitate connection of speakers to operate at individually different power levels and make it easier to carry out future changes in the loudspeaker system.

The operation of a large cluster of loudspeakers with *series* connection is not recommended. High total transient voltages which may result can be great enough to cause arc-over in the voice coil air gap of some of the speaker mechanisms. For this reason, it is desirable that all units which are grouped at one location be placed in parallel or series/parallel arrangement, and then by means of a suitable transformer matched to the line impedance.

Sometimes, transformer matching problems make it difficult to utilize parallel connection. Series operation may then be used, provided each speaker is electrically insulated from the adjoining speaker. This can be achieved by installing the speaker cluster on a 2 x 4 in. base, or other wood support, so that no metallic connection (electrical continuity) exists between each loudspeaker mounting bracket. The reason for insulating speakers in series circuits is not often appreciated. The voltage across a driver unit may suddenly rise to many times the normal rated value. For example, during a transient period lasting for only a few milliseconds, a 25 watt unit (which should have a maximum of only 20 v across it) may experience a momentary surge of 75 or more volts. Thus when four or six driver units are wired in series, the total surge voltage may be *several hundred,* causing breakdown across the magnetic gap between voice coil winding and the magnet structure of the units at the "hot" end of the series circuit. However, if the precautions recommended are taken, this possibility will be reduced appreciably.

It is obvious from the foregoing, therefore, that where very long speaker lines are necessary, or the installation involves too many speakers to handle at voice coil impedances, drivers with built-in line matching transformers are the logical solution. In cases where a constant 70 v amplifying system is used, these same drivers will provide the proper power taps.

Selecting A Horn

It has been common practice to select heavy duty trumpets primarily on the basis of initial cost, usually with the assumption that only low frequency response is being compromised. A second glance at trumpet specifications, however, will reveal a relationship between trumpet size (air column length and horn mouth diameter) and the angle at which the sound is dispersed. Note that the dispersion angle *decreases* as the horn size increases. Thus a gain in fidelity is accompanied by a loss of coverage off speak-

Continued on page 82

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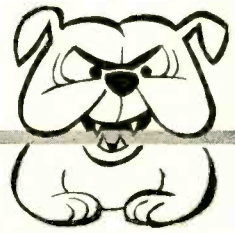
NEW CAPABILITIES IN: ELECTRONIC TUBES • SEMICONDUCTORS • MICROWAVE DEVICES • SPECIAL COMPONENTS • DISPLAY DEVICES

TOUGH DOG CORNER



Difficult Service Jobs Described by Readers

Lower Frequency Conversion

Dealers here convert many American made TV sets from 60 to 50 cps ac operation. I bought a Motorola Model 14P5 from another dealer and soon found all kinds of trouble. The raster became very weak and developed vertical jitters and bottom foldover. The sound was bad.

I figured the jitters was probably caused by improper filtering in the power supply, so I ordered two new electrolytics, connected them in parallel, and installed them in positions 807-A, B and C as shown in the diagram. This is the regular procedure for filtering 50-cycle current in a 60-cycle set. During the process, I noticed the original dealer had connected the 10 μf to the 12CU5 vertical output tube instead of the 12CU5 audio output tube, which accounted for the bad sound.

I also paralleled 3 10Ω 25 w resistors in series with one side of the ac power input to lower the voltage slightly. It is best to do this with converted equipment to prevent 50 cps overheating.

The jitters disappeared, but the vertical hold was unsteady. After this experiment, I installed a 680 K resistor in place of R-605 (470 K) in series with the vertical hold control. Everything was fine now except the vertical foldover which started about 20 minutes after the set was switched.

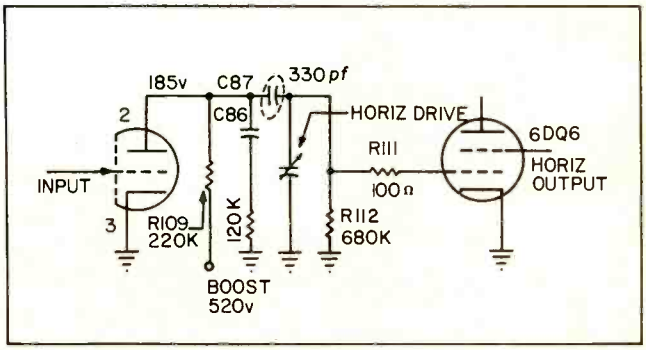
I then replaced the vertical sweep and output tubes, but the foldover remained. Capacitor C-612 (0.002 μf 1000 V) shunting the VOT primary was bad, so I replaced that. The foldover still remained.

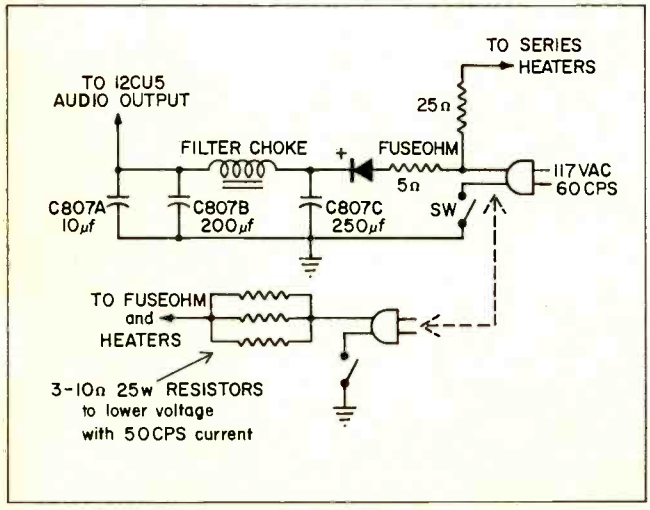
I then remembered an article in ELECTRONIC TECHNICIAN which said to replace several capacitors in the vertical sweep circuit when such troubles persist, so I pulled out all the capacitors listed in the diagram and replaced them. I also replaced 3 resistors because they were badly burned. I am now happy to say that the set works perfectly on 50-cps with good sound and a crystal-clear raster. The raster was very weak before, probably because "second hand" electrolytics had been installed previously in the power supply. *Reid Montgomery, Mexico City, Mexico.*

Hot Capacitor

A rather elusive trouble was located in a Zenith 22T20 chassis brought to the shop for service. The customer had complained that the picture became narrow several minutes after the set was turned on. Tubes didn't help and it was noted that the horizontal output tube plate gradually became cherry red. With the chassis on the bench, however, the set would perform normally for hours! But as soon as it was in the cabinet again the picture would slowly become narrow. We suspected that the problem was being caused by insufficient horizontal drive when something warmed up. But what? The only clue seemed to be a slightly low plate voltage on the horizontal discharge tube. Further checking finally revealed that the coupling capacitor C87 had high resistance leakage of about 1 MΩ while relatively cool but decreased to 300 K when the set warmed up. *Alan G. Sorensen, Milpitas, Calif.*

When leaking capacitor warmed up it caused picture to shrink.





Detailed schematic of TV set conversion from 60 cps to 50 cps operation.

TOUGH DOGS WANTED

$10.00 paid for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Photographs are desirable. Unacceptable items will be returned if accompanied by a stamped envelope. Send your entries to "Tough Dog" Editor, ELECTRONIC TECHNICIAN, 1 East First St., Duluth, Minnesota 55802.

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SHOP HINTS

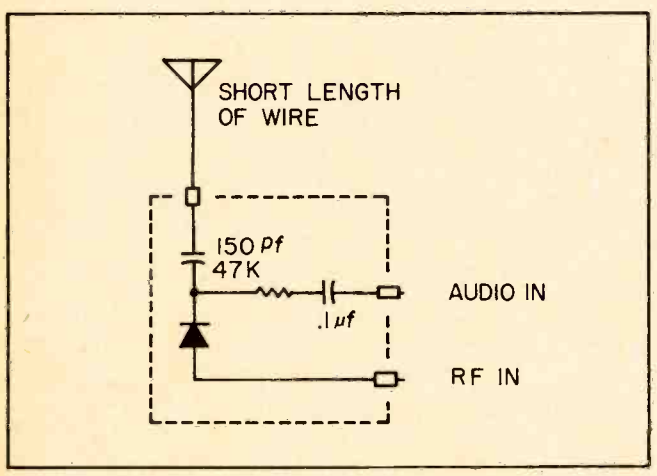
TIPS FOR HOME AND BENCH SERVICE

Tuner Repair

If after a good cleaning turret-type tuners still perform erratically, I simply remove each channel strip, one at a time and bend the detent that holds the channel strip in place toward the front of the tuner. This, in turn, puts a little pressure on the channel strip, to insure that it does not vibrate in its place, which may cause intermittent operation. Be careful to bend the detent just enough to stop the looseness of the channel strip. *John A. Krzywulak, Trenton, N. J.*

Remote Control Tester

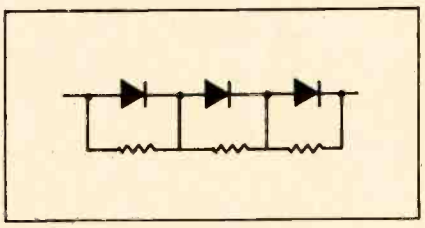
As a side line we do considerable service work on tone modulated radio controlled garage door openers. Occasionally we work on the radio receiver section of these systems when the transmitter used with them is not available to us at the time of servicing. We have a standard good AM radio generator in our shop, but its only tone modulation is the standard 400 cycles. This is of no use when the required audio tone may be anything from a few hundred cps to several thousand cps. Our shop also boasts a good audio frequency generator. The problem was to find a means of combining the signals from these two generators to obtain the desired composite signal. The circuit diagram we hashed together accompanies this article. We built ours in a small one by one by two and a half inch plastic box. It has fulfilled all of our needs. Experimentation shows it provides good quality modulation of every radio frequency and are audio tones so far tried with it. *Bob Hutson, Poway, Calif.*



Circuit Diagram used to modulate RF carrier when testing remote control receivers.

Repeated Silicon Rectifier Failure

A few isolated cases of repeated silicon rectifier failure have been reported. This condition seems to be caused by transient high voltage peaks or spikes on the incoming AC line. These surges are of extremely short duration (of the order of about 10 microseconds), and are generated by external sources located near the receiver. These surges result from the operation of almost any number of electrical devices—motors, furnace igniters, etc. They can also be caused by a sharp load change across the line, and, at times, even by lightning.



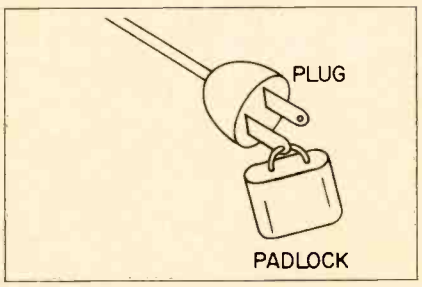
Resistors paralleling rectifiers can prevent surges from destroying rectifiers.

When it has been determined that repeated silicon rectifier failure is being experienced, the receiver may be protected against further trouble from these transient voltages by the installation of three rectifiers in series in the place of the original one. Each of these rectifiers should also be paralleled by a 50 K, ¼ watt resistor. See diagram.

Remember, this procedure should only be employed after it has been positively determined that the set is not at fault and that the condition is a recurrent one. It should not be employed on initial failure. *GE Service Dept.*

Fail Safe

Each of our servicemen carry along some small, inexpensive padlocks. When on a service call it is necessary to leave the TV set, appliance, etc; for a while for some reason and we want nobody to turn it on in our absence, we simply hook a padlock through one prong of the plug so it can't be plugged in. *Harry J. Miller, Sarasota, Florida.*



SHOP HINTS WANTED

$3 to $10 for acceptable items. Use drawings to illustrate whenever necessary. A rough sketch will do. Unacceptable items will be returned if accompanied by a stamped envelope. Send your entries to Shop Hints Editor, ELECTRONIC TECHNICIAN, Ojibway Building, Duluth, Minn. 55802. The hints published in this column have not necessarily been tried by ELECTRONIC TECHNICIAN editors and are the ideas of the individual writers.

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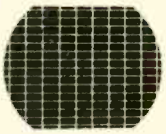
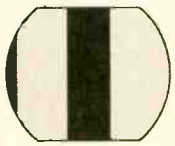


Crosshatch

Vertical Lines

Horizontal Lines



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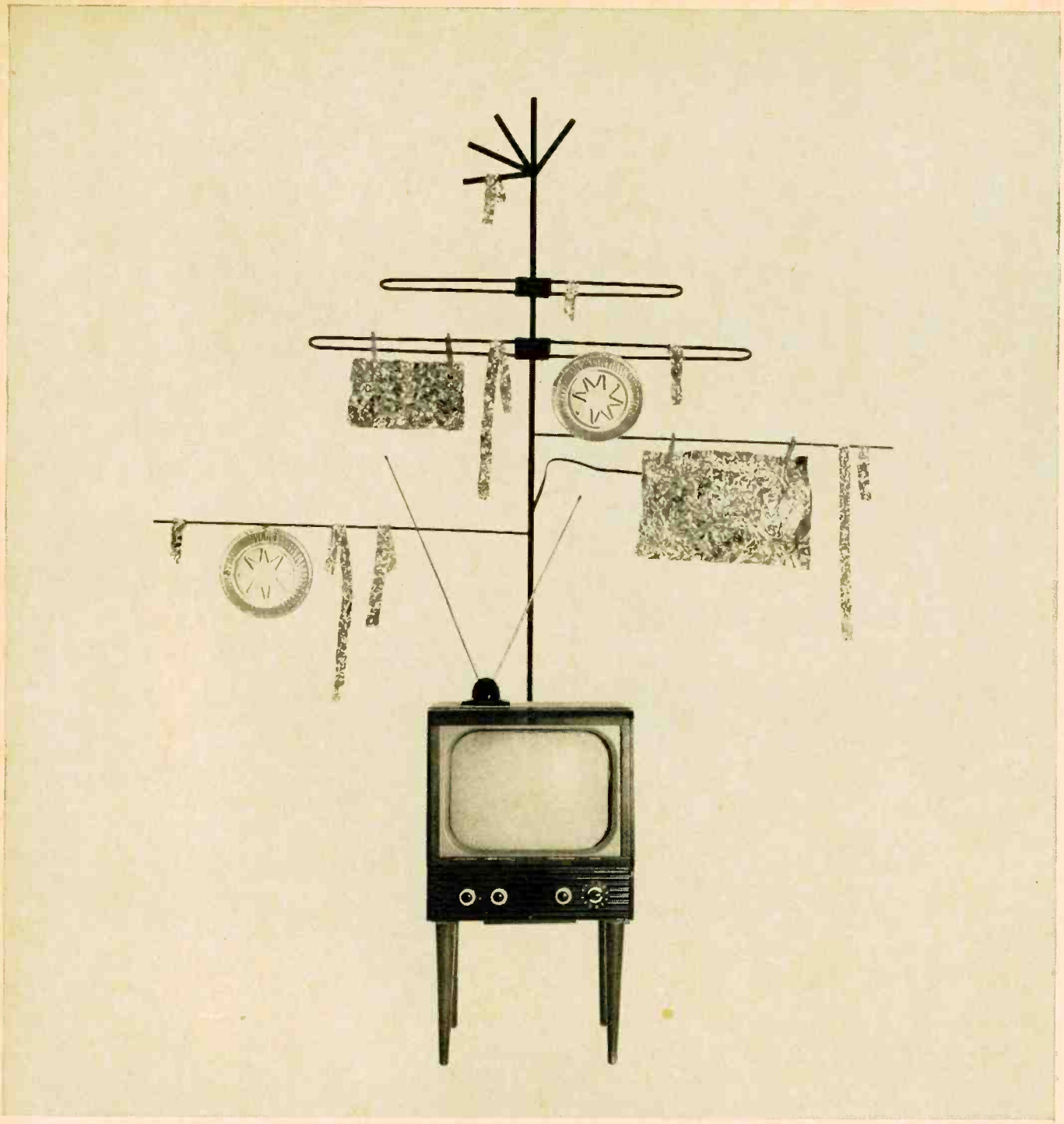

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INDUSTRIAL ELECTRONIC SECTION

CONTENTS

JULY • 1964 • VOL. 80 • NO. 1

Do-all diode serves as undervoltage and overvoltage circuit element, in voltage regulator circuits and remote control systems

NEXT TIME USE A ZENER

by Robert P. Brickey

■ Zener diodes have been available in a wide range of power ratings, tolerances and voltages for some time. Few technicians, however, are thoroughly familiar with applications. This is not too surprising. Many far-reaching advances have been made in solid state physics—and the zener diode is one important component.

Characteristics

Zener diode properties are derived from a PN junction operated with a reverse bias—in an avalanched condition. When the N side of a PN junction is made more positive than the P side—by less than the breakdown voltage—the junction is reverse biased and very little current flows across the junction. Under this condition, electrons on the N side are repelled by the negative charge on the P side, and the positive holes on the P side are repelled by the positive voltage applied to the N side. Because the N and P type semiconductor materials are never perfect, existing impurities cause some holes in the N side and some free electrons on the P side. Hence, when back-biased, a very small current flows.

If the back bias is increased up to the junction breakdown voltage and beyond, diode conduction increases rapidly. This is the zener operating region. The change from nonconductance to conductance as the voltage increases is very rapid in a diode designed specifically for zener operation.

The current increasing power at the avalanche point is somewhat involved—similar to electron multiplication in a photo-multiplier tube. An electron accelerated by a voltage across the junction collides with a fixed electron and knocks it free. These electrons then collide with other electrons, multiplying the current flow across the junction. Increased current will cause an increased voltage drop across a series impedance in the diode circuit, resulting in a constant voltage drop across the diode. It is obvious, therefore, that a zener diode can serve like a gas tube shunt regulator.

Voltage Regulator

A gas tube voltage regulator circuit is shown in Fig. 1 A similar circuit employing a zener diode is shown in Fig. 2. Although circuit operation in both cases is similar, several differences should be understood.

A graph of the applied voltage versus the output voltage for the regulator tube circuit is shown in Fig. 3. Since the gas ionization potential is somewhat higher than the operating potential, the supply voltage must exceed the ionization level. In Fig. 4, however, the zener diode graph shows that the supply voltage is only slightly above the operating voltage.

There's another advantage in us-

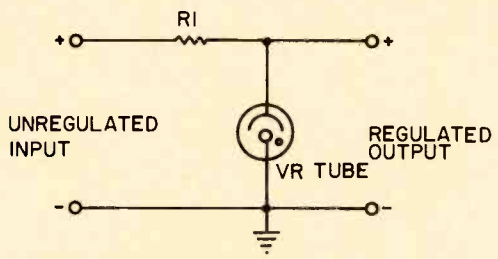

Fig. 1—VR tube voltage regulator circuit.

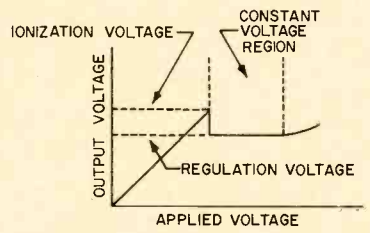

Fig. 3—Curve of gas tube regulator circuit output voltage.

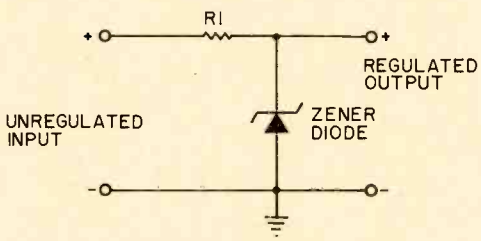

Fig. 2—Zener diode voltage regulator circuit.

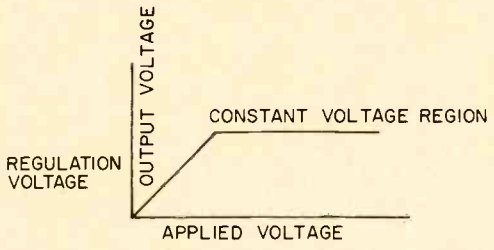

Fig. 4—Zener diode regulator circuit output voltage curve.

ing zener diodes, too. Voltage regulator tubes operate at discrete voltages—70, 90, 105, 135, for example—but zener diodes are available that operate over a continuous range from 3.3 to 200 v in either 5-, 10- or 20-percent tolerances.

If a gas tube regulator must feed a capacitive load to provide additional filtering, decoupling, etc., great care must be used in selecting the operating parameters; otherwise, strong relaxation oscillations might occur. When using a zener diode, however, the load may be capacitive with perfectly stable operation.

The life of a VR tube is also limited by the internal gas discharge which eventually results in changed operating conditions. As presently known, the life expectancy of a zener diode is infinite.

Other advantages — including high power-handling capability, small size and physical ruggedness —make zener diodes attractive as voltage regulators. A suitable zener diode may be used to replace gas tube voltage regulators in almost any application. This does *not* mean, however, that a VR tube can be pulled and a zener diode simply soldered across its cathode and anode socket terminals. The characteristics of the zener diode may differ from those of the VR tube, requiring the series resistor to be changed. When a conversion is made, always check the operating current and voltage before the converted unit is placed back in operation.

Likewise, the power-dissipation and heat-sink requirements of the zener must be considered. If a single zener replaces a single VR tube, a heat sink may not be necessary. If a single zener diode replaces more than one VR tube, the diode temperature must be kept within ratings.

Overvoltage Protection

A relay is frequently used in RF amplifier fixed bias circuits to open the B+ in the event bias fails. The reliability of this type of undervoltage control can be improved with a zener diode. A diode is selected which has a zener voltage equaling the desired undervoltage trip level. As shown in Fig. 5, R1 is chosen to provide the necessary current to close the relay. If the supply voltage drops below the zener point the relay contacts open, disabling the RF amplifier. The zener provides a reliable reference voltage, eliminating critical relay adjustments.

Bias Loss Protection

Many electronic circuits require protection from overvoltage surges. A simple fuse is usually not adequate for most equipment. And it is frequently difficult to obtain a fuse that will give proper protection under widely varying load currents. Because zener diodes are very sensitive to small voltage changes, this problem can be solved by connecting a zener as shown in Fig. 6. Select a diode with its zener operating point just above the normal operating voltage. If the supply voltage exceeds the zener voltage, the increasd current through the zener diode will add to the load current and blow the fuse. This circuit provides effective protection to the load.

Zeners may also be used to clip transistor collector voltage spikes that would otherwise exceed maximum ratings. A typical dc-to-ac converter application is shown in Fig. 7. If the zener breakdown voltages are chosen to be slightly below the maximum transistor collector voltage rating, the zener will conduct above the zener voltage, decreasing the circuit impedance, and the voltage spikes.

Remote Control System

The circuit of a multicontrol, zener remote control system is shown in Fig. 8. Each relay will close as the voltage across the line exceeds the diode's zener voltage. A great many circuits may be controlled over a single telephone-type pair. Additional controls can be easily added.

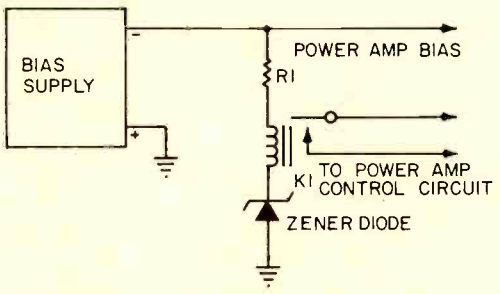

Fig. 5—Power amplifier bias supply undervoltage protection circuit.

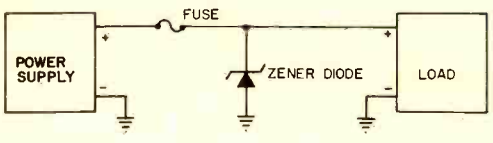

Fig. 6—Zener diode overvoltage protection circuit.

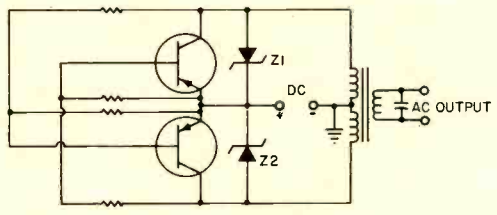

Fig. 7—Zener diodes used to clip collector voltage spikes in a dc to ac converter.

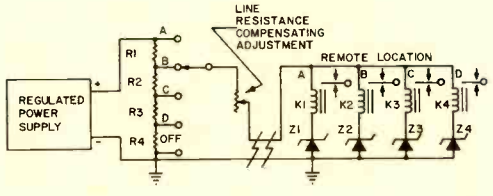

Fig. 8—Remote control system using zener diodes.

Here are the facts about how to determine whether or not you should age tubes

"Tube Aging Benefits— FACT OR FANCY?"

by Carl Henry

■ Any time technicians get together for a bull-session, talk always seems to turn to call-backs and what to do about them. Then someone mentions tube aging as a cure-all.

Well, what about this tube aging? Does it really do any good? Tube manufacturers today are producing a higher quality product than ever before. Tube design is constantly being upgraded. But in mass production, it is not possible to thoroughly test every tube made, and mass production is what keeps the price down.

One approach to a problem like this is to look around and see what others are doing about it. IBM, for example, uses many tubes in its computers, and a high percentage of early failures would be very troublesome. But IBM does not age their tubes. They do recognize the inherent problem of early tube failure, of course, but they use only premium tubes constructed to their specifications.

The Boeing Company, on the other hand, has discovered that most defects in tubes running its automatic machines show up in the first 400 hours. All tubes are aged under normal operating conditions for 200 to 400 hours before being put to use. After aging, they are good for 5000 to 10,000 hours.

Western Electric Company is one of the world's largest tube manufacturers, and they approach the problem from a different angle. They define tube aging as the operation of a new tube in such a way as to optimize and stabilize its characteristics. They divide tube aging into two steps. The first step is called "activation," which brings the tube electron emission up to a satisfactory level. In general, activation requires the application of higher than normal voltages on the tube for a predetermined period. This is normal procedure among all tube manufacturers. The second step of the aging process is called "stabilization," in which the tube is operated for a certain length of time with normal voltages to establish a satisfactory equilibrium. The aging schedule varies in duration and complexity depending on the particular tube and such other factors as construction materials, pumping quality, and general quality requirements. Fig. 1 illustrates a typical bank of tubes being aged by Western Electric's aging method.

Tube failures can generally be grouped into two classes. The majority of tube failures are caused by a gradual loss of emission over several thousand hours of operation. A definite percentage of failures are, however, catastrophic; that is, heater burn-outs, glass cracks, or short-circuits occur rapidly within the first few hours of operation.

Of course, nothing can be done about the slow loss of emission in tubes. But what about catastrophic failure? In a 1959 study[1], some 400,000 tubes were tested in an incoming component inspection program. At first, the same procedure—random sampling—was used for other components. High failure rates of equipment in the field due to defective tubes led to the study, which concluded with the testing of all incoming tubes. Visual, electrical, X-ray and noise tests were among those performed. In the electrical testing program, a failure rate of only 1.8 percent was found. This, along with a previous Air Force test[2], led to the conclusion that mere testing of incoming tubes is not worthwhile. Certainly, critical tube types which have been shown by experience to have a high failure rate should probably be tested 100 percent; but most of the others have such a low failure rate that testing them at all is not economically justifiable.

Another report[3] along these lines suggested that the use of premium type tubes in certain critical categories can reduce the catastrophic

failure rate from 6.6 percent to less than 0.1 percent. However, none of these studies considered the possibility of preaging vacuum tubes to reduce catastrophic failure rates. The Southern Railway System has approached the problem of eliminating catastrophic failures among regular tubes by aging incoming tubes 48 hours. Failure rates from 7 percent to less than 1 percent, depending on tube type and manufacture, was found among incoming tubes. These tubes are used in mobile VHF radio equipment, and a reduction in failure rate in this application is valuable to the company. After aging, the tubes are tested to determine their quality. Tubes aged 100 hours have only 10 percent of the catastrophic failure rate of unaged tubes. This means that if in your application you age tubes 100 hours, your failure rate will probably be 10 percent of the normal 5- to 7-percent catastrophic failure rate, or about 0.5 percent.

One way you can reduce the catastrophic failure rate of tubes you install is to construct the tube ager shown in Fig. 2. The proper heater voltage is supplied from a transformer. In the unit shown, all electrodes except the filaments are left open, and no voltage is applied to them. Whether the other tube elements are activated seems to be a matter of individual taste more than anything else; some technicians prefer to age with a slight plate current, some with only the heater voltage. Results seem the same in either case, and the failure rate does not appear to be substantially different.

After constructing the ager, try some of the tube types that give you the most trouble on call-backs. Of course, tubes with directly-heated cathodes must not be aged very long in comparison to heater-cathode tubes, and "instant heat" type tubes should not be aged at all, since their life may be substantially shortened. Start your aging at 50 hours, and increase it if necessary.

Over a period of weeks you can determine which tubes need aging most, which types are most likely to fail within 50 or 100 hours, and which types have a low failure rate. Discontinuing the aging of tubes with low failure rates makes sense, as does aging and checking all tubes that show a high failure rate. By using such an aging/testing procedure, call-backs on industrial equipment can be considerably reduced. ■

References:

(1) "Can Tube Testing Spot Early Failures?", M. Goetz and R. H. Johnson, Westinghouse Electric Corp., ELECTRONICS, July 24, 1959

(2) "Evaluation of Incoming Inspection and Selection Procedures for Electron Tubes," Aeronautical Radio, Inc., Pub. 117, Washington, D. C., April 4, 1958

(3) "Airline Tube Reliability Curve Goes Up," Philip Klass, AVIATION WEEK, Sept. 13, 1954

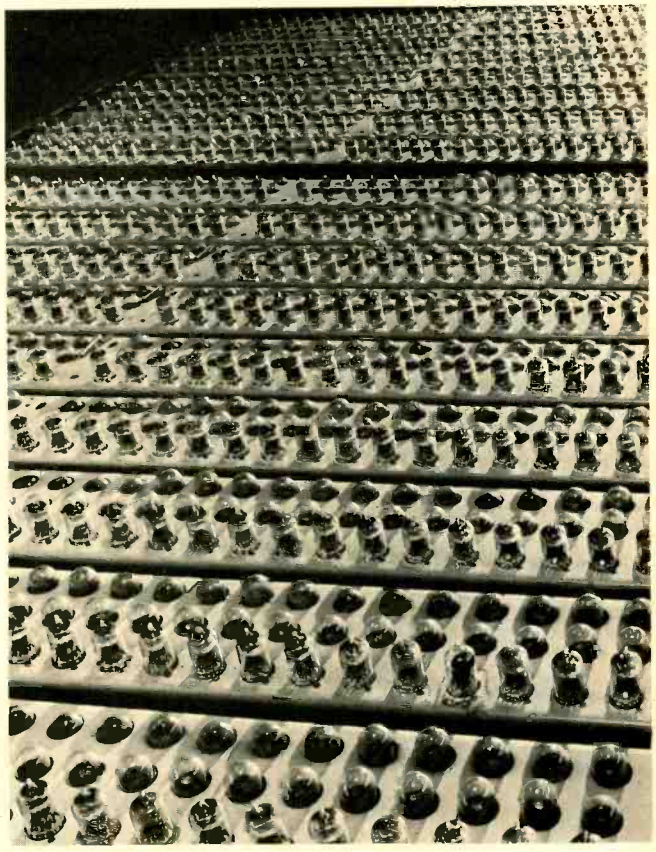

Fig. 1—A rack of tubes being aged in the Western Electric plant. The company ages all tubes in order to stablize their performance before they are put into service.

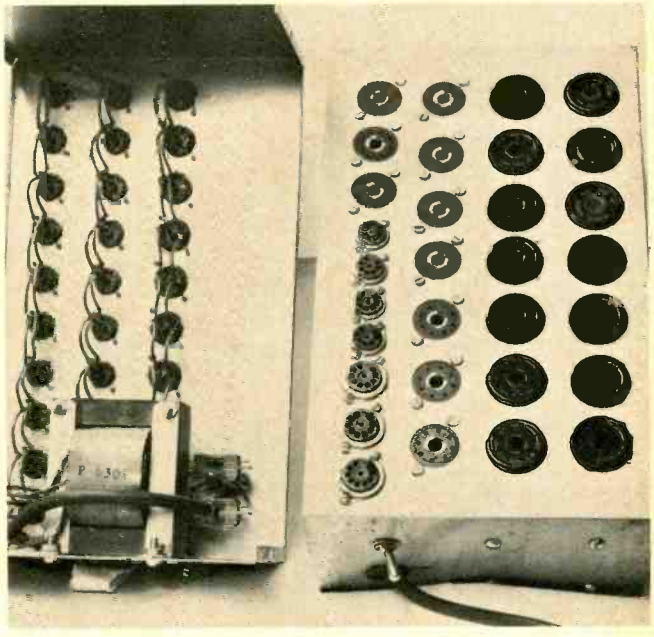

Fig. 2 — A typical shop-built tube ager for use in an industrial service shop. Sockets are provided for all types to be aged, and the heater voltage is set accordingly.

Repairing & Troubleshooting Xenon Lamp Devices

This rundown gives you a head start in servicing an industrial electronic device that becomes more common each month

PART I

by Reginald W. Neale

■ Many industrial processes require an extremely intense source of visible and ultraviolet light. Until a few years ago, the only available source of light at these wavelengths was the bulky, erratic carbon arc lamp. But the carbon arc now is being phased out in favor of the more reliable, compact xenon arc (XA lamp), shown in Fig. 1. As the field of applications for these lamps expands, it is increasingly likely that the industrial electronic technician will eventually be faced with the problem of diagnosing and servicing these units. And here are some hints to make the job easier.

The XA Lamp

The XA lamp is a tube filled with xenon gas at a high pressure. When the gas is ionized and conducting current, the excited atoms of gas radiate light in much the same way mercury gas does in an ordinary fluorescent lamp. Unlike the fluorescent lamp, however, the xenon arc discharge is concentrated in a volume of a few cubic millimeters. Radiation from the arc has a continuous spectrum that extends into both the ultraviolet and infrared (Fig. 2).

XA light is especially useful for photographic purposes because it contains a much larger proportion of ultraviolet radiation than the light from an equivalent wattage incandescent lamp. Its color is a good match for daylight and is relatively insensitive to current variations.

The XA lamp is very compact for a given wattage and therefore normally runs quite hot. Its envelope is made of quartz, which transmits ultraviolet and resists heat. To keep temperatures at a reasonable level, forced air cooling is necessary in all but the smallest lamp sizes.

Safety Precautions

A lamp which has just been turned off will remain scorchingly hot for several minutes. If it must be handled, allow plenty of time for it to cool.

The lamp itself should be handled with the same care as a large CRT. The envelope is under pressure of several atmospheres even at room temperature. New lamps are supplied in a protective casing, and the lamp should always be in its protective casing when it is handled or transported.

Because the large amounts of ultraviolet (UV) radiation emitted by an XA lamp can damage the sensitive retina of the eye, never look directly at an operating lamp or even at its reflection from a nearby shiny surface. In addition, the area around large lamps should be ventilated to prevent the accumulation of ozone generated by the UV.

Power Supplies, Ac & Dc

Most XA lamp power supplies include a built-in starter circuit. The main arc discharge is initiated by a high-voltage, high-frequency

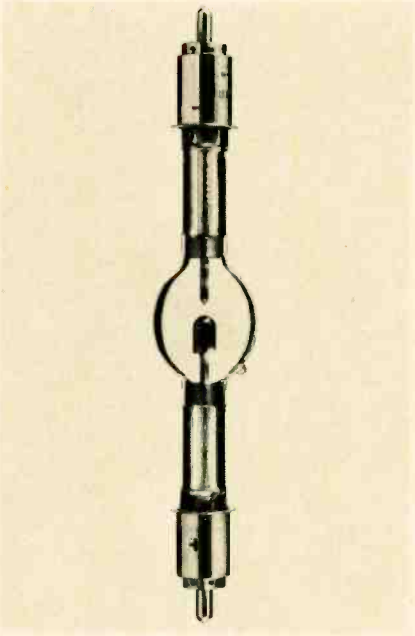

Fig. 1—Xenon arc lamp.

discharge. Usually, when a cold lamp is started, the arc will strike, go out immediately, strike again and go out again several times with a characteristic popping or sputtering sound. The popping may continue for a few seconds before the arc becomes established in a stable form. A hot lamp, however, will restart immediately. Some starters have a timing circuit which applies starting voltage for only a second or two when the start button is momentarily depressed and which prevents the starter from being energized continuously no matter how long you hold your finger on it.

The power supply must deliver high current at a relatively low voltage to the lamp. Voltages for all sizes of lamps fall between 19 and 25.

Some applications can use an XA lamp on ac—as the exposure of very slow photographic materials, for example. The ac supply is the simplest to manufacture, but it has the disadvantage that the arc goes out as the supply voltage drops to zero on each half-cycle, then re-forms again as the voltage increases in the other direction.

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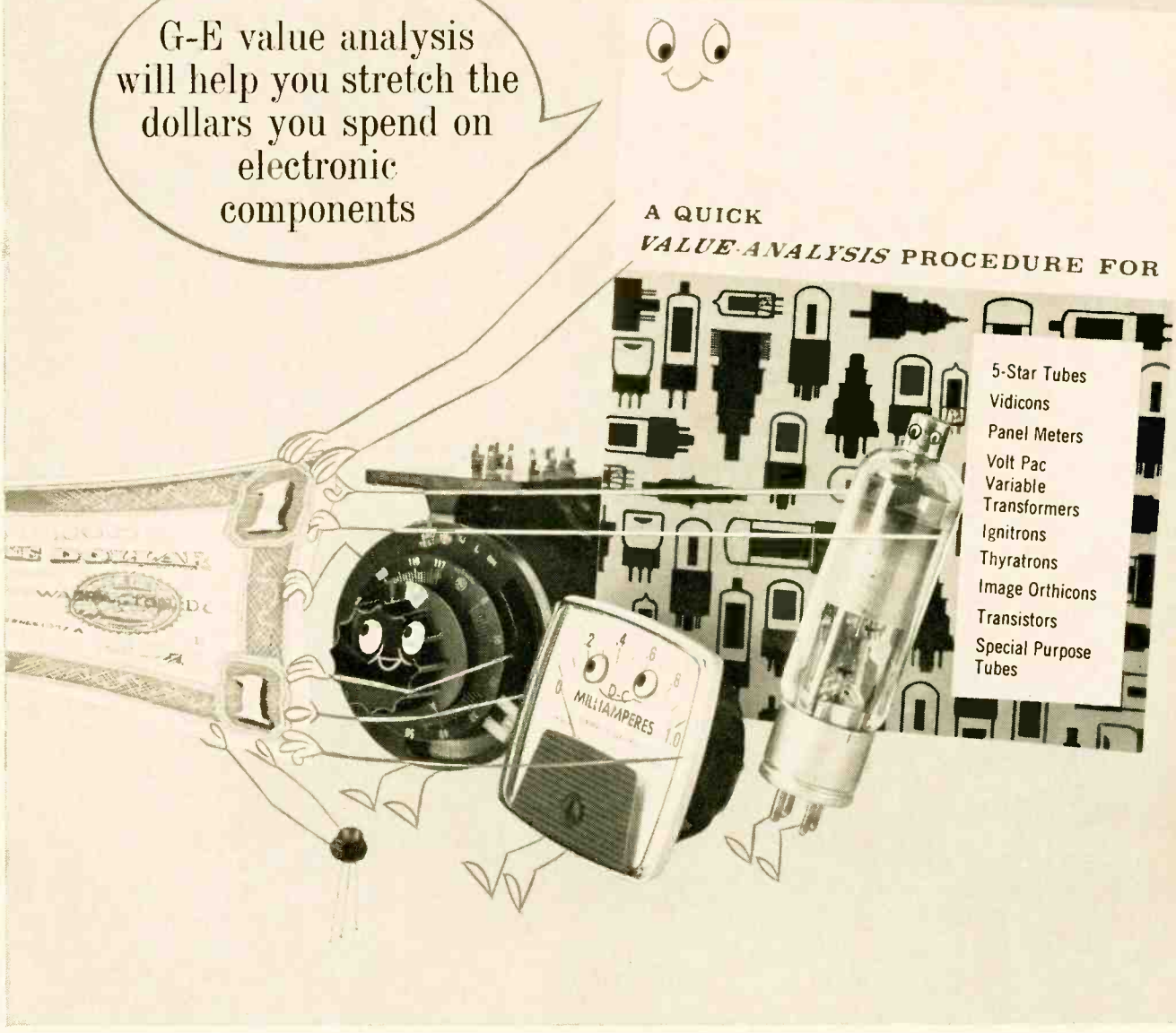

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GENERAL ELECTRIC

- - - for more details circle 22 on post card

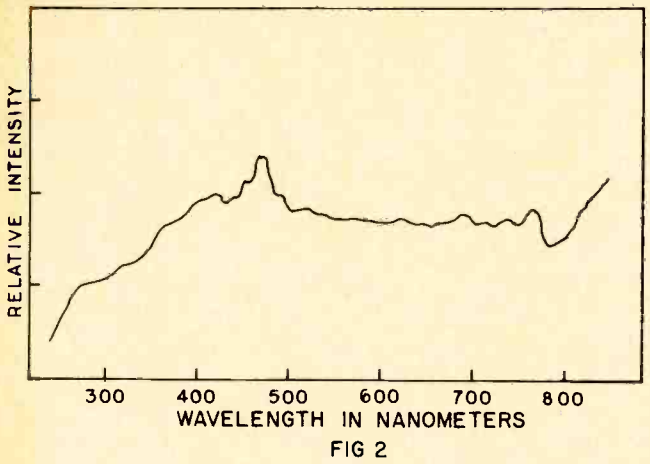

FIG 2

Fig. 2 — Radiation spectrum of xenon arc lamp.

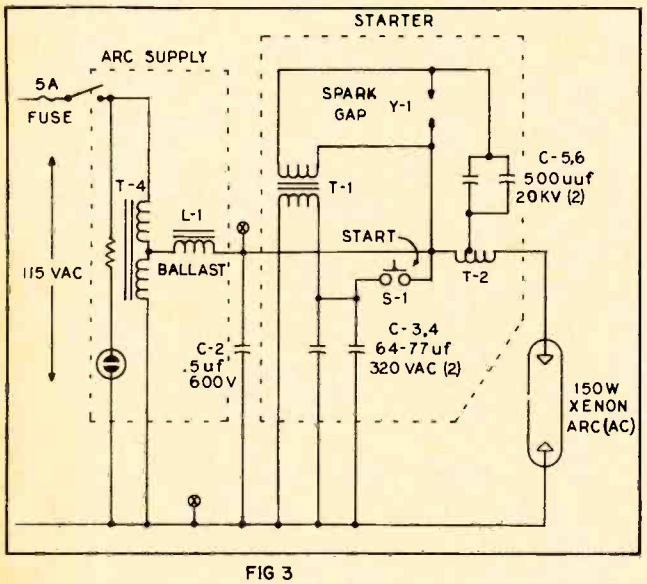

FIG 3

Fig. 3 — Schematic of typical low- or medium-power xenon arc power supply and starter.

This causes a 120-cps flicker or "strobe" effect. Where this effect is objectionable, a more expensive dc supply must be used.

Dc lamps have the two electrodes shaped differently to minimize erosion. The upper, larger electrode is connected to the positive side of the supply. (Although the lamp would operate with reversed polarity, its life would be markedly reduced. For this reason some supplies have a relay which prevents the starter from operating if the lamp leads have been reversed.) For maximum lamp life, dc lamps must be operated with a ripple voltage of less than 10 percent.

The expense of the power supply is not the only important difference between ac and dc lamps. Dc lamps have much longer life, are easier starting and have less arc "jitter." The principle advantage of an ac lamp, on the other hand, is its ability to diffuse or distribute the arc intensity more uniformly.

Troubleshooting

The most frequent trouble call on one of these rigs is for a lamp that won't start. This can be because the lamp is nearing the end of its useful life. Gradual erosion of the electrodes results in an increased gap length, conductive deposits on the inside of the envelope, and contamination of the gas, all adding up to a higher required starting voltage. The average useful lifetime of XA lamps is between 1000 and 2000 hr.

XA lamps should not be operated after the light output has fallen to 50 percent of the original value at the same arc current, even if no starting difficulty is encountered. The increased current required to maintain brightness at the "new" level boosts the wattage, and the dark coating on the inside of the envelope absorbs a significant portion of the radiated output. The heat that results from this absorption could soften the quartz and cause an explosion.

A good first step in troubleshooting is to install a replacement lamp. Lamps are not ordinarily subject to catastrophic failure, so if it won't start because it is defective, it probably has a history of increasingly harder starting. Lamp aging also results in a tendency for the arc to "jitter" from one position to another.

When changing the lamp, remove the protective casing from the replacement lamp. Wipe the envelope thoroughly with alcohol and distilled water.

If a new lamp won't start either, then the area of investigation can be divided into two sections, depending on whether the characteristic sputtering of a momentarily ignited arc is observed.

If no flashes are seen, the difficulty can be in either the main power supply or the starting circuitry. The open-circuit arc supply voltage can be measured at the lamp terminals. It should be at least 65 vdc or peak ac. (Do not attempt to measure voltage at the lamp while the starter is operating. Your meter will certainly be ruined, and you may receive a dangerous shock.)

A lack of arc supply voltage calls for a continuity check through both positive and negative sides of the supply, back to the ballast. A diagram of the unit is almost a must, but Fig. 3 is representative of many low and medium-power units. The resistance of all windings which carry or regulate arc current, such as both windings of T1 and T4, should be too low to measure accurately with an ordinary 20KΩ/v meter. All connections must be solid. Check the fuse, of course, and the rectifiers if the supply is dc. ■

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NEW PRODUCTS

SHOCK/VIBRATION ISOLATOR 400

A series of shock and vibration isolators are announced. They are said to have unusually high inherent

damping, providing low resonant transmissibility of about 2.0. A total of twelve load ranges are available to provide efficient isolation from 20 to 850 lb per isolator. The central core for attaching equipment to the isolator can either be a through-hole or tapped. Barry Wright.

HAZARD SENSOR 401

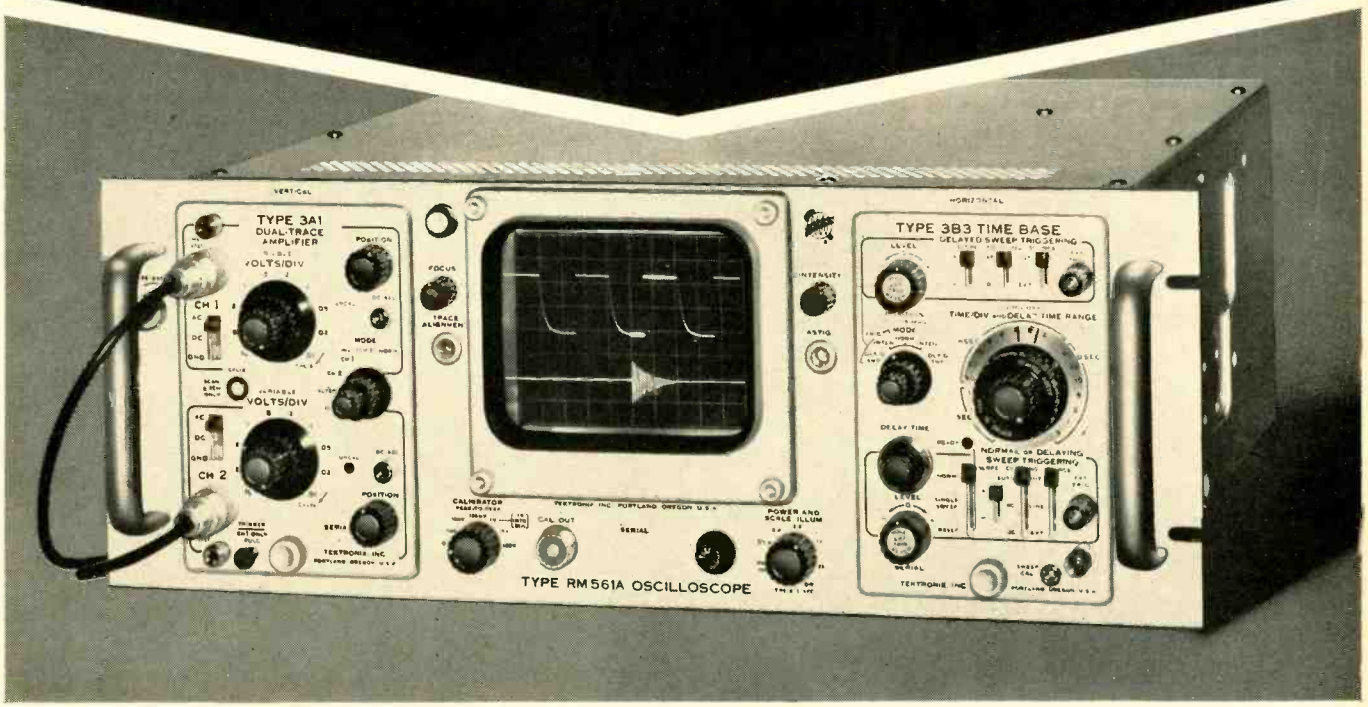
Announced is a sensor device with high capabilities in the field of accident prevention, according

to the maker. Known as the "Hazard Sensor" the device promises significant application in the constant problem of accident prevention in industry, manufacturing plants, laboratories, institutions, swimming pools, refineries, dry docks, electrical stations, sump pump installations and test areas, it is said. Shock-Proof Electronics.

RESISTORS 402

A line of resistors designated Pyromeg, series HR 1250, are Ultra High Meg types, offering resistances from 10^8 to 10^{14} Ω. The interiors

ONLY 7 INCHES OF RACK HEIGHT *for this Tektronix Oscilloscope* THAT ACCEPTS 17 PLUG-IN UNITS



Type RM561A Oscilloscope—with Type 3A1 Dual-Trace Amplifier Unit and Type 3B3 Time-Base Unit—provides high sensitivity, wide-band, dual-trace operation *combined with calibrated sweep delay* in a compact, moderately priced package.

You can use any of 15 other amplifier and time-base units for differential, multi-trace, sampling, other applications, including matched X-Y displays using the same type amplifier units in both channels.

Also, you can observe no-parallax displays and sharp trace photography. For the new crt has an internal graticule with controllable edge lighting.

TYPE RM561A OSCILLOSCOPE
(without plug-ins) $525

TYPE 3A1 DUAL-TRACE UNIT $410

Passband from dc-to-10 Mc for each channel • Sensitivity from 10 mv/cm to 10 v/cm in 10 calibrated steps, 1-2-5 sequence, variable control.

TYPE 3B3 TIME-BASE UNIT $525

Normal and Delayed Sweeps from 0.1 μsec/cm to 1 sec/cm in calibrated steps, 1-2-5 sequence, with variable control • 5X Magnifier • Single Sweep for Normal Sweep • Delay Interval from 0.5 μsec to 10 sec • Flexible Triggering Facilities with triggered operation to above 10 Mc.

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- - - for more details circle 43 on post card

NEW PRODUCTS

of the resistors are filled with nitrogen and hermetically sealed to provide complete protection of the resistance element, the report said. Voltage coefficient: Below 200 ppm/v, temperature coefficient: Does not vary with resistance value, voltage rating: 5000 vdc, size: 1¼ x 9/32 in. Pyrofilm.

RESISTANCE STANDARD 403

The model RDS-615, decade resistance standard, containing six dialable decades with individual

controls and numeric displays, features ± .0025 percent accuracy and low reactance of less than 0.1 percent phase angle at 10 kc, the maker says. Instrument availabe for rack mounting or with walnut case for bench use. Price $495. General Resistance.

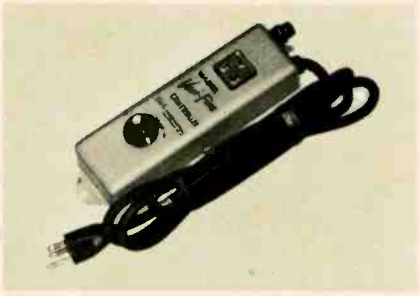
ULTRASONIC UNIT 404

Announced is the Mini-Sonic, a compact ultrasonic cleaner featuring a plug-in stainless steel cleaning tank which may be easily removed

for draining or other purposes, the maker said. The tank has a one pint capacity and tank dimensions of 3½ x 3½ x 2-5/8 in., power output of 17 w. Price $79.50, complete with stainless steel cover. L & R Manufacturing.

CONTROLLER 405

A solid state motor speed and light controller—a device featuring stepless change from zero to max-



imum—is introduced. The model 200 permits infinite control of motor speed and light intensity, and can be utilized to vary the speed of ac/dc universal motors, the report said. Load currents up to a maximum of 7 amp at 117 v, 60 cps are possible. The device measures 8¼ x 2¼ x 1½ in. and features mounting ears for use where fixed installation is desired, the maker said. Price $14.95. Waber.

PHOTOELECTRIC SYSTEM 406

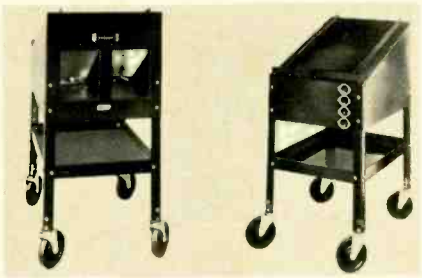
An all-silicon transistor photoelectric conveyor system is announced. The self-contained units

consist of two parts, the relay and light source. Called the TR-1, general-purpose unit, it operates up to 2,000 cpm and two different time-delay relays are available for dark or light operation with maximum time delay of 12 sec with a reset

of 50 ms. The matching LS-4 light source operates any system up to 15 ft without using special optics, the announcement said. Farmer Electric.

SCOPE DOLLY **407**

A scope dolly for laboratory and shop applications, is introduced. Known as the model 61056, the



dolly will accommodate any popular type laboratory scope and has a protective rubber gasket which prevents damage to the scope while installing or removing. Features include three convenient power outlets and one input; a storage area for spare preamplifiers plus a storage pan for accessories (power cord, tools, manuals, etc.); casters are 5 in. diameter ball bearing, swivel-type with semi-hard rubber wheels. It is easy to assemble and is constructed of cold rolled steel with gray baked enamel finish which meets MIL specs, the report said. Metal Dynamics.

REVISED SCOPE **408**

It is announced that oscilloscope type 545A has been replaced by type 545B, featuring dc to 30-Mc

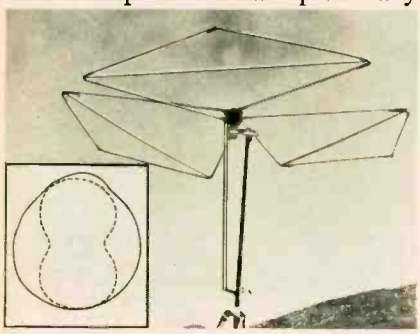
passband, 6-cm vertical scan, broadband triggering, and an illuminated internal graticule. A new CRT and a hybrid, solid-state/electron-tube vertical amplifier has been substituted, the announcement said. Complete compatibility with all 15 type A-to-Z plug-in preamplifiers has been retained, and new types 1A1 and 1A2 plug-in units provide dual-trace displays at dc to 33-Mc passband. Tektronix.

NEW PRODUCTS

FOR MORE INFORMATION CIRCLE PRODUCT NUMBERS ON POSTCARD FOLLOWING PAGE 90.

FM ANTENNA 200

An omni-directional FM antenna, Model 4407G, is announced. Antenna is reported to have practically



equal gain in all directions. The dipole system consists of three separate diamond shaped dipoles in parallel. This design provides constant gain in all directions, at all FM frequencies, producing ideal, almost circular, directivity patterns, the report indicated. It has been designed to fill the newly-developing needs of the metropolitan and suburban FM markets. Price $15.70. Channel Master.

TUNER/SWITCH CLEANER 201

A tuner and switch cleaner, said to be safe for all plastics used in TV tuners, knobs and cabinets is introduced. Known as Super Rid Ox, it is reported to be a blend of three selective cleaners, each designed to do a particular cleaning job. Packaged in an 8 oz spray can with a shock proof extension. Price $1.89. Colman.

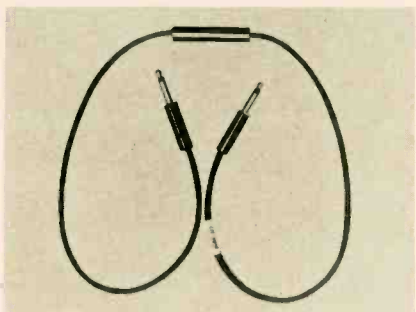
POCKET-SIZE RECORDER 202

A transistorized "Electronic Notebook" is said to record up to 30 minutes on one tape. It picks up ordinary conversation as far as 25 ft away, the maker said. Fits pocket, purse, brief case, or glove compartment. It weighs 1½ lb. and measures 2 x 3½ x 5 in. The unit is powered by 4 standard 1.5 v penlight batteries. Price of $39.95 includes remote control microphone,

earphone, 4 batteries, tape, extra reel, leather carrying case, shoulder strap. The Hahn Co.

PADS 203

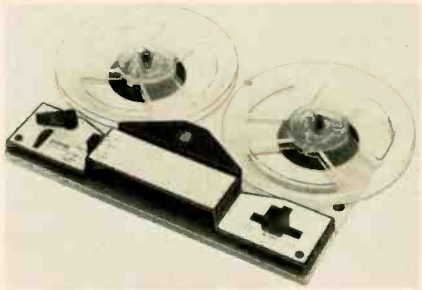
Communications and testing pads, equipped with PJ-055 telephone plugs, are announced. The



Pad is made of a black Nylon outer shell with white Nylon end inserts. Fairhill.

TAPE DECK 204

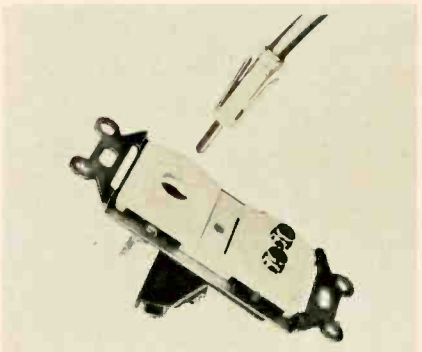
A 3-speed tape deck BSR TD10, is announced. Speeds: 1⅞, 3¾, and 7½ ips. Heads: ¼ track stereo playback, record and erase, 7 in.



Reel capacity, Fast forward, fast rewind, 3-digit counter. Size: 12¼ x 8⅛ x 2¼ in. (above motor board). Vidaire.

MASTER ANTENNA TAPS 205

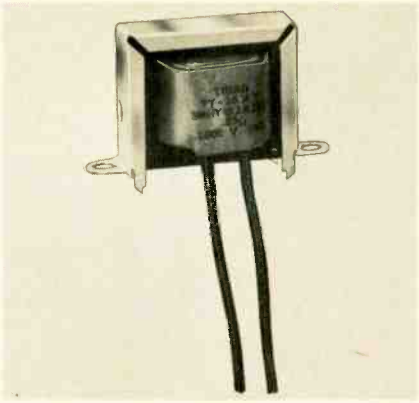
A series of flush-mounted, color-matched wall taps that can be installed before the rooms of a hotel or motel are painted is announced. Called Versa-Taps, they enable an installer to check out an entire MATV system as soon as power is turned on in a building, the



maker said. Modular constructed, they are available for VHF, UHF or FM systems. Blonder-Tongue.

AUDIO TRANSFORMERS 206

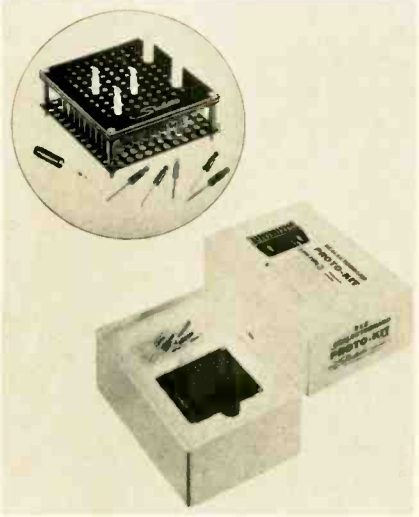
A line of shielded wide-range output transformers for use with low-profile high-fidelity amplifiers is announced. Eight models are available, ranging from 3300 to 8000 Ω primary impedance for use with Williamson circuits, single-ended and push-pull operation. Frequency response for each is said to be ± 2 db from 20-20,000 cps, with secondary impedances of 4, 8,



and 16 Ω. Case height is only 2½ in. Triad.

PROGRAMING BOARD **207**

Announced is a miniature program board device for Hi Fi showrooms, capable of switching multiple

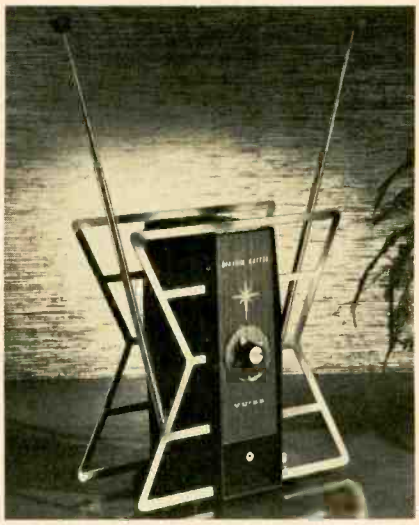


inputs to multiple outputs. The Proto-Kit is available in two sizes, 9 x 8 and 10 x 10 hole matrices, both of bussed contact design, whereby paralleling of inputs and/or outputs may be achieved by simply inserting a connecting pin at the desired points in the matrix, it is said. Price $19.70 for the 9 x 8 and $28.00 for the 10 x 10. Sealectro.

INDOOR ANTENNA **208**

Called the VU-82, model 4000, a UHF/VHF/FM indor antenna is said to be two separate antennas, operating independently, and using two separate transission lines to the set's VHF and UHF antenna terminals. The unit was reported to work as 2 stacked antennas, maintain constant 300Ω impedance, and provided with an impedance-compensating switch to eliminate dipole-

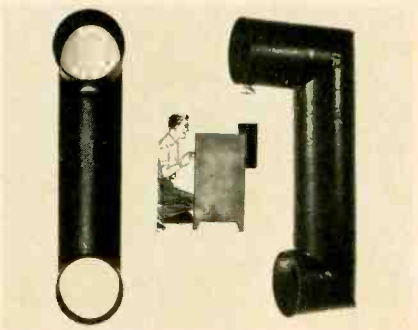
NEW PRODUCTS



handling when changing channels within bands. Channel Master Corp.

CONVERGENCE AID 209

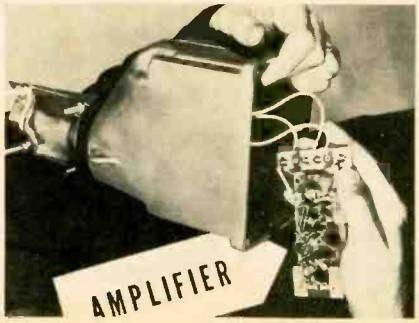
The reflect-o-scope, model 333, is announced. The device is said to simplify static convergence ad-



justments on color TV sets even in a fully lighted room. It weighs 1½ lb and measures 4⅜ x 7¾ x 18 in. Price $4.95. Wallin-Knight.

BOOSTER ROTATOR 210

A combination antenna booster/rotator combination, called the Gemini, has been announced. Combines the Tenn-A-Liner automatic



rotator with the Telstar transistorized booster and 2-set coupler. The amplifier section of the booster is hidden inside the rotator housing. The booster's power supply section is built into the control console. As a result, the Gemini requires only one unit on the mast and one housing at the set. The announcement indicated that only one transmission line is required; 80 ft of low-loss 4 conductor line is included with the unit. One line carries the rotator voltage, booster power, and the antenna signal, it was said. Channel Master.

COLOR CRT TESTER **211**

Announced is an instrument designed specifically for testing TV color picture tubes. The report

said that the device tests each gun for emission quality, interelectrode leakage and short. It has a large 3-color, sensitive meter with two scales: Red/green "quality" scale, with reference marks from 0 to 10, separate yellow scale to indicate interelectrode leakage and the meter permits accurate cut-off adjustment for each gun the announcement indicated. It has built-in cable and socket assembly and comes complete with sturdy laminated vinyl case with convenient cable-storage compartment. RCA.

ENCODER/DECODER **212**

A fully transistorized "silent sentry" attachment for two-way radios, the unit causes the transceiver to which it is attached to speak only when spoken to. This eliminates the unwanted conversations and background noises usually heard on voice radio channels, the report indicated. When the set is

NEW PRODUCTS

transmitting, it generates a desired tone of a special frequency. At the receiver, another unit listens for the tone and permits only the prearranged frequency to pass. Upon hearing this signal, it can either flash a light to tell people at the receiver that they are wanted or actuate the loud speaker so that the message itself can be heard. Price $69.50. Raytheon.

TEST CLIP 213

A universal test clip is announced which consists of a fine retractable spring clamp which is activated by

light pressure on the head of the handle. The clip will grip the finest wire and then retract into the insulating sleeve, thus permitting its use in high density circuitry without danger of shorting, the announcement said. The head contains a standard banana jack which permits the most flexibility in rapid interconnection. Hunter Associates.

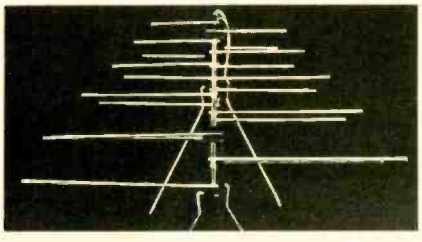
CB TESTER 214

A test unit for citizen band and

amateur equipment is announced. Called the Optimizer, it is said to be a high quality, single test unit with the versatility to test antenna power in watts, modulation by a meter reading, strength, antenna output, harmonics and SWR and base and mobile station efficiency. Price $47.50. UTICA.

INDOOR UHF ANTENNA 215

Announced is an indoor UHF antenna of the periodic type, called the "Golden Arrow," which is said



to provide excellent reception with color and black and white sets. Both all-channel sets and converters can be used with the new unit, the announcement indicated. Blonder-Tongue.

. . . INTRUSION PROTECTION

Continued from page 47

tamper-proof detection systems have a sideline benefit. The very existence of an installation, and reports of its use, act as a deterrent to professional or experienced burglars.

Economical to install and operate, the scientific type detection system cuts protection costs, is not subject to human failures or frailties, and can be put to work any time—anywhere—for as long as the protection is needed. Their applications range from industrial plants, commercial buildings, schools, museums and churches, to numerous governmental installations such as the U. S. Treasury and State Departments and the U. S. Bullion Deposit at Fort Knox, Ky. Contact your distributor to find out how you can sell and service alarm systems. ■

Continued from page 56

er axis. On the other hand, if the sound is required to penetrate to as great a distance as possible, or override high ambient noise, the larger trumpets with their sharper distribution pattern will provide more sound intensity along the speaker axis than the smaller horns. The larger horns, in addition to affording greater protection to the driver unit against low frequency overload, distribute the load on the driver diaphragm more uniformly, thereby producing smoother over-all response as well. Obviously, then, there are three essentials to be considered when selecting a trumpet; fidelity, distribution angle and penetration of distance or noise.

Four general trumpet sizes with different low frequency cut-offs are available for applications where such directional projection characteristics are desired. These range from very low frequency to higher frequency cut-off where a heavy duty speaker must be relied on for highly intelligible speech reinforcement.

The wide-angle horn is another contribution in solving certain sound problems, but they do not replace the round "directional" trumpet.

If we were to attempt to make up for a 3 db loss when using a wider horn, in order to penetrate to the same *distance* of projection, the power input to the driver would have to be *doubled*. If it were not a matter of distance, but the need to overcome particularly troublesome noise conditions, again that loss of 3 db could make a big difference.

Clearly then, what the wide-angle projector has to offer is *uniformity* of wide-angle response, falling off less rapidly, off speaker axis, than the *equivalent* directional horn. But, does "wide angle" mean *more coverage?* Not necessarily; it all depends on the configuration of the area to be covered. If the area is very *wide* but not too deep, the "wide angle" horn with a 120 deg horizontal x 60 deg vertical projection pattern would probably do a good job. On the other hand, supposing the area to be covered was *very* narrow and *very* deep.

Continued on page 86

. . . GLOSSARY OF CC-TV TERMS

Continued from page 49

shape of the scanning spots of the pickup equipment and picture monitor and does not depend upon the high-frequency response or bandwidth of the transmission medium or picture monitor.

SHADING A large area brightness gradient in the reproduced picture, not present in the original scene.

STREAKING A term used to describe a picture condition in which objects appear to be extended horizontally beyond their normal boundaries. This will be more apparent at vertical edges of objects when there is a large transition from black to white or white to black. The change in luminance is carried beyond the transition and may be either negative or positive. For example, if the tonal degradation is an opposite shade to the original figure (white following black), the streaking is called negative; however, if the shade is the same as the original figure (white following white), the streaking is called positive. Streaking is usually expressed as short, medium or long streaking. Long streaking may extend to the right edge of the picture and, in extreme cases of low-frequency distortion, can extend over a whole line interval.

SUBMERSIBLE (Immersible)* *Deprecated. Submersible means so constructed as to be successfully operable when submerged in water under specified conditions of pressure and time.

SYNC COMPRESSION The reduction in the amplitude of the sync signal, with respect to the picture signal, occurring between two points of a circuit.

Continued on page 89

on the extensive "Apple" system developmental program for color television. "We foresee, over the next few years," Mr. Newell said, "a rapidly accelerating demand for color television sets. With Philco's already proven capability in black-and-white engineering and manufacture, and years of research in color, we will intensify our developmental programs with a view to establishing and maintaining Philco's competitive position in the years ahead."

Handy Andy Wins

A Retailer-of-the-Year Plaque was awarded to the Handy Andy TV and Appliance, Inc., of Sacramento, California, in the Brand Name Retailer-of-the-Year Awards Competition, Appliance-TV Stores category. The award was presented by Brand Names Foundation, sponsors of the annual competition, at a luncheon held in the Imperial Ballroom of the Americana Hotel, New York City. Keith Anderson, president of the firm, in accepting the award said, "Our advertising of Brand Names ties in wherever possible with National advertising and predominantly points up the manufacturers' brand name, exclusive features, quality and value. In this way, we feel we gain the confidence of our customers and assure satisfaction."

Daystrom Changes Name

The board of directors of Daystrom, Incorporated, a subsidiary of Schlumberger Limited, has announced that Daystrom has changed its name to Weston In-

NEWS OF THE INDUSTRY

National Sales Representation

PACE Communications Corp. of Gardena, California has appointed sales representatives across the nation for distributor sales of its new line of all transistor 2-way radio equipment including a full 5-w all Silicon Transistor CB radiophone. Key distributors have been set up in the major trade areas and the company reports a sizable backlog of orders on the new radios. Production is being increased to maintain a more current delivery status for the authorized PACE distributors. A unique radio check out service and module exchange program instituted through the authorized PACE distributor has been well accepted by both distributor and user as the needed answer to dependable customer servicing in the 2-way and CB radio market.

Color CRT R & D

Philco Corporation's Lansdale Division has launched an extensive research and development effort in color television tubes, and already has begun limited laboratory production of these tubes. M. W. Newell, Philco Vice President and Lansdale Division General Manager, said the revived research efforts will build

minimum at about $428 and sell a "quality product" rather than join the fast growing ranks of manufacturers selling color sets for $399 and less.

New 25 in. Color CRT

Zenith Sales Corporation announces it is demonstrating several production prototype models of color receivers equipped with a new 25-in. rectangular tube. "Development of this new 90-degree color tube climaxed several years of intensive research by Rauland scientists working in close collaboration with Zenith's color circuit laboratories," L. C. Truesdell, Zenith's president said.

New 2-Way Organization

The Pace Communications Corporation of Gardena, Calif., has been formed to furnish high reliability 2-way radio equipment to industrial users. The company initially will introduce all silicon AM citizens band transceivers. Subsequently all transistor 2-way radios in the 25-54 Mc band will follow.

'Teen-Timing'

What is said to be the largest TV advertising campaign promoting transistor radio batteries is announced by RCA Electronic Components and Devices. Harold S. Stamm, manager, advertising and sales promotion, said the new program is aimed at the teenage market and will feature 60-sec commercials on Walt Disney's "Wonderful World of Color" over the NBC/TV network.

...New Developments in Electrical Protection

struments, Inc., effective at the close of business May 8, 1964.

'Kookie U'

For the first time in history, a college education in merchandising of tape-recorders is being made available to dealers and salesmen with the opening of Craig-Panorama University, which may set a record as the kookiest hall of learning in existence. No tuition fees are charged at CPU, and there are no exams to take. CPU promises such exciting school events as phone booth jamming, panty raids, cheating and gas station hold-ups among its extra-curricular activities, interspersed with serious studies on how to sell tape-recorders without using physical violence, or how to use physical violence and sell tape-recorders. There are also snap courses in how to approach a prospect, how to revive dead accounts, and how to qualify a customer. All of this is being done in a new "fun" approach to merchandising, explains Burt Deverich, vice president of Craig-Panorama, Los Angeles producer of transistorized tape-recorders, instigators of CPU. "For several years now, complicated technical advances of the industry have jumped so far ahead of knowledgeable selling techniques that a way had to be found to help dealers and salesmen to understand the peculiarities of their business," said Deverich.

No 'Scrap Color TV'

According to Gene K. Beare, president of General Telephone & Electronics, Sylvania will not sell "scrap color TV." The company plans to hold the color price

. . . AUDIO DISTRIBUTION SYSTEM

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In this case the wide angle horn could be mounted and used in a manner opposite to normal, with the horizontal dispersion of the horn operating physically in the vertical plane. Used in this manner, a wide angle horn is satisfactory, *provided* the distance of depth is not greater than can be penetrated with the sound output of the horn. Mounting angles are obviously very important, especially in applications just discussed. Wide angle horn coverage is clearly shown in Fig. 3.

Now let's take a look at the round "directional" horn. From Fig. 1 we see that the area covered by a round horn with moderate dispersion angle (neither wide nor too narrow) resembles something like a teardrop. Because the vertical dispersion and sound energy is the same as that of the horizontal plane, considerable distance of penetration results. The actual configuration of sound on the ground surface would be a circle, becoming more of an ellipse as greater distance penetration is attempted. In fact, this pattern can often be duplicated by the round trumpet angularly mounted for distance, without as much loss in sound pressure. Considering the wide selection of round trumpets available, it is easy to see why the majority of applications and many special requirements will be satisfactorily met by these "directional" types. ■

. . . REMOTE CONTROL SWITCHING

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from the simple to the complex. They can be used to open a door on the other side of the room or turn on a pump 10 miles away. A simple system designed to operate at distances up to 500 ft can usually provide greater operating distance merely by choosing a different antenna. Where control from more than one station is desired, extra transmitters are available.

Opportunity

The variations are endless. Uses are limited only by the imagination. The man who is looking for avenues of business expansion will do well to explore the field of remote control switching. It is relatively uncrowded, yet requires no special

knowledge of electronics other than that already possessed by professional technicians. Your distributor can direct you to the manufacturers who supply the necessary equipment and you will find that the manufacturers' literature will give you whatever supplementary information you may need.

Remote control switching by radio provides you with the avenue to a great new career and it's as simple as pushing a button! ■

. . . CLOSED CIRCUIT TV

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to quit the whole business, even though we were able to double our business in every year—1958 1959. By 1960 we were turning the corner—starting to realize sales and follow-on service from contracts we had made months, even years before. In 1961 we turned a good profit. In 1962 we increased sales earnings and staff, extended our selling efforts in neighboring states, tied-in with a growing dealership in St. Louis, expanded our facilities.

Growing

By 1963 Illinois Electronic Systems acquired the St. Louis dealership, opened a Detroit office, moved to specially designed quarters, expanded their staff to 16 full time persons, changed their name to Video Systems, Inc.—and cut their ties with the past by selling off at a handsome profit their first love—North Shore Television.

Why sell North Shore? The Video Systems Associates say it simply became more profitable to spend their time on VSI—and when a solid offer came along for North Shore, they took it and pumped even more capital into Video Systems.

What About You?

Could other television repair firms duplicate the success of Video Systems?

"Yes," says Bertrand, "the market for closed circuit television is just being scratched. And a sharp, aggressive firm that knows TV should have a much easier time than we did since potential customers are pre-sold to a much greater degree than they were when we first started knocking on doors in traditional cold-call fashion."

What about pitfalls in marketing CCTV? What should the electronic technician who is interested in CCTV look for before he commits himself to television?

Both Bertrand and Ruehrdanz took their time before answering this question, and then they agreed on a set of suggestions for potential television sales and service firms.

Look into the possibility of acting as the service arm for a distributor such as Video Systems. VSI has installations in several mid-western states, but maintains offices in Chicago, Detroit and St. Louis only. To service its installations it prefers to have a reputable local-area television firm do its service work. By tying in with Video Systems a local shop can expect to be the VSI service representative, calling on VSI accounts for scheduled preventive maintenance as well as hurry-up emergency calls. At first these calls will probably be for service only. When VSI is looking for a local firm to service customers it checks those service firms that

appear capable, then interviews and selects one to do VSI contract work. Special training needed is done by VSI in the local area—or the new service representative is brought to VSI's facilities for a more thorough course in CCTV.

Don't try to go too big. By starting in the service end of CCTV operations, the risk is small yet you can get a firsthand look at how CCTV is sold.

Do get with a reputable firm. Do think big in this respect since you'll benefit from a large manufacturer's experience and reputation, as well as a large firm's ability to presell prospects with promotion and merchandising aids. Chances are too, that a well-known firm has tested methods of providing maintenance techniques and that means less emergency calls.

Ruehrdanz and Bertrand are proof that TV repair firms can make the jump into large-scale CCTV systems engineering. But they caution that their success was built on hard work, good timing, the right products at the right time, good associates.

It can be done. ■

. . . GLOSSARY OF CC-TV TERMS

Continued from page 83

SYNC LEVEL The level of the peaks of the sync signal.

TARGET (Camera Tubes) A structure employing a storage surface which is scanned by an electron beam to generate a signal output current corresponding to a charge-density pattern stored thereon.

Note: The structure may include the storage surface which is scanned by an electron beam, the backplate and the intervening dielectric.

TARGET VOLTAGE (in a Camera Tube with Low-Velocity Scanning) The potential difference between the thermionic cathode and the backplate.

TEARING A term used to describe a picture condition in which groups of horizontal lines are displaced in an irregular manner.

TIGHT (used as a suffix) Apparatus is designated as watertight, dust-tight, etc., when so constructed that the enclosing case will exclude the specified material.

VIICON A camera tube in which a charge-density pattern is formed by photoconduction and stored on that surface of the photoconductor which is scanned by an electron beam, usually of low-velocity electrons.

WHITE COMPRESSION (White Saturation) The reduction in gain applied to a picture signal at those levels corresponding to light areas in a picture with respect to the gain at that level corresponding to the midrange light value in the picture.

Note: The gain referred to in the definition is for a signal amplitude small in comparison with the total peak-to-peak picture signal involved. A quan-

titative evaluation of this effect can be obtained by a measurement of differential gain.

The overall effect of white compression is to reduce contrast in the highlights of the picture as seen on a monitor.

Courtesy Electronic Industries Association.

ADVERTISERS INDEX

MALLORY

Tips for Technicians

Mallory Distributor Products Company
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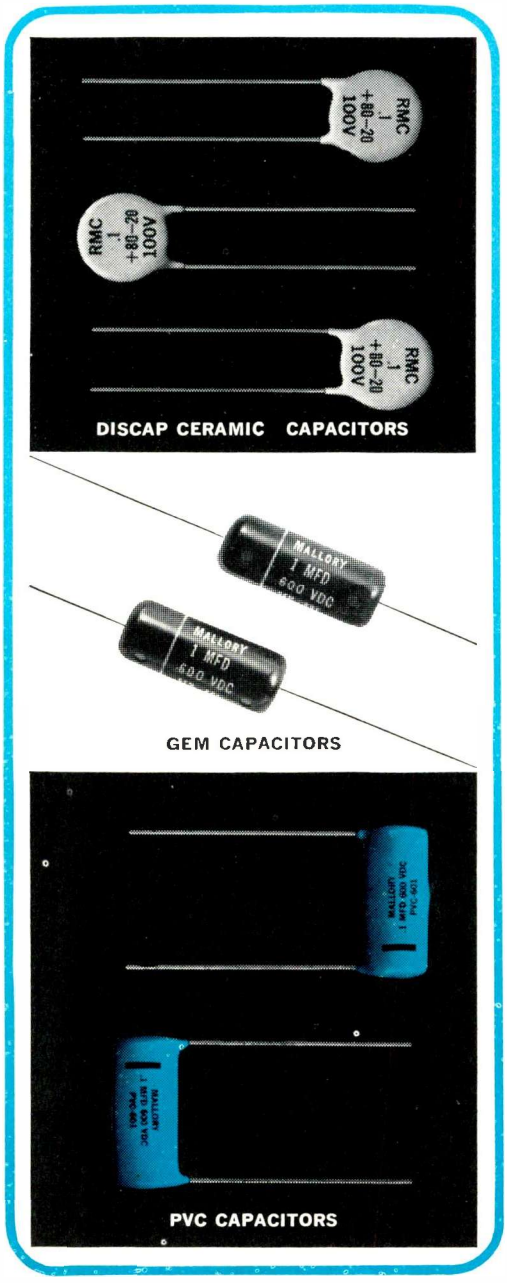
Indianapolis, Indiana 46206

How to break the capacitor replacement habit



Ever hear of "original capacitor-itis?" It's a habit that has been plaguing service technicians for decades. Here's what it means. If you need to install a new capacitor, you automatically get one *exactly* like the one that was in the circuit. The original capacitor, in theory, is the best one for the job.

But . . . it ain't necessarily so. And breaking the habit can often save you money.

When you need to replace a mica capacitor, for instance . . . consider ceramics. They'll often do a better job, for less cost (and we mean up to ½ as much) than mica capacitors in most circuits. Ceramic capacitors often give you an extra safety factor in voltage rating, too; except for a few miniature and special types, their standard rating is 1000 volts DC. Some up to 30 KV. You can almost always replace mica with ceramic. But . . . you seldom can replace ceramic with mica, because ceramics are often selected by original equipment designers for temperature compensating functions.

Don't forget to think of ceramics, too, when you need to replace a molded tubular capacitor. They cost about the same or even less, value for value. If you've got 'em, you can use 'em.

Here are two tips that may save you time and money.

First . . . when you're replacing a capacitor, all you need 9 times out of 10 is the same microfarads and voltage rating. Not a round one. Or a square one.

Second . . . when you need capacitors, see your Mallory Distributor. He carries not only a complete line of Mallory Discap® ceramic capacitors . . . the finest in the industry . . . but also Mallory GEM® and PVC® Mylar* tubulars. Plus Mallory electrolytics, batteries, volume controls, switches, semiconductors. All of them at famous Mallory quality, at sensible Mallory prices.

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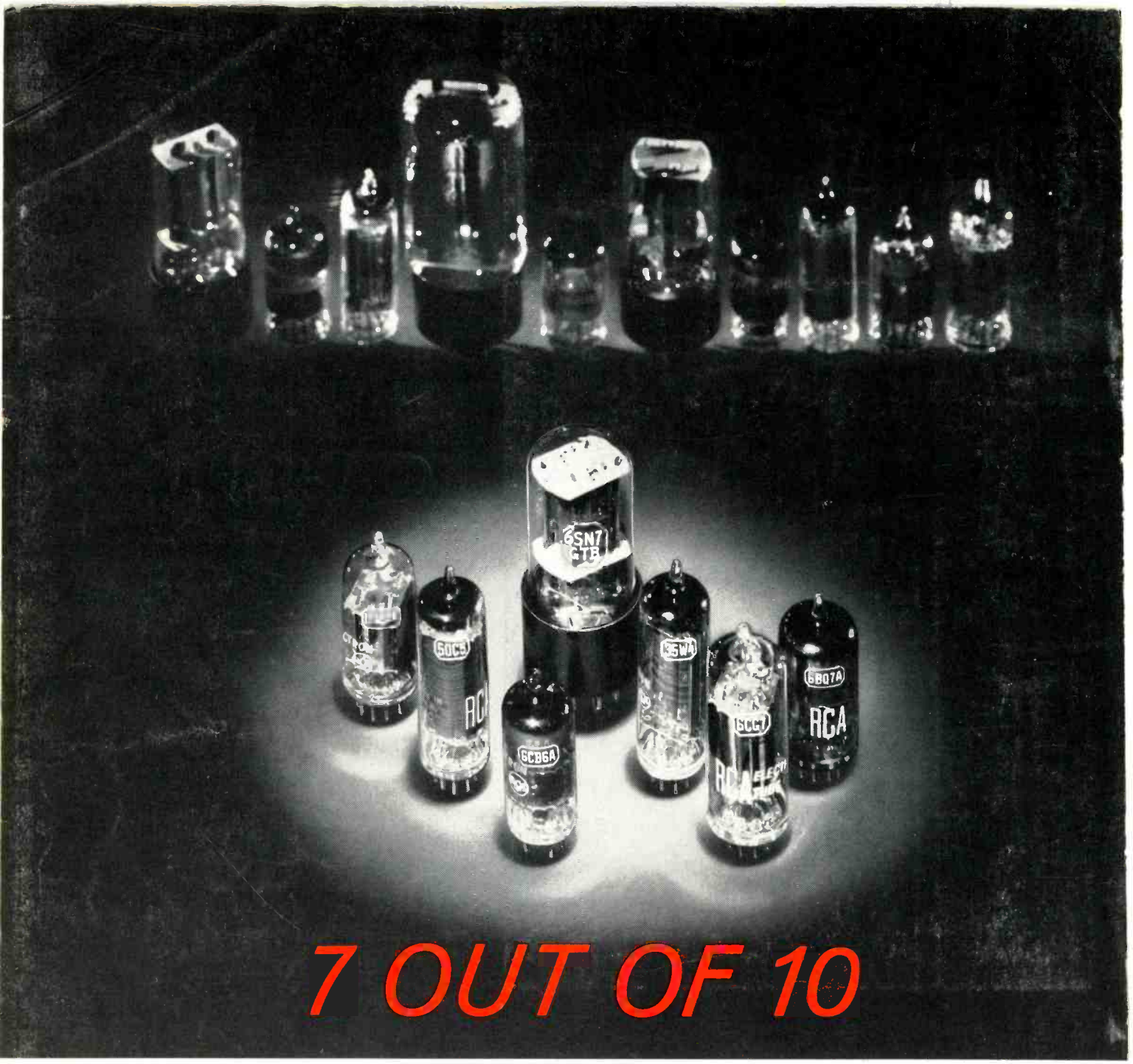

7 of the top 10 replacement receiving tube types* were developed by RCA!

This is RCA product leadership at work, creating tubes with great versatility to be used in a wide variety of applications.

As part of its constant search for new heights of tube performance, RCA continues to introduce improvements with new materials and processes. Developments in recent years include *N-132 Cathode Base Material* which offers exceptional uniformity of characteristics and therefore greater reliability; *S-311 Plate Material* which results in very effective heat dissipation; and the revolutionary *Dark Heater* which drastically reduces the chance of heater-associated tube failures. RCA's latest development, *the Bonded Cathode*, virtually eliminates cathode-peeling problems.

When you recommend and use RCA receiving tubes, you identify your business with the industry's product leader, RCA, the brand known for high quality standards and wide acceptance by industry and consumers.

Your authorized RCA distributor is ready to supply you with top-quality receiving tubes, produced by RCA, the Most Trusted Name in Electronics.

**EIA report of industry replacement sales for first 9 months, 1963*

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

The Most Trusted Name in Electronics