OCTOBER 1955
25¢

Radio-Television
SERVICE DEALER
TV-AM-FM-RADIO-ELECTRONICS

JOE'S RADIO-T.V.
SERVICE CENTER
EVERYWHERE U.S.A.

GOOD SERVICE... THE KEY TO GOOD ENTERTAINMENT
setting new selling records everywhere

C.D.R TV antenna ROTORS
the COMPLETE line
A Model for Every Need

AR-1
The completely AUTOMATIC rotor, powerful and dependable, with a modern design cabinet. Uses 4 wire cable.

AR-2
Completely AUTOMATIC rotor with thrust bearing. Handsome cabinet, uses 4 wire cable.

AR-22
Here is the completely AUTOMATIC version of the famous TR-2 with all the powerful features that made it so famous.

TR-4
The heavy-duty rotor complete with modern cabinet with METER control dial. Uses 4 wire cable.

TR-11
The ideal budget all-purpose rotor with new, modern cabinet featuring meter control dial. Uses 4 wire cable.

TR-2
The heavy-duty rotor with plastic cabinet featuring "compass control" illuminated perfect pattern dial. Uses 8 wire cable.

TR-12
A special combination value consisting of complete rotor with thrust bearing. Handsome modern cabinet with meter control dial, uses 4 wire cable.

CORNELL-DUBILIER
SOUTH PLAINFIELD, N. J.

THE RADIART CORP.
CLEVELAND 13, OHIO
EVERY SERVICE FIRM OWNER IN THE U.S.A.
Receives SERVICE DEALER Monthly

Member BPA Circulation Statement sent on request

COWAN PUBLISHING CORP., 67 West 44th Street, New York 36, N. Y.
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POSTMASTER: SEND FORM 3579 TO RADIO-TELEVISION SERVICE DEALER.
67 WEST 44TH ST., NEW YORK 36, N. Y.
The general purpose scope that gives you most for your dollar...has flat face CRT for usable trace edge to edge. It combines laboratory accuracy with ruggedness and compactness that makes it ideal for field service...

VERTICAL AMPLIFIER
Frequency Response: 6 cps to 4.5 mc ± 1 db
Sensitivity: .01 v/in rms
Input impedance: 1 megohm, 35 mmf (±2 mmf) over entire range of attenuator

HORIZONTAL AMPLIFIER
Frequency Response: 6 cps to 500 kc ±3 db
Sensitivity: .075 v/in rms
Input impedance: 1 megohm

SWEEP RANGES
15 cycles to 100 kc

Television V & H frequencies 60 cycle, variable phase

CALIBRATION
Internal 60 cps square-wave 0.05 to 150 volts peak-to-peak ±5%

SYNCHRONIZATION
Internal, external, positive, negative or AC line

POWER REQUIREMENTS
115 volts, 60 cycles, 100 watts

SIZE...WEIGHT
8 1/2" x 11" x 10½"...22 lbs.

MODEL 617
3' OSCILLOSCOPE

MODEL 616
COLOR BAR/DOT GENERATOR

...for adjusting and testing color receivers and transmitting equipment by manufacturer, station or serviceman. Features: Seven output forms of bars, dots, cross-hatch, phase and color-difference signals, including NTSC color bars. Panel presentation shows actual color and sequence of generator output...

SIGNAL OUTPUTS:
Composite video...either phase
...adjustable 0 to 1.5 volts peak-to-peak across 75 ohms
RF...10,000 microvolts fixed level
...optional channel 3 or 4...crystal controlled...modulated sound carrier
Sync in or out

TYPES OF SIGNAL:
Vertical bars...variable from 15 to 20
Horizontal bars...variable from 10 to 15
Cross-hatch...variable as above

Dots...variable as above
Color Bars:
"A"...NTSC colors (Phase accuracy ±5°...luminance and chrominance amplitude 10%)
"B"...B-Y at 90°...R-Y...B-Y
"C"...Black...1...0...Black
Black...R-Y and B-Y within ±1° of quadrature

PHYSICAL CHARACTERISTICS:
Power: approximately 125 watts
Size: 8 1/2" x 11" x 10½"
Weight: approximately 22 lbs.

A new oscilloscope concept...automatic triggered sweep...
Simplifies adjustments, makes synchronization positive.
Special CRT has flat face for usable trace edge to edge.
One of today's most advanced TV servicing aids...

VERTICAL AMPLIFIER
Frequency Response: 6 cps to 500 kc ±3 db
Sensitivity: 10 mv rms (28 mv peak-to-peak) per inch
Input impedance: 1 megohm, 40 mmf (± 2 mmf) over entire attenuator range

HORIZONTAL AMPLIFIER
Frequency Response: 1.5 cps to 500 kc ±3 db
Sensitivity: 75 mv rms (210 mv peak-to-peak) per inch
Input impedance: 100k, 25 mmf

SWEEP CHARACTERISTICS
Usable writing speed...0.03 sec/in to 3.6 sec/in

MODEL 622
5' OSCILLOSCOPE

MODEL 614
VTVM

Convenience at unprecedented low cost sums up this rugged, serviceable instrument. It's lightweight, versatile. Probes stow inside case, ready for instant use...

RANGES
DC: 0.1, 5, 15, 50, 150, 500, 1500 volts
AC: 0, 5, 15, 50, 150, 500, 1500 volts rms (with associated peak-to-peak scales)
Ohms: 0-1000 megohms in seven ranges

INPUT IMPEDANCE
11 megohms

FREQUENCY RESPONSE
Direct Probe: 30 cps - 3 mc

Crystal Probe: 50 kc - 250 mc

INDICATOR
6½" meter

ACCURACY
DC and ohms: 3%...AC: 5%

POWER REQUIREMENTS
115 volts, 60 cycles, 6 watts

SIZE...WEIGHT
8 1/2" x 11" x 7½"...10 lbs.
Today's only rotator with all 3!

Plus a score of other profit-building features that make the better-than-ever JFD Roto-King today's outstanding rotator value. See your JFD distributor today.

**1 TODAY'S MOST POWERFUL GEAR TRAIN!**

Compare these 6 large heavy duty close tolerance gears that develop smoother, greater torque. Yes, power capable of turning a 4-bay channel 2 Yagi.

**2 CONTROL CASES IN 3 STRIKING DECORATOR COLORS!**

Smartly styled console cases in glamorous color, to match milady's decor. The perfect complement to gracious living that TV set owners will go for.

**3 THE ONLY ROTATOR WITH REPLACEABLE POWER UNIT!**

FACTS ARE FACTS

Rotators Break Down and Require Servicing

Dismantling and re-erecting a TV installation is an unnecessary and added expense, in time, labor and customer satisfaction. The JFD Roto-King with replaceable power unit, saves you these added expenses by effectively making your servicing simple, quick and easy. Just remove the power cartridge and install a new one.

---

**MODEL**

- RT100-M
- RT100-IV
- RT100-EB
- RT25C-M†
- RT25C-IV†
- RT25C-EB†

**STYLE**

- Mahogany
- Ivory
- Ebony

**LIST PRICE**

- Mahogany
- Ivory
- Ebony

- $55.95
- $49.95
- $52.95

†25 cycle for Canada and other countries.

© CONTROL CASES IN 3 STRIKING DECORATOR COLORS!
**Compare the Latest Circulation Statements!**

**SERVICE DEALER**—the only magazine which reaches, every month, the owner or manager of every firm in the USA that does radio-TV-electronics service work—now leads its nearest competitor by over 19,454 and the third magazine by over 26,080 in "service field coverage."

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All circulation figures quoted here are taken from the latest ABC and BPA Statements.

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<tr>
<th>CLASSIFICATION</th>
<th>RADIO TELEVISION SERVICE DEALER</th>
<th>TECHNICIAN</th>
<th>SERVICE</th>
</tr>
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<tbody>
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<td>1a—Radio-TV service firm owners &amp; independent servicemen.</td>
<td>27,488</td>
<td>23,378†</td>
<td>26,952†</td>
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<td>1b—Service managers employed by service firms.</td>
<td>372</td>
<td>202</td>
<td>280</td>
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<td>1c—Technicians employed by service firms.</td>
<td>4,380</td>
<td>2,417</td>
<td>1,400</td>
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<tr>
<td>2a—Owners &amp; managers of retail firms that operate service depts.</td>
<td>19,096</td>
<td>10,370</td>
<td>3,633</td>
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<tr>
<td>2b—Service managers employed by above service dealer group.</td>
<td>686</td>
<td>1,356</td>
<td>513</td>
</tr>
<tr>
<td>2c—Technicians employed by above service dealers.</td>
<td>3,308</td>
<td>3,693</td>
<td>1,414</td>
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<td>1,731</td>
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<td>4—Part-time servicemen.</td>
<td>3,361</td>
<td>57†</td>
<td>†</td>
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<td>1,553</td>
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<td>703</td>
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**TOTAL SERVICE CATEGORY CIRCULATION**

| RADIO TELEVISION SERVICE DEALER | 61,975 | TECHNICIAN | 42,521 | SERVICE | 34,895 |

† Both Technician and Service include in classification 1a all the part-time independent servicemen subscribers they serve. Both Technician and Service include in classifications 1b-c the industrial electronic service firm subscribers served.

The average total paid circulation for the 6 month period January-June 1955 of the respective publications was: SERVICE DEALER—46,218; SERVICE—50,271; TECHNICIAN—44,700. The average total monthly distribution for the same period was: SERVICE DEALER—70,832; SERVICE—56,191; TECHNICIAN—50,572.
CONQUERORS OF DISTANCE!

For All-Channel TV!

- DUPLEXED ELEMENTS FOR MAXIMUM GAIN
- COMPENSATED "TROMBONE" MATCHING SECTIONS FOR MAXIMUM EFFICIENCY
- FULL VIDEO, AUDIO BANDWIDTH FOR MAXIMUM BLACK AND WHITE COLOR FIDELITY

The new Telrex "THUNDERBIRD" multi-element wide-band Beamed Power arrays are engineered for fringe and "sub-fringe" area reception, and for all receiving conditions requiring exceptionally good directivity and high sensitivity.

Super Thunderbird Model T-120 is the finest wide-band, multi-element array ever developed. A system of variable impedance phasing loops permit precision tuning and the duplicating of element functions to provide the equivalent of 5 operating elements on the LO channels; 13 elements on the HI channels. Element for element, they develop greater gain and directivity than many single channel arrays. Model T-120 is accurately matched to 300-300 ohm transmission line for both HI and LO channels with compensated "trombone" sections to yield exceptionally high gain and optimum signal transfer efficiency. LO band gain averages better than 5.5 db; HI band gains exceed 12 db, while front-to-back ratios range to 25 db.

For brilliance, interference-free signals under toughest reception conditions, choose the Telrex Super Thunderbird T-120! Available also in 2 bay units—Model T-122, 1/4-wave stacked for gain increases averaging 3 db on all channels; and Model T-122S, 1/4-wave stacked to provide gain increases up to 4.5 db on LO channels, over single bay units.

Thunderbird Model T-110 incorporates all the high-performance features of the Super Thunderbird T-120 including variable impedance loop phasing, compensated "trombone" matching sections and in-line, low wind resistance configuration plus high strength, all aluminum, quick-rig construction for dependable, high performance, low cost, long lasting installations. Duplexed elements are equivalent to 5 effective elements on LO channels for average gains exceeding 5 db; and 11 operating elements on the HI channels for gains exceeding 10 db. Front-to-back and front-to-side ratios of better than 15 db minimize interference.

Available stacked 1/4-wave, Model T-112, for all channel gain increases of 3 db and 1/4-wave stacked, Model T-112S, for increased gains to 4.5 db on LO channels.

Thunderbird T-130 employs Conical Dipole and "V" Beam quadrature phased driven elements to achieve virtually flat, stepless gain characteristics on all VHF channels, with minimum number of elements. Model T-130 also employs variable impedance phasing loops, duplexed elements and Telrex compensated "trombone" matching sections. Four effective LO channel elements; 9 operating elements on HI channels, produce gains to 5 db on 2-6, and up to 11 db on channels 7-13. Special trap circuitry used in all Thunderbirds, attenuates interference arising outside the assigned TV bands to assure crisp, smear-free picture quality and full sound response.

Model T-122 stacked 1/4-wave gives average gain increase of 3 db on all channels; 1/4-wave stacked Model T-132S provides up to 4.5 db gain on LO channels over single bay.
You Asked For Them

During the summer months we asked nearly half of the 62,000 servicemen who read SERVICE DEALER a simple question: "What can we do to SERVICE DEALER editorially to make it more valuable to you?" The overwhelming answer was simply this: "Give us complete in one issue the TV schematics that cover all of the chasses in any given TV set manufacturer's line for that season." This was a tall order but we'll fill it starting with our next issue. The 12 complete sets of schematics we'll publish every year will most likely cover 90% of the sets made during that year.

John F. "Rider Speaks"

Recently, while chatting with Mr. Rider, I learned that his views concerning the fast-changing trends of radio-TV servicing and his outlook as to "what kinds" of electronic servicing will be commonplace 5, 10, and 20 years hence coincide with my own.

In this regard and at this time I will not delve too deeply into my personal beliefs about future servicing techniques except for one brief hint. Automation, for example! Make no mistakes about it, automation is a "comer." And I believe that while a single unit of automation equipment may in some instances in the future do the work formerly done by 40 or 60 skilled laborers, that single piece of automation equipment itself may require the full-time services of 10 or 15 thoroughly trained electronic technicians merely to keep it working perfectly. This is an electronic age—but it's still in its baby stage.

So, having heard Mr. Rider's views, I asked him to become a regular contributor to this magazine. He agreed. So, beginning with our November issue you'll find regularly a page or so titled "Rider Speaks." He will cover a myriad of timely and often controversial subjects. Mr. Rider's views, as expressed herein, may or may not coincide with my views as Publisher of this journal.

Uppermost in Mr. Rider's mind will be the betterment of servicing and the best interests of servicemen. So, there you have it! Starting in November, through this magazine exclusively, "Rider Speaks!"

Jury—What's Your Verdict?

There's a reason why the advertisement titled "Mr. Manufacturer" appears on page 28.

During July and August I called upon several manufacturers of items such as test equipment, parts, antennas and soldering irons whose advertising has been running consistently in magazines that reach parts jobbers, but who have not advertised in servicemen's magazines.

To my chagrin, several of the manufacturers I spoke to told me candidly that they believed that their first and most intensive selling effort should be done at jobber level—and that advertising to servicemen could be given consideration for a later date. These manufacturers stated that once they "sold" a jobber—that jobber in turn would "sell his servicemen" customers their products.

Usually a TV set manufacturer's line for any year consists of 3 to 5 different basic chasses—ranging high, medium and low. These few chasses may cover 40 to 50 different models—but fundamentally—that's all there is to it.

For example, when our November issue arrives, it will have in it schematics on RCA's complete 1956 line of black and white TV chasses. Then in December SERVICE DEALER you'll find all the schematics on Motorola's new 1956 line. You asked for this service and we'll provide it.

Now the questions I ask you servicemen are simple. Was I wrong in saying what I did to these manufacturers? Do you servicemen make up your own minds as to what brands you buy or do you rely to a large degree upon recommendations given you by your jobber? I'd like to hear from you! Tell me frankly—which influences you most in regard to your selection—your jobber or the advertisements you read in servicemen's magazines?

The manufacturers who advertise in SERVICE DEALER want servicemen's business and say so. I believe they are entitled to servicemen's continued support. That's why SERVICE DEALER favors them with Honor Roll Recognition. Meanwhile—I am awaiting your views as to where manufacturers should advertise.
Never before—an antenna with such utterly . . .

**Fantastic**

front-to-back ratios

Low Band: from 20:1 to 50:1 relative VOLTAGE (2500:1 relative power)

High Band: up to 13:1 relative VOLTAGE (169:1 relative power)

**CHANNEL MASTER'S new “K.O.” all-channel antenna**

Knocks out venetian blinds and co-channel interference!

Channel Master's new "K.O." has the highest front-to-back ratios ever recorded for any TV antenna! The sensational "K.O." actually sets up an INVISIBLE BARRIER to signals coming in from the rear. Working with supreme efficiency on both VHF bands, it totally REJECTS rear signals, preventing venetian blinds and other picture problems caused by co-channel interference.

**Spectacular High Gain!**

Low Band, 7 to 9 DB, single bay; High Band, 8.5 to 10.5 DB, single bay. True Yagi performance, combined with completely independent High and Low Band operation for maximum efficiency.
When you are a Raytheon Bonded Electronic Technician, the answer is simple. You have the exclusive tool, the only tool in the industry that creates customer confidence — draws customers to your shop.

Under the Raytheon Bonding plan, your work and parts guarantee is backed by a Bond issued through one of America’s largest insurance companies. Customers appreciate the value of this extra protection and, all else being equal, give their business to the Raytheon Bonded Dealer.

If you can qualify for the Raytheon Bond, it won’t cost you a penny. Call your Sponsoring Raytheon Tube Distributor today for the whole story.
Servicing Auto Electronic Accessories Offers A Profitable Source of Income

by STEVE TRAVIS

ONE of the big mysteries in radio and electronics servicing is the discrimination practiced by servicemen against servicing certain pieces of electronic apparatus. For some reason car radios and mobile equipment have been ignored for the supposedly easier field of TV and home radio. Actually, mobile equipment installation and servicing, considered in the broad sense of car radios, transceivers, etc., is one of the more prosperous and consistent aspects of electronic servicing as only too few service companies appreciate.

Let's consider briefly the many electronic changes and new devices that will be encountered by those who hope to enter this sphere of electronic activity. These opportunities have been mostly ignored and yet are full of the promise of interesting, profitable service work. Regarding changes in automobile systems and radios, it will do well to look at these at the same time, noting their influence on mobile electronic servicing.

Automobile 12 Volt Electrical Systems

The addition of such features in modern cars as air-conditioning, signal seeking radios, headlamp dimmers, electric window controls and electric antenna extenders place a great drain on the electrical system of automobiles. Copper losses in the wiring of the 6 volt systems were found to be appreciable and the additional current load of the new devices caused a considerable voltage drop across the interconnection cables. This voltage loss at first may appear to be of little concern. However, after considering that it represents a large proportion of the available voltage it can be seen that it will bring about reduced voltage and therefore less efficiency in operation of the new accessories. Therefore a 12 volt system has been adopted in many of the new cars to add a little "muscle" to the voltage supply.

The Autronic-Eye

The Autronic-Eye (automatic headlight control), optional equipment for the more expensive automobiles, is an electronic unit that responds to the headlights of approaching automobiles and automatically switches the headlights from bright to dim, or from high beam to low beam. Once the car traveling in the opposite direction has passed, the headlights are switched back to high beam without the driver having to be concerned about making the beam changes. This inexpensive accessory item works very well and although it is slowly being received its acceptance seems assured.

As can be noted in Fig. 1 the Autronic-Eye is composed of four primary units, an amplifier, a power relay, a foot switch and a phototube unit. The schematic diagram for these units is shown in Fig. 2. The phototube unit consists of a lens that focuses the received light on a phototube inside. The phototube develops a signal as a result of the light intensity. This voltage, negative in polarity, is applied to the grid of the amplifier tube. When a large enough negative voltage is developed and applied, the tube current is reduced to the amount that will allow the sensitivity relay to release an arm, and the contacts of the switch are changed. The new connection allows battery voltage to be applied to the power relay making it draw the pole piece so that the headlamp contacts are changed from high beam to low beam.

When the headlight beams pass the car the negative voltage is removed, the sensitivity relay changes contacts, the power relay is open circuited and connection is made for the high beam. An auxiliary foot switch is provided as a means of physically switching to the upper beam when the Autronic-Eye is in control and has caused the low beam to be on. This is a desirable feature for such purposes as signalling to pass a car.

The phototube unit is generally installed on top of the instrument panel at the left side and is positioned 25 to 30 degrees to the left of the centerline of the car. Adjustments in sensitivity must be made for either tinted or clear windshields. The Autronic-Eye is designed to operate at about 400 to 500 feet from an approaching vehicle. Some states have traffic laws requiring the dimming of headlights with the approach of a car. When the distance is specified as 500 to 600 feet it is an easy matter to adjust the sensitivity to cause the unit to respond sooner.

Both the amplifier and power relay are usually mounted under the hood while the auxiliary foot switch is installed near the standard foot switch. The relay is of the special contact point variety having to switch heavy currents. The servicing of this unit is much simpler than repairing a TV receiver.
and will be found to be interesting. There are definite test procedures that make adjustments and repairs straightforward.

**Electronically Controlled Garage Door Openers**

An electronic operated garage door opener is rather unique and proves quite interesting to friends and neighbors. The unit is a means of opening or closing the garage door without getting out of the car. It is a neat trick and is accomplished through the use of a small transmitter operated at 27.255 mc in the Citizens Radio band. The pressing of a button in the car causes the transmitter to send out a signal that is received by a radio fixed-tuned to this frequency in the garage. The receiver then activates a relay, starting a motor. The motor does the physical work of pulling a chain or turning a gear mechanism as the case may be to lift or lower the door. When the door has reached the desired extent of travel a microswitch opens the circuit ceasing its operation. Along with this action another switch can be added to turn on the lights inside when the door is opened and off when the door is closed.

Of course, entering and exiting the garage when the car is inside without this equipment requires the lifting of the garage door. With the radio controlled garage door opener all that is necessary is to press a button positioned outside the garage or even inside the house. Naturally, it is desirable to have the garage door in view from the position of the button so as not to cause an accident. Thus, the garage can be opened or closed when entering or leaving the garage on foot. Those who house their autos in their own private garages can realize and appreciate the convenience this inexpensive unit offers not only for those occasions of inclement weather but for the general ease of accessibility to the garage.

The radio controlled garage door opener has achieved increased popularity and is an excellent sideline for the enterprising electronic serviceman. These units are commercially available and are straightforward installations in both the car and garage for 6 or 12 volt automobile power systems.

In the car the transmitter unit is usually mounted under the hood as shown in Fig. 3. Power in the unit is developed with a vibrator type of supply and selenium rectifiers are sometimes used in a voltage doubling arrangement for greater voltage. Most equipment commercially built has been designed so as not to cause interference to television receivers through the use of filters in the antenna and power leads. Servicing is not any more difficult than that of a table model radio. Conventional procedures are employed in locating any troubles that may develop. The measuring of voltages and resistances applies with these units as with other electronic gear. Checking the vibrator power supply and tubes is one of the first steps and, as a matter of fact, the servicing of these units is right down the alley of a good serviceman.

The operating range of the electronic

**[Continued on page 55]**

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**Fig. 2**—Circuit diagram of Autronic Eye unit.

---

**Fig. 3**—Radio-Controlled garage door installation.
INTRODUCING THE
New GEOMATIC TV ANTENNAS
by FINCO®

with exclusive Fidelity Phasing*

* Dictionary: the highest degree of accuracy in the reproduction of a signal

Here are the antennas they said could never be developed—combining the finest features of an impedance matching, driven folded dipole on low-band, with super-gain of a 3-element colinear on high-band (without the use of matching harness) to produce the —GREATEST BROAD-BAND ANTENNAS EVER BUILT! In addition, the new GEOMATIC Series features extremely high FRONT-TO-BACK RATIO! Models range from "in-town" types to super-fringe area antennas.

GEOMATIC means customized for your locality

Now For The First Time — Regardless of channels, distance from station, or terrain FINCO can deliver a model that is perfectly suited for your area — at no extra cost!

Write: wire or phone
The FINNEY Company
Henderson 2-2130 4612 St. Clair Avenue
Dept. 50-105 CLEVELAND 3, OHIO

Copyright, 1955
The Finney Company
Troubleshooting Oscilloscope

by Harold White

The Probescope is a new compact portable troubleshooting oscilloscope utilizing a 1CP1-one inch cathode ray tube. Its features include speed of operation, ease of handling and visibility of application. Patterns obtained are sharp, and bright enough to observe in daylight. Its frequency response (7 cycles to 70 kc at -3db) is adequate for routine servicing of TV receivers. It does not contain provisions for sweep alignment.

Applications

The scope has enough sensitivity to pick up a signal on the 1st video if tube for observation of the low frequency contents of the signal which include the horizontal and vertical sync pulses. If desired a detector may be inserted at the probe tip for visual observation of the demodulated video signal. In this manner it can be used to signal-trace the complete video if channel.

It also may be used as a signal-tracer in the sound if channel in conjunction with a detector connected to the probe tip. Visual observation of the audio signal following FM detection is straightforward; one merely applies the probe tip to the point where the signal is to be observed.

The video signal itself may be signal-traced from the video detector on to the picture tube in the same manner. The horizontal sweep of the scope in this case may be set at 15,750 cps for

[Continued on page 48]
Auto-Radio Technicians:

DELCO RADIO

TRAINING COURSES MEAN MORE BUSINESS FOR YOU

Week-long courses for experienced service technicians provide latest radio and repair information—enable you to do the job faster and more efficiently.

Quick, accurate auto radio diagnosis and repair to factory specifications boosts your profits. That’s why so many qualified auto radio technicians attend these Delco Radio training courses at no cost for tuition, school supplies, or equipment.

Factory-trained instructors, using latest equipment and instruction methods, conduct these intensified week-long courses, designed to familiarize repairmen with modern auto radio developments and factory-approved repair techniques.

The Delco Radio diploma, awarded only to those who successfully complete the course, is proof that you’re equipped to give more and better service to more people—and that means more business.

If you’re an auto radio service dealer, come yourself, or send your technicians. There’s one of 30 GM Training Centers near you. Apply through your local Delco Electronic Parts Distributor or write Delco Radio Division of General Motors, Kokomo, Indiana.

Turn to BUSS for all your fuse needs

COMPLETE LINE

It is easy to select a BUSS fuse to do the job right. The BUSS fuse line includes: dual-element (slow blowing), renewable and one-time types — in sizes from 1/300 ampere up ... plus a companion line of fuse clips, blocks and holders.

BUSS FUSES ARE MADE TO PROTECT — NOT TO BLOW NEEDLESSLY

To assure unfailing dependability — every BUSS fuse normally used by the Electronic Industries is tested in a sensitive electronic device. Any fuse not correctly calibrated, properly constructed and right in all physical dimensions is automatically rejected.

With the cost of a fuse being so insignificant compared to the value of the equipment it protects and the value of your good name — it is just good business to refuse to take a chance on anything less than BUSS quality in fuses.

IN SALES AND SERVICE, PROFIT BY THE BUSS TRADEMARK

Millions upon millions of BUSS fuses for home, industry and automotive use have firmly established BUSS as the Known brand. Handling quality products, like BUSS fuses, help you maintain your reputation for quality and service.

More information is available on BUSS and FUSETRON small dimension fuses and fuseholders ...

Write for bulletin SFB.

Makers of a complete line of fuses for home, farm, commercial, electronic, automotive and industrial use.

BUSSMANN MFG. CO. (Division of McGraw Electric Co.)
UNIVERSITY AT JEFFERSON ST. LOUIS 7, MO.

RADIO-TELEVISION SERVICE DEALER • OCTOBER, 1955
NOW... the All-purpose 'Scope by WESTON

Model 983 is a high gain, wideband Oscilloscope designed to accurately reproduce waveforms comprising a wide band of frequencies. High sensitivity of 15 millivolts per inch RMS makes this 'scope ideal for—

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The 'scope contains identical vertical and horizontal push-pull amplifiers with a choice of AC or DC coupling without affecting either sensitivity or band width. Both amplifiers have compensated step attenuators and cathode follower input. It has excellent square wave reproduction with overshoot of only 2 to 5%, with a rise time of 0.1 microsecond. The 'scope response is essentially flat throughout the specified range of 4.5 mc and is usable to 6 mc.

The unit has provisions for internal calibration, internal phased sine wave, and Z-axis intensity modulation. Reversal of polarity of both horizontal and vertical signals is easily accomplished by means of toggle switching. Tube replacements are non critical, and etched circuitry facilitates quick and rapid maintenance.

The Model 983 Oscilloscope is now available through local distributors. For complete literature write WESTON Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, New Jersey.

WESTON Instruments
By popular demand, the serviceman's most-wanted book, Video speed Service Systems Vol. 1. is now also available in a low cost PAPER BOUND COVER EDITION

Facts About Video speed Service Systems:

CONTENTS:
A compilation of specific receiver service repairs, "bugs", chronic troubles, field circuit changes, manufacturers' production revisions, etc. The compilation enables the service technician to pin-point what is wrong with any given TV set and to correct the fault in the shortest possible time.

SOURCES:
The material was obtained directly from manufacturers, distributors' service departments, TV service organizations, and top TV Service-dealers throughout the country. Furthermore — all material has been checked carefully to assure dependability and accuracy.

USES:
The VSSS data sheet for any particular TV set maker's model or chassis number gives: 1 — the section of the set affected; 2 — the symptom; 3 — the cause of complaint; 4 — the solution, in simple, understandable and usable form.

Video Speed Service Systems is guaranteed to simplify servicing all TV sets. Contains over 600 service items representing over 2500 of the most serviced TV models now in use. Over 25 different manufacturers' lines are covered. Almost 15,000 copies of VSSS have been sold at $4.95. Every technician needs a copy.
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There are no dogs in this line, and what's more 101 new items have been added in the last 300 days. That's why more servicemen come to Merit for their

NO OTHER MANUFACTURER CAN SUPPLY THIS COMPLETE LINE OF COILS AND TRANSFORMERS.

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PHOTOFACT Service Data is the only service information based upon first-hand examination of the actual production-run receivers and equipment. It is authentic, uniform data developed through actual study and analysis by service engineers in the Howard W. Sams Laboratory. PHOTOFACT is the only data prepared from the practical point of view of the Service Technician.

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FULL SCHEMATIC COVERAGE

1. Famous "Standard Notation" uniform symbols are used in every schematic. 2. The same standard, uniform layout is used for each schematic. 3. Diagrams are clear, large, easy to read, easy to handle. 4. Wave forms are shown right on the TV schematics for quick analysis by 'scope. 5. Voltages appear on the schematics for speedy voltage analysis. 6. Transformer lead color-coding is indicated on the schematic. 7. Transformer winding resistances appear on the schematic. 8. Schematics are keyed to photos and parts lists.

FULL PHOTOGRAPHIC COVERAGE

9. Exclusive photo coverage of all chassis views is provided for each receiver. 10. All parts are numbered and keyed to the schematic and parts lists. 11. Photo coverage provides quicker parts identification and location.

ALIGNMENT INSTRUCTIONS

12. Complete, detailed alignment data is standard and uniformly presented in all Folders. 13. Alignment frequencies are shown on radio photos adjacent to adjustment number—adjustments are keyed to schematic and photos.

TUBE PLACEMENT CHARTS

14. Top and bottom views are shown. Top view is positioned as chassis would be viewed from back of cabinet. 15. Blank pin or locating key on each tube is shown on placement chart. 16. Tube charts include fuse location for quick service reference.

TUBE FAILURE CHECK CHARTS

17. Shows common trouble symptoms and indicates tubes generally responsible for such troubles. 18. Series filament strings are schematically presented for quick reference.

COMPLETE PARTS LISTS

19. A complete and detailed parts list is given for each receiver. 20. Proper replacement parts are listed, together with installation notes where required. 21. All parts are keyed to the photos and schematics for quick reference.

FIELD SERVICE NOTES

22. Each Folder includes time-saving tips for servicing in the customer's home. 23. Valuable hints are given for quick access to pertinent adjustments. 24. Tips on safety glass removal and cleaning.

TROUBLE-SHOOTING AIDS

25. Includes advice for localizing commonly recurring troubles. 26. Gives useful description of any new or unusual circuits employed in the receiver. 27. Includes hints and advice for each specific chassis.

OUTSTANDING GENERAL FEATURES

28. Each and every PHOTOFACT Folder, regardless of receiver manufacturer, is presented in a standard, uniform layout. 29. PHOTOFACT is a current service—you don't have to wait a year or longer for the data you need. PHOTOFACT keeps right up with receiver production. 30. PHOTOFACT gives you complete coverage on TV, Radio, Amplifiers, Tuners, Phonos, Changers. 31. PHOTOFACT maintains an inquiry service bureau for the benefit of its customers.

HELPs YOU EARN MORE DAILY
BUSY servicemen to whom time is money will be interested in a new piece of test equipment that measures capacitance and permits coupling condensers to be tested for leakage without disconnecting them from their circuits. This instrument manufactured by the Tele Test Corp. of New York is called the Capacitester. Besides a saving in time, the following additional advantages are provided: Grid Current effects that tend to make voltage tests of leaky couplers hard to interpret are avoided (since the receiver is off when the tests are made.) This is an advantage the Capacitester enjoys over a voltmeter. Its superiority to an ohmmeter check for a leaky coupler lies in the fact that voltages similar to those present in normal receiver operation are applied to the condenser under test, causing leakages that exist only under such "hot" conditions to appear and be detected.

The leakage testing section of Capacitester employs a unique test set-up that is interesting enough to warrant description. This set-up is shown in simplified form in Fig. 1. A "magic-eye" 6AF6 tube is used as an indicating device in conjunction with the condenser circuit under test. This circuit is shown in Fig. 2. Here point A corresponds to the B+ Jack Connection of Fig. 1; point B corresponds to the Grid Jack Connection; and ground corresponds to the B-Jack Connection. If the grid return of the stage does not go directly to the ground, the B-Jack lead connects to the "low" side of the grid resistor. Changes in the shadow-angle of this eye-tube are produced when leakage exists in the component under test.

Two pushbutton switches, labeled TEST PUSHBUTTON and REFERENCE PUSHBUTTON, respectively, are employed. When the TEST PUSHBUTTON is depressed, a pulse of current flows from the power supply of the Capacitester (represented by the battery in Fig. 1) through C-1 and R-1. This charging current causes a momentary positive voltage to be developed between the top of R-1 and ground. Since the grid of 6AF6 is connected to the top of R-1, the voltage across R-1 also appears between grid and ground. The resultant change in bias of the magic-eye causes the shadow-angle to narrow. Following the surge of current, C-1 becomes fully charged almost immediately (if the condenser under test is normal), and the current through R-1 consequently drops to zero. This restores the bias of the 6AF6 to its original (zero) value and the shadow-angle returns to normal. The effect of testing a normal condenser, thus, is to produce a momentary narrowing of the shadow-angle in the eye-tube.

On the other hand, when the condenser under test is leaky, the voltage drop across R-1 does not drop to zero since current continues to flow through C-1 and R-1. In this case the shadow-angle becomes narrower and stays narrower. To help the serviceman judge whether or not the angle has actually narrowed, a reference setting is needed. Such a setting is provided by the REFERENCE PUSHBUTTON.

Let's assume that a circuit under test contains a leaky condenser. In our first operation after connections are made the REFERENCE PUSHBUTTON is depressed (at the same time that the TEST PUSHBUTTON switch is kept closed.) Since R-1 is short-circuited, the grid of the 6AF6 is shorted to ground, and the eye opening assumes a certain reference angle. Releasing the REFERENCE PUSHBUTTON restores the positive bias due to the leaky condenser, causing the shadow-angle to narrow. If the condenser under test is normal the grid-to-ground voltage will be zero before and after the REFERENCE PUSHBUTTON is depressed, and the shadow-angle will be unchanged. Changes in the shadow-angle thus provide a positive indication of leakage. The amount of leakage present is not measured, but this is unimportant, since the serviceman will want to change a leaky condenser whether the leakage is small or large (provided this leakage is abnormal.)

The Capacitester may be used, not only for testing condensers in coupling circuits, but in some other circuits as well. It may also be employed for checking unconnected components — such as a condenser that has been taken off a shelf. The instrument may additionally be used to determine whether a "hot" or short is present between two transformer windings, or between two contacts on a socket.

In a few circuits a resistor is connected in parallel with the condenser under test. If the condenser is checked for leakage, the shunt resistor will prevent an accurate test from being made. A simple ohmmeter test will readily reveal whether a considerable amount of leakage is present in such a condenser. If the leakage is not appreciable enough to

Fig. 1 (left)—Simplified schematic of testing with Capacitester.
Fig. 2 (right)—Equivalent circuit of coupling condenser in receiver.

[Continued on page 47]
The Work Bench

by PAUL GOLDBERG

This Month:
FILTER CONDENSER PROBLEMS

The following installment deals with three filter condenser problems. These problems can be dealt with easily with a small amount of equipment when proper diagnosis is given. The following case histories are typical examples.

Zenith 21J21

The receiver was turned on and a faint vertical white line was observed down the center of the cathode ray tube face. The high voltage fuse was checked and was found to be okay. Only a small arc could be drawn off the 1B3 filaments. This indicated of course, inefficient high voltage. The horizontal deflection coils L16 and L17 were next measured for continuity and were found to check correctly. The high voltage transformer section A to B was next measured for continuity. It also checked correctly. L19, the width control also was found to measure okay. It seemed that the only possibility was C74, 20 μf. C74 was therefore bridged with a new 20 μf condenser and immediately the raster appeared and the receiver functioned normally. C74 was obviously open.

In looking back on this problem, it can be seen that if the 6W4 were defective, there would be no high voltage. Thus no white line could possibly be seen on the CRT face. If C78 or C73 were open the high voltage would not be affected to a great degree. Moreover, the raster though horizontally non linear, could nevertheless appear. An open horizontal linearity coil would also cause no high voltage. Therefore, the symptoms involved in this problem made it a rather easy one to solve.

Admiral 21J1

The receiver was turned on and it was immediately observed that two black bars blanketed the picture and a hum was heard in the sound through the speaker. The two black bars in the picture indicate low voltage power supply leakage. These two black bars plus the hum in the sound indicate what is usually a filter problem. As full wave rectifiers deal with both halves of the sine wave, leakage will cause a large amount of 120 cycle ripple. Leak-
age in the half wave rectifiers would produce a 60 cycle ripple. This ripple or poor regulation causes the black bars in the picture. In the audio circuits this leakage produces a hum in the speaker.

Knowing these facts, all the filters were checked individually in the low voltage power supply. A new 80 µf filter was bridged across C407C but it had no effect. C432 was bridged with a new 60 µf condenser and the trouble immediately disappeared. Thus a new C432, 60 µf was installed. We noted at this point, that some hum still remained in the speaker. The hum however, could not be heard when the volume was turned up. The filters were then checked once more for leakage. Bridging C407C with a new 80 µf condenser now removed the remaining hum. Thus we can conclude that C407C was only slightly leaky and affected only the audio while C432 was leaking bad enough to cause not only the hum but the two black bars in the picture.

DuMont RA-112

The receiver was turned on and the picture was observed to be jittering vertically. It was noted also that when the brightness control was turned from maximum to minimum the left side became dark before the right side. This effect often indicates a filter problem.

Fig. 3—Partial schematic of Admiral 21JJ chassis.

The diagram was studied in order to determine which filter condenser would cause the vertical jitter and dark left side. C259A and C259B, the main filters affecting the entire B+ system, if leaky, would probably cause a hum in the sound and possibly black bars in the picture. Thus, these two condensers were eliminated as possible trouble makers.

Most other filter condensers could probably cause this trouble. Therefore, at this point each filter was bridged individually with a new one. But the trouble remained. C253, 50 µf, off the -50 volt buss, however, had been over-[Continued on page 55]
IN THE previous installment, it was mentioned that the two most commonly used types of radiation detectors are Geiger Counters and Scintillation Detectors. The principle of operation of the Geiger Counter has already been discussed and a circuit analysis of a very simple type of Geiger Counter was given in the September 1955 issue. Let us turn now to the "Scintillation Detector" or the "Scintillation Counter" as it is also known.

Scintillation detectors have two basic advantages over Geiger Counters. First, they are very much more sensitive. Some scintillation detectors are more than 100 to 500 times as sensitive as Geiger Counters. This makes them especially suitable, for example, for aerial or motor prospecting. The second basic advantage is that they have a much shorter "dead time" than Geiger Counters. This term "dead time" requires a little explanation. When the gas within a Geiger tube becomes ionized by an entering radioactive ray, a pulse of current flows through the tube. Since the tube is now a relatively good conductor (low resistance), the voltage drop across its terminals decreases. When the voltage drops sufficiently, ionization can no longer be maintained, and the flow of current stops. The tube voltage then rises again and the counter is then ready to "count" the next entering ray. This process takes a certain definite time, and during this time the tube will be insensitive to any other radioactive rays which may impinge upon it. The terms "dead time" or "recovery time" are used in referring to this insensitive period. Typical values of "dead time" for GM tubes run from about 100 to 300 microseconds. Thus, when measurements are being made in high intensity radiation areas, there will be no difference in reading when the ionizing capability of the radiation is greater than the recovery time of the tube. Under these conditions the Geiger Counter will fail to count rays during the "dead time."

The scintillation detector, as we shall see, has a "dead time" in the order of only a half to one microsecond. The advantage in the measurement of strong radiation is obvious.

**Principle of Operation**

When radioactive rays strike certain materials, they cause these materials to give off flashes of light or "scintillations." If the light thus given off were reflected to the window of a photodetector, it would in turn cause the emission of electrons from photosensitive surface of the cathode. The photo tube may be placed in a standard circuit containing a load resistor across which a voltage will be developed, with the size of the voltage depending on the amount of light received. An amplifier may then be used to build up this voltage and finally give an indication on a meter. The meter reading will be indicative of the number of flashes per second, and therefore it will also give a measure of the strength of radiation. These are the basic principles of operation of the "Scintillation Detector." In actual practice, however, there are a few refinements with which the serviceman must become familiar.

**The Photomultiplier Tube**

Instead of being an ordinary photodetector tube such as commonly em-

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**Fig. 1**—Typical photomultiplier tubes commercially available.

**Fig. 2**—Schematic representation of photomultiplier tube.

**Fig. 3**—Shielded photomultiplier is shown in this illustration.
COUNTERS

Detection Devices Describes The
As Used In These Instruments.

ployed for door openers, alarm systems,
etc., a much more sensitive device called
a photomultiplier tube is used in Scintillation Detectors. Fig. 1 shows the
photographs of a few representative
types of photomultiplier tubes. Fig. 2
is a schematic representation of this
tube. It will be seen immediately, that
this is somewhat different from the
tubes that servicemen are usually con-
cerned with. The cathode is at one end
of the tube and is photosensitive, that
is, it emits electrons when light falls
upon it. The anode, at the opposite
dynode, is the plate of an
ordinary amplifier tube. The circuitry
is arranged to make the anode positive
with respect to the cathode by about
1000 volts. Spaced between the cathode
and anode are a series of electrodes
called "dynodes," usually ten in
number.

Starting at the cathode, the dynodes
are connected to progressively higher
and higher positive potentials with re-
spect to the cathode. When light strikes
the cathode, electrons are emitted.
Dynode No. 1 is about 100 volts posi-
tive with respect to the cathode so that
these electrons are attracted to it. The
dynodes are coated with a material
which gives off a number of secondary
electrons for each bombarding electron.
Dynode No. 2 in Fig. 2 is at a poten-
tial of about 100 volts higher than
dynode No. 1, so the secondary
electrons given off by dynode #1 are
attracted by dynode #2. The construc-
tion of the dynodes together with ap-
plicated potentials, is such as to cause the
electrons given off by each dynode to
be focused on the next one.

To illustrate the operation of the
tube, suppose for example that a single
electron striking a dynode results in
the production of 5 secondary electrons.
each of these striking the next dynode
would give rise to a total of 25 elec-
trons. At the third dynode the electron
stream would have swelled to 125. The
process repeats until finally there would
be well over a million electrons in the
stream by the time the last dynode is
reached. Amplification of over a mil-
on is readily obtained with present
day photomultiplier tubes. In order to

The Scintillating Crystal

Sodium iodide crystals are most com-
monly used for producing the flashes of
light under the influence of radioactive
tubes. The presence of this crystal is usu-
(Continued on page 46)
"I NEVER HEAR COMPLAINTS..."

when I use Tung-Sol Tubes for replacement jobs! These dependable, long-lasting tubes stay put. Instead of wasting time on callbacks, I'm out servicing new business!

TUNG-SOL®
dependable
PICTURE TUBES

TUNG-SOL ELECTRIC INC., Newark 4, N. J. Sales Offices: Atlanta, Chicago, Columbus, Culver City, Dallas, Denver, Detroit, Newark, Seattle.

An extensive Color TV Training Course being offered to all RETMA Accredited Technicians in the New York Area by the Certified Electronic Technicians Assn. which is composed of technicians who have proven their technical qualifications to the satisfaction of a Radio-Electronic-Television Mfg. Assn. Committee and have received industry accreditation. With the expansion of the RETMA Accreditation program to other areas of our nation, CETA is ready to charter Regional Chapters wherever the number of Accredited Technicians makes the formation of a chapter desirable.

A $1,000 reward is offered by Sylvania Electric Products Inc. for information leading to the arrest and conviction of any individual or company fraudulently branding small radio and television receiving tubes with the Sylvania name, it was announced by D. W. Gunn, General Sales Manager for the company's electronic products. In his letter to dealers, Mr. Gunn urged each of them to take full advantage of the $1,000 reward offer. "Counterfeiting is injuring your reputation and your business now," he said, and asked that the dealers write to him if they have any Sylvania receiving tubes that appear counterfeit.

The nation's first substantial multiple installation of color television receivers in hotel guest rooms has been completed at New York's Hotel Governor Clinton. Fifty 21-inch RCA Victor color sets were placed in various rooms and suites as part of the regular furnishings at no extra charge to guests. Seven hundred RCA Victor 21-inch black-and-white receivers also are in use and the hotel plans to increase the number until TV has been installed in all 1,200 rooms. Arrangements for the installation of the color receivers, as well as the black-and-white sets, were made by Wells Television, Inc., of New York.

"The Finest TV Picture Ever Seen In The American Home," a sixteen-page, full-color cartoon book that presents the TV service dealer, his skill, his fair charging and his importance as a member of the community, is the new Tung-Sol sales promotion tool available to TV dealers for customer-prospect mailings. The story of the making and alumini-zing the Tung-Sol Magic Mirror picture tube is also told in language the customer can understand. The integrity of service dealers and the reasonableness of their charges are stressed because Tung-Sol feels that keeping public opinion of dealers at a high level is just as important as providing them with fine tubes. It is felt that this cartoon book will help counteract the damage done by a slim few unscrupulous dealers whose actions make front page reading from coast to coast. Dealers may get free copies of this good-will and sales-building self-mailer from their Tung-Sol supplier or by writing direct to: Sales Promotion Department, Tung-Sol Electric Inc., Newark 4, N. J.

Retail sales of television receivers established new records in the first seven months of this year, reports the Radio-Electronics-Television Manufacturers Association. During the first seven months of this year 3,584,562 television receivers moved through retail outlets compared with 3,174,394 sets sold in the same period last year. From January
through July, RETMA reported that 2,732,983 radios, excluding automobile sets, were sold at retail compared with 2,822,090 sets sold in the similar 1954 period.

Upon recommendation of the Set and Tube Divisions, the Board of Directors authorized General Counsel Glen McDaniel and the RETMA Legal Committee to take whatever steps are appropriate to obtain a reversal or modification of FTC Rules 9 and 12 having to do with the measurement of TV screen sizes and the labeling as "used" of any cathode ray tube in which a repossessed glass envelope is employed in the manufacturing process.

A completely new Master TV Installation Manual is available at no charge from Blonder-Tongue Laboratories of Westfield, New Jersey. The 12-page booklet discusses all types of multiple TV systems, Industrial TV Systems and the proper use of B-T Masterline equipment. Illustrated sections cover antenna and line installation, signal distribution, closed-circuit TV, system maintenance and trouble-shooting procedures. Simplified charts and tables, with specific examples, show how to calculate signal levels at any point. Blonder-Tongue amplifiers, converters, taps-off and accessories are fully described, and the manufacturer offers free engineering assistance to all dealers and installers. Proposed system layouts may be sent to B-T's Sales Engineering Department.

J. M. Williams, RCA's Advertising and Sales Promotion Manager, states: "We have planned our entire color television campaign for this Fall and Winter to integrate with the mounting public interest and excitement being generated by the vastly increased number of hours of color programming to be telecast by NBC and other networks."

An unusual example of cooperation between commercial and educational TV groups and service dealers for civic improvement has been occurring in Detroit during the last two years. WTVS now is telecasting a test pattern on UHF Channel 56 several hours a day and programs will be on the air in October. The Detroit Educational Television Foundation during the past two years obtained funds for the erection of the transmitter and for equipment in three studios. In an area blanketed by four VHF commercial stations the problem of obtaining listeners for UHF telecasts is a major one. Indifference to UHF among dealers and servicemen is being overcome by the joint efforts of the educational groups, servicemen's associations, dealers and manufacturers. The Television Servicemen's Association of Michigan offered to aid the project. TSA members with other TV servicemen's organizations are getting prepared to handle the problems of UHF conversion and installation.

An assortment of gun-type soldering tips now being marketed by Electric Soldering Iron Co., Inc., of Deep River, Conn. It includes "the smallest soldering gun tip ever"... only 1/16" thick for soldering heretofore impossible-to-reach tight spots and deep chassis connections. A complete assortment of these new tips, in varied sizes and shapes, has just been made available for servicemen's use through trade channels. [continued on page 41]
NEW COMPONENTS

In requesting more detailed information on these products, please check the code number of the product on the convenient coupon on page 53, and send it, along with your company letterhead or business card, to New Products Dept., SERVICE DEALER, Suite 510, 67 West 44th St., New York 36, N.Y.

CORRECTION: We wish to call the readers' attention to the correct placement of Merit and Superex Products which were incorrectly placed in last month's issue.

New Merit Transformers
Merit Coil and Transformer Corp. has announced the introduction of several additional exact replacement horizontal and high voltage output transformers. Newly introduced are the HVD-36 (illustrated) and the HVD-44 exact replacement for Admiral, the HVO-49, a replacement transformer for Silvertone and the HVD-21, a replacement transformer for Silvertone, Sentinel, Hallcrafters and the Crosley "Boxer V." For information, check C118.

Superex Core Kit
Replacements for almost 90% of TV cores are available in a new Ferrite Core Kit from Superex Electronics Corporation. Containing 27 pieces and priced at $2.25 net, this core kit will offer service men to save the cost and effort of replacing coils, and transformers in the horizontal deflection, sound and video portions of most TV receivers. For information, check C119.

Sprague Sampler Assortments
The Sprague Products Company is now offering to service dealers sampler assortments of their popular "Blue Jacket" resistor series. Assembled in an attractive, legible fashion, these individual cards feature component part numbers, resistors from the miniaturized Maximum three-watt units (assortment RK-1) through 5 watts (RK-5) to 10 watts (RK-6). For further information, check C116.

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Beayland Anti-Noise Solution
A new product, called Quiet, is offered to dealers by the Byland Engineering Co. Its prevention effort to stop static builds up, Quiet prevents the "pops" and "ticks" in microgroove records. Records are kept clean and lubricated by applying Quiet. Stylie, needle bristles, and surface noises are stopped, and record life is extended considerably. Each Quiet kit contains 5 oz. bottle of liquid Quiet, applicator brush, and needle brush. One bottle treats both sides of 200 ten-inch records. For further information, check C112.

Jensen "Rumpus" Needle
The Rumpus, a "junior-proof" phone needle that's guaranteed not to bend or break, is the latest addition to the Jensen Industries line of all-priced needles. This is Jensen's answer to the demand for a really sturdy needle to be operated by careless small-fry and overly enthusiastic teen-ageers on their recreation room phonographs. The needles will sell for $1.00 each and are mounted by the dozen on smart, gaily-colored Rumpus display cards. For more information, check C114.

Clarestat Card-Kit
At a proper price, a wide selection of resistance and wattage values--such is the purpose of the Series 96 card-sets offered by Clarestat Mfg. Co. Each GK card holds a selection of power resistors by means of handy clips. Any resistor instantly slips off the card while its designation remains to facilitate reordering that particular value. There are six GK cards in all, covering the usual requirements of servicing. For more information, check C110.

Mellotone Grille Fabrics
To meet the market for the new MELLOTONE fabrics, a free display stand for square package has been developed. It enables the jobber to order the grille cloth by the square yard, and, with a small investment, to offer all Mellotone patterns. After he is assured of the demand for the material and determined the fastest moving patterns, the jobber may then order rolls and be provided with a roll display at no charge. For further information, check C112.

Pyramid Glassed Capacitors
Small capacitors capable of withstand- standing vibrational stresses and severe shock conditions are available in Pyramid's solid dielectric glassed capacitor line. The functional operation range is from -85°C to -115°C and the capacitors work normally under conditions of severe humidity. Capacitance Range is .001 mfd to 1.0 mfd. Voltage range: 100 to 600 Volts. The units can be provided to standard tolerance of plus or minus 10 percent or closer and are available in both inserted tab and extended foil constructions. For further information, check C112.

Delco Parts Kits
Clear plastic, pocket-sized kits to hold small replacement parts for Delco electronic technicians have been introduced by United Motors Service Division of General Motors. There are four different kits to cover the whole range needs, each divided into small compartments to carry an assortment of replacement hardware from turn-screws to ease screws. A chart on the cover names the part and number for convenience when ordering refills, supplied in plastic bags. For information, check C111.
NATESA
A survey of the just completed NATESA Convention reveals that a total of 1580 persons registered, representing 44 States, Canada, the Hawaiian Isles, Philippines and Cuba.

Delegates from 38 Affiliates met in official session. A new plan for creating new districts, which will create governors for districts, state chairman, and a new advisory council will complete the job of organization all the way down to the town level.

A plan to standardize on one name for all locals was voted and a target date of one year hence was set. The name to be Television Electronic Service Association, TESA for short. Thus NATESA will be truly the National Alliance of TESA's.

Elected to office were Frank J. Moch of Chicago, Pres.; Robt. Hester, Mission, Kansas, Secr’y Gen’l; Bertram Lewis, Rochester, N.Y., Treas.; Harold Eskin, Rochester, N.Y., Eastern V.P.; Russ Harmon, Cincinnati, East Central V.P.; Vince Lutz, St. Louis, West Central V.P.; Jim Failing, Greeley, Colo., Western V.P.; P. P. Pratt, Buffalo, N.Y., Eastern Sec’y; L. C. Stallicup, Nashville, Tenn.; East Central Sec’y; Joe Driscoll, St. Paul, West Central Sec’y, and Albert C. W. Saunders, Educational Director.

The spring Board of Directors meeting was voted to Omaha; the tentative date, April 22, 1956. The dates for the 1956 annual convention were tentatively set for August 19th with Chicago as the scene.

Unity Meeting Held in Pittsburgh

On Sunday, August 7th, 1955 representatives of ninety-four (94) Television Servicemen’s Associations met in Hotel Sherwyn, Pittsburgh, Pa., to explore the possibilities of Unity within the Electronics Service Profession.

About twenty-eight (28) delegates together with members of the Trade Press were present, representing National and State groups, comprised of ninety-four Associations.

The morning session was devoted to the exploration of the possibility of Unity among the established associations. A Chairman and Secretary Pro-Tem were named to conduct the after-

[Continued on page 47]
MR. MANUFACTURER — give this some thought!

If, in attempting to "get your share" of the $2 billion radio-TV replacement market, you have concluded that Parts Distributors are your primary customers, CHANGE YOUR MIND QUICKLY!

Parts Distributors are merely middlemen between Manufacturers and the 53,000 Service Firms and Service Dealers who do 92% of the nation's radio-TV service work. These two service groups are actually the primary and basic customers of all Manufacturers who sell to the replacement radio-TV market. Distributors seldom influence Servicemen's selections.

When a serviceman, influenced through advertising, or some other medium, decides to buy and use any Product or Brand, HE'LL BUY THAT PRODUCT, and no Distributor's salesman can successfully "switch" him into some competitive Brand on a permanent basis.

Professional Servicemen realize that for many reasons no one Distributor can always stock all Brands or all items of every Manufacturer's line. Thus Servicemen usually deal with several Distributors.

Servicemen also know that they, and they alone, are the ones who are held responsible, by set-owners, for satisfactory performance of the tubes, parts and accessories they use in repair work. That's why Servicemen DECIDE FOR THEMSELVES what Brands they want to buy and use.

Once a Manufacturer has "sold" a Serviceman on the merits of his Brand he can rest assured the Serviceman will insist on BUYING and GETTING that Brand even when Distributors attempt to "switch" him to some other Brand.

MANUFACTURER—DON'T UNDERESTIMATE THE DECISIVE BUYING POWER OF SERVICEMEN AND SERVICE DEALERS. THESE GROUPS—YOUR BASIC CUSTOMERS—FAVOR AND BUY PRODUCTS ADVERTISED IN "SERVICE DEALER."

### RADIO-TV SERVICE DEALER'S Honor Roll of Manufacturers Who Advertised This Year

- Acme Electric Corp.
- Aerovox Corporation
- Alliance Mfg. Co.
- Allied Radio Corp.
- American Microphone Co.
- American Phenolic Corp.
- American TV & Radio Co.
- Anco Electronics, Inc.
- Astron Corp.
- Atlas Sound Corp.
- Audite Publishers
- B & K Mfg. Co.
- Barst Electronics Corp.
- Bedford Mfg. Co.
- Blonder-Tongue Labs.
- Boge Co., Inc., David
- Bussumans Mfg. Co.
- CBS-Mhtons, Div. of CBS
- Cannon Electric Co.
- Capco, Inc.
- Centralab Div. of Globe-Union Inc.
- Channel Master Corp.
- Chicago-Standard Transformer Corp.
- Chrysler Mfg. Co., Inc.
- Clear-Beam Antenna Corp.
- Columbia Wire & Supply Co.
- Cornell-Dubilier Elec. Corp.
- Delco Div. of General Motors Corp.
- Dumont Labs, Allen B.
- Eby Sales Co.
- Electric Soldering Iron Co.
- Electric-Voice, Inc.
- Electronic Instrument Co.
- Electronic Chemical Corp.
- Electronic Test Instrument Corp.
- Erie Resistor Corp.
- Federal Telephone & Radio Corp.
- Finney Co., The
- Hickok Elec. Instrument Co.
- Hycos Mfg. Co.
- Illinois Condenser Corp.
- Instruments for Service
- International Resistance Co.
- JFD Mfg. Co.
- Jensen Industries
- Jensen Mfg. Co.
- Jersey Speciality Co.
- Joint Mfg. Co.
- Kenwood Engineering Co.
- Kryton, Inc.
- Littoffin, Inc.
- Merit Coil & Transf. Corp.
- Miller Co., J. W.
- Mosley Electronics
- Moset Electronic Dist. Co.
- Muller Electric
- National Radio Institute
- Oel-ich Publications
- Owens Mfg. Co.
- Oxford Electric Corp.
- Philcostron Company
- Philco Corp.
- Planet Mfg. Co.
- Precision Appliance Co.
- Prentiss-Hall Publications
- Probescope Co.
- Pyramid Electric Co.
- Queen-Richards Co.
- Quiltere Co.
- Racart Corp., The
- Radio City Products Co., Inc.
- Radio Corporation of America
- Radio-Wire Electric Sales
- Ram Electronics Sales Co.
- Raytheon Mfg. Co.
- Rhythmatic Laboratories
- Recorder Corp.
- Rider Publisher, John F.
- Sams & Co., Inc., Howard W.
- Secc Mfg. Co.
- Service Instruments Co.
- Shane Brothers, Inc.
- Simpson Electric Co.
- Skyweeper, Inc.
- Snyder Mfg. Co.
- Solotone Corp.
- South River Metal Prods. Co.
- Synagro Electric Co.
- Standard Coil Products Co.
- Super-ex Electronics Corp.
- Tarkin, Inc., Service
- Tek-Master Corp.
- Technical Appliance Corp.
- Tel-Scope Prod. Inc.
- Tele Test Instrument Corp.
- Telrex Inc.
- Transmission, Inc.
- Triad Transformer Corp.
- Trie Mfg. Co.
- Tribo-Sol Electric, Inc.
- Turner Co., The
- United Catalog Publishers
- University Loudspeakers
- Vaco Products Co.
- Wakeo-Electronics Co., Inc.
- Waho Electronics Corp.
- Wex Products, Inc.
- Weston Electrical Instr. Corp.
- Winston Electronics, Inc.
- Xero Inc.
- Yelts Appliance Dolly Sales Co.
CONVERGENCE PATTERNS

Analysis of the relative motion of the red, green, and blue beams under the influence of the various corrective fields that are applied.

by Bob Dargan and Sam Marshall Part 2

from a forthcoming book entitled "Fundamentals of Color Television"

In the following treatment we refer to Static Center Convergence as the adjustments involving beam convergence at the center of the screen with the permanent converging magnets only. Static Convergence refers to the adjustments of convergence at other points on the screen involving the same permanent magnets. Finally, adjustments involving Parabola and Tilt controls are referred to as Dynamic Convergence.

It will be recalled that in the initial Static Center Convergence adjustments involving radial adjustments of the red, green and blue converging magnets as well as lateral adjustment of the Blue Beam Corrector Magnet, the ultimate objective is to converge the beams at the center of the screen so that a resultant white dot is obtained. It will also be recalled that application of sweep power results in misconvergence of the beams at other points on the face of the screen, resulting in partially superimposed or individual color dots.

Static Center Convergence Pattern

On the completion of Static Convergence the ideal pattern shown in Fig. 1 should be observed if the color tube is mounted so that the blue gun is positioned on top of the tube as shown in the insert. In the case where the blue gun is on bottom the dot pattern obtained will correspond to Fig. 1 turned upside down. This applies to all of the patterns discussed in this installment.

From Fig. 1 the red and green parabolic deformation of the beam traces, both horizontal and vertical, is readily apparent. While this is also true for the blue horizontal beam trace, it is not readily apparent for the blue vertical beam trace for reasons which will be discussed shortly.

Also, from Fig. 1 it would appear that because the beam trace has a greater deviation from a horizontal line at its extremities than at its center, the corrective parabolic convergence fields should have a greater effect at the extremities than at the center in order to straighten out the dot array. While this is one method that may be employed to obtain an aligned array of dots, the practical method used is to move the belly of array in one direction and the ends in the opposite direction. Thus, when the corrective parabolic convergence voltage is increased, the maximum correction of the beam is at the center and the extreme ends, and the minimum correc-

![Fig. 1—Ideal pattern produced after correct Static Center Convergence adjustments are made on receiver. It is assumed that blue gun is positioned on top.](image1)

![Fig. 2—Application of horizontal and vertical parabolic current aligns curved beam traces in straight line traces (symmetrical trios) for final convergence.](image2)
tion is at a point about 25% from the ends.

In pursuing this technique the various curved vertical and horizontal red, green, and blue beam traces, should align themselves in straight parallel lines as shown in Fig. 2. Following this, the individual trios of dots which are arranged in equilateral triangles may then be converged further by readjustment of the Static Convergence magnets.

For various reasons, practical convergence adjustments are not as straightforward as the description up to this point would lead one to believe. However, the reasoning presented in the previous paragraphs does form the basic background of the actual operations performed.

As an aid in remembering the relative radial motion of the green and red beams we include the illustration shown in Fig. 3. In this figure we associate "red" with "left," the blue being the letter "R." so that the direction of the "red" beam takes the direction indicated by the fingers of the "right" hand. Recalling that the radial motion of the blue beam is vertical only, all that remains is to associate the motion of the green beam with the direction in which the fingers of the left hand point. This memory device will be found very helpful in analyzing dot patterns for convergence.

Simplified Convergence Circuit

Magnetic fields which affect the position of the beam parabolically in its motion from left to right and from top to bottom may be obtained in a number of different ways. These will be discussed in the following installment. It must be kept in mind at the outset that these parabolic corrections must be applied to each of the three beams to achieve correction with regard to dot arrays horizontally as well as vertically. Thus, with each beam having separate horizontal and vertical parabolic adjustments there are generally six controls to take care of parabolic convergence strictly. These controls are:

1. Blue horizontal parabola
2. Green horizontal parabola
3. Red horizontal parabola
4. Blue vertical parabola
5. Green vertical parabola
6. Red vertical parabola

A simplified circuit showing how a pair of corrective currents (horizontal & vertical) may be applied to the convergence coils of any gun such as the blue gun is shown in Fig. 4. These currents are designed to set up magnetic fields which vary parabolically with time. How they do this will be discussed in the next installment. However, at this point let us assume that the corrective fields set up in the tube are parabolic, and that the amplitude of the voltages applied to the Blue Convergence core are controlled by $R_1$ for the Horizontal Parabola Coil $L_1$, and $R_2$ for the Vertical Parabola Coil $L_2$. Controls $R_1$ and $R_2$ in Fig. 4 are respectively called the Blue Horizontal and Vertical Parabola Controls.

Blue Horizontal Parabola

A study of the manner in which the blue beam is influenced by the Blue
Horizontal Parabola field as the beam is deflected from left to right is shown in Fig. 5. Here we observe the sequence of blue dot positions in a single center horizontal line before and after dynamic convergence adjustments. Notice that the beam trace has an initial parabolic curvature in an upward direction due to misconvergence (see Fig. 1). Application of a corrective parabolic field is controlled by R1, the Blue Horizontal Parabola control in Fig. 4. In position 4 the full value of the convergence voltage is applied to LI the Blue Horizontal Parabola coil. As we rotate the control from positions 4 to 1 the applied convergence voltage is gradually decreased to zero.

Reference to Fig. 2 indicates that our objective is to obtain a straight line of horizontal blue dots displaced somewhat below the center of the screen. This is done by applying a magnetic field to the blue beam. This is indicated as a number of arrows, which show corrected positions of the individual blue dots shown in Fig. 5. Notice that these arrows are all in a vertical direction, the maximum displacement being applied at the center dot in a downward direction. Notice also that in both directions from center the length of the arrows taper off to zero, and that at the extreme edges of the screen the direction of these arrows are reversed. This reversal of direction can easily be observed by rotating the Blue Horizontal Parabola Control in a receiver, and watching the relative movement of the blue dots at the extreme edges of the screen and in the middle. The waveform of such a distribution of arrows is a parabola. Its final effect on the blue beam trace is a straight line of blue dots displaced a distance X below the horizontal center line of the screen.

Green Horizontal Parabola

Reference to Fig. 1 indicates the need for a dynamic convergence field that will push the belly of the green beam traces in an upward direction thereby positioning the green dots as shown in Fig. 2. The manner in which initial green beam trace is acted upon by the green horizontal parabolic corrective field is illustrated in Fig. 6. This field is indicated by the arrows shown in the figure. Notice that except for the extreme edges of the screen, the forces are in an approximate "Ten O'clock" direction, the maximum force being applied in the middle of the trace. The forces gradually taper off to zero near the screen edges and reverse their direction at the screen edges. The waveform of this distribution of forces is a parabola. The result of this parabolic corrective field on the initial beam trace is a straight

In every respect, Taco Trapper antennas make your job easier and more profitable. Streamlined, modern design plus extra features save you time, trouble and give greater user acceptance.

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horizontal line of green dots positioned, as in Fig. 2, and located a distance Y above the horizontal center line of the screen.

Red Horizontal Parabola

The manner in which the initial red beam trace is influenced by the red horizontal correction field is shown in Fig. 7. Except for the fact that the direction of the red dots is along an approximate "Two O'clock" line the same reasoning we employed in obtaining the final position of the green dots after correction may be applied to the red dots. Under ideal conditions a straight horizontal row of red dots will be obtained, all equally spaced from each other as shown in Fig. 2, and located a distance Z above the horizontal center line of the screen.

Blue Vertical Parabola

The manner in which the blue vertical correction voltage influences the vertical motion of the blue beam in a tube is illustrated in Fig. 8. Here we observe the sequence of blue dot positions in a single center vertical line before and after dynamic convergence adjustments.

In (A) we show the physical distribution of dots along this vertical line in a theoretically perfect tube, that is one in which no geometric error is present and therefore requires no dynamic convergence correction adjustment. Notice the equal spacing between dots. Our object is to try to make the blue dots line up in this manner.

Geometric error produced by the radius of curvature of the shadow mask and faceplate causes the blue dots to be displaced in the manner shown in (B) as the tube is swept horizontally and vertically. Thus, we observe that dot 8, second from the bottom, falls a distance "y" as it appears in position (B). Notice also that in position (B) the geometric convergence error is considerable at the extremities of the tube and zero at the center. The distance through which the dots are displaced from the top of the tube to the bottom varies as a parabolic function and the spacing between dots are no longer equal.

In (C) we show how the Blue Vertical Parabola Convergence adjustment is made to effect equal spacing between dots. Notice that this adjustment involves a further downward displacement of dots, except for the very ends of the screen where the direction of motion is reversed. Notice also that this displacement is greatest at the center and zero near the tube extremities. Thus, dot 8, whose progress we have been following undergoes no vertical change from (B) to (C). The sum total of this corrective convergence adjustment is that all the blue dots are now equally spaced again; however, they have all been shifted an equal amount in a downward direction with respect to (A). The position of the blue dots in (C) corresponds to the position of the vertical blue dots in Fig. 2.

In (D) we illustrate the final positions of the dots after static convergence adjustment for the Blue Converging Magnet. Now all blue dots are raised an equal amount in a vertical direction and are in positions identical to the ones they occupied in (A). The amount of vertical displacement effected in this last adjustment is shown as "Z".

Green Vertical Parabola

Correction of the green vertical beam trace involves pushing the belly of the green beam trace from right to left as shown in Fig. 9. This requires the application of a parabolic correction.
Mfr: DuMont  
Chassis No. RA-162
Card No. DM 162-1
Section Affected: Raster
Symptom: Loss of horizontal and vertical size.
Cause: Defective condenser
What to Do:
Replace: C314, 4 \( \mu F \), which is bad.

Mfr: DuMont  
Chassis No. RA-162
Card No. DM 162-2
Section Affected: Raster
Symptom: No raster, no horizontal sweep
Cause: Defective condenser
What to Do:
Replace: C231, 120 \( \mu F \), which is shorted.

Mfr: DuMont  
Chassis No. RA-162
Card No. DM 162-3
Section Affected: Sync
Symptom: Critical vertical hold
Cause: Defective condenser
What to Do:
Replace: C230, .047 \( \mu F \), which is open.
Mfr: DuMont Chassis No. RA-162
Card No. DM 162-4
Section Affected: Pix
Symptom: Overload video
Cause: Defective condenser
What to Do:
Replace: C228, .001 µf, which is shorted.

Mfr. Dumont Chassis No. RA-162
Card No. DM 162-5
Section Affected: Sync
Symptom: Horizontal hold drifts repeatedly
Cause: Defective condenser
What to Do:
Replace: C308, .001 µf, bad.

Mfr. Dumont Chassis No. RA-162
Card No. DM 162-6
Section Affected: Raster
Symptom: Horizontal size decreases
Cause: Defective condenser
What to Do:
Replace: C334, .1 µf, which is leaky.
Mfr. Westinghouse  Chassis No. CH-V-2175
Card No. WE 175-1
Section Affected: Sound
Symptom: Sound bars in pix and hum in sound
Cause: Defective condenser
What to Do:
Replace: C220, 10 µf, which is leaking.

Mfr. Westinghouse  Chassis No. CH-V-2175
Card No. WE 175-2
Section Affected: Pix
Symptom: No brightness
Cause: Defective condenser
What to Do:
Replace: C315, .05 µf, which is shorted.

Mfr. Westinghouse  Chassis No. CH-V-2175
Card No. WE 175-3
Section Affected: Pix
Symptom: No video
Cause: Defective condenser
What to Do:
Replace: C310, 10 µf, which is shorted.
12AU7 HORIZ. MULTIVIBRATOR

Mfr. Westinghouse  Chassis No. CH-V-2175
Card No. WE 175-4
Section Affected: Raster
Symptom: No H. V.
Cause: Defective condenser
What to Do:
Replace: C421, 120 µf, which is shorted.

6AU5 HORIZ. OUTPUT

Mfr. Westinghouse  Chassis No. CH-V-2175
Card No. WE 175-5
Section Affected: Raster
Symptom: Width shrinks intermittently
Cause: Defective resistors
What to Do:
Replace: R451, and R442 that are changing value.

6SN7 VERTICAL MULTIVIBRATOR

Mfr. Westinghouse  Chassis No. CH-V-2175
Card No. WE 175-6
Section Affected: Raster
Symptom: No vertical sweep
Cause: Defective condenser
What to Do:
Replace: C412, .05 µf, which is shorted.
In requesting more detailed information on these products, please check the code number of the product on the convenient coupon on page 53, and send it, along with your company letterhead or business card, to New Products Dept., SERVICE DEALER, Suite 510, 67 West 44th St., New York 36, N.Y.

Simpson Leakage Tester
Simpson's new Model 283 In-Circuit Capacitance Leakage Tester actually shows the presence or absence of leakage in virtually all paper, mica, or ceramic capacitors while connected in the circuit...eliminating tedious disconnecting and resoldering. Checking is done at rated working voltage, right in the circuit. Capacitors under test can be shunted by circuit resistance which is much lower (1% or less) than the value of the leakage resistance. For further information, check T112.

Hickock Tube Tester
A new field engineer's Dynamic Mutual Conductance type tube checker is now available in portable form. The Hickock Model 755 incorporates all the latest tube testing features to permit evaluation of any tube normally encountered in all phases of electronic work including the latest ruggedized types and the new series hoister-string tubes. Manufacturer states that this instrument also tests germanium diodes and selenium rectifiers. For full information, check T116.

Precise VTVM
Precise Development has a VTVM Model 9071, selling in kit or factory wired form, which claims the distinction of having true voltage regulation, and features a 1/4 inch meter, and a new type VR tube assuring true, accurate and stable readings. The unit also has a separate 5V AC scale; a 20 MHz input on DC, true zero center and is housed in a steel case. 11 x 8 x 5 in. It weighs 11 lbs. and comes with a 3-color "step by step" construction book. For more information, check T111.

Du Mont Oscillograph
A new highly precise cathode-ray oscillograph called the Type 331, has been announced by the Allen B. Du Mont Laboratories. The instrument, only slightly larger than a shoe box, may be used as a time-measuring device for time intervals as long as 20 seconds and as short as the rise time of its signal amplifier which is 2.5 microsec. It also is an a-c-d-e electronic voltmeter with a range of 0.4 to 400 volts, full scale, with an upper frequency limit of 4 megacycles (30', down). For further specs, check T118.

Phostron VTVM
A new vacuum tube voltmeter known as the "QVTVM, has been announced by Phostron Electronics. It is completely self-contained, with all accessories fitting easily into its leather carrying case. Accessories include: A High-Frequency Co-Axial Cable, D.C. Probe and A.C. Line Cord, and a 28 page illustrated Instruction Manual...the A.C. Line Cord is easily reeled onto the handle. For specifications and price, check T115.

B&K Tube Tester
The Dyna-Quick Model 598, is a new portable, low cost, dynamic mutual conductance tube tester, announced by B&K Manufacturing Co., with which any serviceman can quickly, accurately and completely test shorted, grid emission, gas content, leakage, dynamic mutual conductance life expectancy under actual operating conditions. Dyna-Quick checks 90% of all tubes in use today, including the new 600 mill series tubes. For more information, check T114.

Decade Instrument Sweepalator
The Sweepalator, a new doubleduty unit which will serve as a combined signal generator and sweep generator, has been announced by Decade Instrument Company. Claimed to have great accuracy, the unit features decade switching, crystal CW or center frequency and wide range calibrated output. For detailed information, literature and prices, check T112.

Century Analyzer
The Century Electronics Company has marketed its Model 201 Condenser-leakage Analyzer, which will test condensers and resistors for quality and value, either in out of the set. The unit checks condensers from 40 microhm to 150 milliohm, for leakage up to 10 microhm as well as open, shorted or intermittent operation. Universal capacity values are registered on the dial. For further information, check T117.

Weston Sweep Generator
Weston has announced their Model 894 sweep generator, for trouble shooting of sound and video IF circuits, associated trap circuits, TV tuners, video amplifiers and all-purpose visual alignment. RF output, Frequency modulated, TV channels 2 to 11 or centimeter, complete FM coverage available by means of two preset selector positions. Frequencies are fundamentals of the oscillator frequency. For further information, check T119.

Tescon Rejuvenator-Tester
Tescon, Inc. has announced a CRT Rejuvenator-Tester, model RT-1, which will analyze performance characteristics of a CRT, locate and eliminate inter-element shorts, repair open elements, weld open diodes, and rejuvenate the tube, all without removing the tube from the set. For complete information, check T119.

RADIO-TELEVIZION SERVICE DEALER • OCTOBER, 1955

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Dear Answerman:

I have noticed a condition of horizontal streaking in a Westinghouse chassis V2345. This streak is not there at all times and seems to be most prevalent on the weaker channels. I was wondering if you have any answer for this condition.

F. P.
Hicksville, N. Y.

The condition has occurred several times previously to my knowledge. What is wrong is that the leads to pin 8 and 9 on the transformer require reversing. This may have been an error in wiring in the transformer but more than likely the leads coming out of the coil were inadvertently reversed when being connected to the transformer panel. With the circuit wired as it evidently is the incorrectly phased voltage is supplied to the phase comparing stage with the result that the picture has the horizontal bar out of phase and positioned in the middle of the picture tube.

This is a problem to remember because it can occur in any of the receivers that use a pulse from the horizontal transformer for afe action. The schematic of the windings of the horizontal output transformer is shown in Fig. 2.

Dear Sir:

I have noticed in some of the Stromberg-Carlson model X21 chassis that the high voltage fuse on occasion opens. An inspection of the circuit reveals nothing wrong. A new fuse is installed and the receiver seems to operate quite normally. I'm generally suspicious of a receiver that opens a fuse but in these cases I can find no cause for it.

F. T.
Youngstown, Ohio

The delayed action type of fuse is preferable in these circuits as turning the receiver allows more current to flow than when the receiver is in operation.

[Continued on page 45]

Model ES-550 Standard: Electrically identical to above but in standard black cabinet with black anodized aluminum panel. Case dimensions 8¼ x 14½ x 18½ inches. Complete as above. Net Price: $210.00

MODEL SP-5 OSCILLOSCOPE TEST PROBE SET
for TV Signal Tracing, Alignment, Trouble-Shooting and Waveform Analysis

Engineered to cover a wide range of modern electronic applications including MONOCHROME and COLOR TELEVISION

The Model ES-550 is the PRECISION® answer to laboratory, industrial and technician requirements for a rugged, dependable instrument for broad coverage of modern electronic oscillograph applications, INCLUDING COLOR TV. It provides a new and unparalleled standard of high sensitivity with single, overall wideband frequency response, plus other special performance features—at most sensible selling price.

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- Linear, Multi-vibrator Sweep Circuit: 10 cycles to 100 KC plus automatically synchronized 30 cycles and 7875 cycles sweep for TV sync-pulse analysis. Amplified sweep terance blanking.
- Amplified Auto-Sync Circuit active on all internal sweep ranges
- Four Way Sync. Selector Switch provides for Internal Negative, Internal Positive, External and Line Synchronization.
- 3,000 Volt Intensifier Power Supply assures utmost visibility of "scope traces. Essential to high frequency and pulsed waveform analysis.
- "Z" Axis Input Terminal for blanking, timing and marking.
- Built-in 60 cps Phasing and Blankin Controls especially designed for more convenient FM, Monochrome and Color TV alignment and sync pulse analysis.
- All 4 Deflection Plates Available with full beam centering facilities.
- High Contrast. Filter Type. Removable Calibrating Screen

See the new Model ES-550 at your favorite Electronic Parts Distributor. Ask for new 1955 catalog describing the complete line of PRECISION® Test Instruments for all phases of AM, FM, TV.
NEW ANTENNAS AND ACCESSORIES

In requesting more detailed information on these products, please check the code number of the product on the convenient coupon on page 53, and send it, along with your company letterhead or business card, to New Products Dept., SERVICE DEALER, Suite 510, 67 West 4th St., New York 36, N.Y.

JFD Deep Fringe Arrays

JFD Manufacturing Company Inc. has developed two new Fireball line broad-band antennas for deep fringe VHF-UHF application. The FB500S-68 3-bay model is custom-tailed to high band with co-channel and cross channel interference. The stacking harness of the FB500S-68 is particularly recommended to eliminate adjacent channel or co-channel disturbance on channels 7 to 13. The FB600S-96 model in 96-inch Low Band Boost Stacking Transformers is engineered to increase gain on channels 2 to 6, and recommended for areas where weak local signals are received. For further information, check A114.

Holloway Broadband Antenna

Holloway Electronics Corporation announces production on their line of all channel EX100 TV antennas. EX100 is called an exponential antenna because its elements are curved in the form of an exponential curve. These curved elements properly positioned with respect to each other, the antenna's upper frequency range is unlimited. Pictured above is their wide research laboratory. For further information, check A115.

Snyder "Tenna-Phony"

According to a recent survey, 12.2% of all radios have no radios in the case. This is particularly the case where the young motorist wants to listen to one of the crowd but cannot afford a radio. To meet this consumer demand, Snyder Mfg. Co. is now producing a "Tenna-Phony" for autos. For more information, check A112.

Transvision TV Amplifiers

Transvision Incorporated has announced a new line of Low Cost TV Antenna Amplifiers for TV Master Antenna Systems. Eight different types are available, each designed to handle particular problems encountered in installing Master Antenna Systems in Communities and Buildings. Features include built-in "Cable Loss Equalizers" for repeater amplifiers, "Signal Outputs" for systems requiring more than one main line, and choice of low band only, high band only or low band-high band amplifiers. For further information, check A116.

Word Fiberglas Antenna

Fiberglas auto antennas have been marketed by Ward Products Corp., which exhibit several advantages over the conventional chrome-plated brass antenna: They will take an extra heavy wind or return to its original position without any "set" taking place. The color is "inhale" into the red, and not affected by salt air, humidity, heat or cold. Permanency remains constant because antenna is of fixed length. No need for collapsing, clears overheads; Matches or complements colors of vehicle. For more information, check A110.

Blonder-Tongue Transformers

Blonder-Tongue Laboratories announces two impedance matching transformers: The MB Balun, an outdoor model for antennas or amplifiers, and the TV Transformer which mounts directly on the TV receiver. Both provide good 75 to 200 ohm match over the entire VHF range. The MB features a bracket with strap for mast or pole mounting. It greatly improves directivity of 200 ohm balanced antennas when connecting to 75 ohm coax cable, and increases gain by up to 3 db. The Model TV cable is easily connected or disconnected in plug and jack. For further information, check A115.

Taco Highlander Yagis

The Technical Appliance Corporation has announced their Highlander series of wide band antennas, with high gain, good front-to-back ratio and a sharp forward pattern. Directors, rotors and driven elements are all constructed in the new Mono-Lock construction which is extremely fast of assembly and prevents cable locking. Each element is easily flipped into position where it is needed. For further information, check A111.

Fretco "Dimension"

Fretco, Inc. has announced the high-gain all channel antenna called the "Dimension." It features the Foto Phased element which makes possible the broad banding of Yagis which up until now were single channel narrow band antennas. In the Foto phase design, signal loss through wet or dirty points is precluded. The Foto Phased element is supported at the point of low voltage and high current thereby retaining the "Q" on all channels with equal performance. For more information, check A118.

Channel Master "Lancer" Series

Two new all-channel VHF antennas, the Lancer and Super Lancer, have been announced by Channel Master Corp. They are to include more elements and more power than existing similar types. The Lancer, Model No. 331, has one additional Low Band Director, gives 1½ to 2½ more low band gain. The Super Lancer, Model No. 334, has four additional parasitic elements, and gives 1½ to 2½ more gain than similar types. Both are entirely "Super-Semsed," requiring no hardware adjustment. For more information, check A117.

LaPointe Attic Installation

LaPointe Electronics Inc., Rockville, Connecticut, announces the Koutenna—an indoor antenna of scientific design for attic installation, with a built-in rotator. Available in two types, Model RO-210 for 2-channel UHF-VHF, and Model RO-213 for VHF only. Includes a reversible 24-volt rotator built into the boom of the antenna and a modernistic control unit in pale green or mahogany. The antenna, which feature snap construction, are attached to an attic beam by an adjustable mast that hangs down from the beam and rotates in a 54-inch radius. For further information, check A119.

RADIO-TELEVISION SERVICE DEALER • OCTOBER, 1955
The FCC has been asked to close down television reradiators in the Northwest. Milton J. Shapp, of Jerrold Electronics Corp., stated that the continued operation of reradiator transmitters in the Northwest is delaying the spread of television to fringe areas. Reradiators pick up a channel, amplify the signal, and retransmit it on the same frequency. FCC has expressed fear that this means of transmission causes interference, not only with the station being boosted, but also with other TV stations on the same channel.

A colorful new Bulletin No. 211 illustrating and describing the new E-V line of Do-It-Yourself High Fidelity Speaker Enclosure Kits has just been issued by Electro-Voice, Inc., Buchanan, Michigan. This bulletin tells how easily one, at low cost, can build his own speaker enclosure with simple tools. Every piece in each E-V kit is precut, ready to assemble. Finished kits are comparable to the Electro-Voice factory-assembled enclosures. Seven kit models are listed, covering the Electro-Voice Patrician IV, Georgian, Centurion, Regency, Empire, Aristocrat and Baronet. Finishing Kits for fine furniture finish, and Decorative Trim Kits are also listed. Simple step-by-step instructions are supplied with each kit or may be obtained separately at nominal cost. With E-V kits service dealers can open new vistas in custom Hi-Fi sales to their customers. For a free copy of Enclosure Kit Bulletin No. 211, write to Electro-Voice, Inc., Buchanan, Michigan.

The new “Geomatic” TV antennas now being marketed by The Finny Co. of Cleveland combine the famous collinear high band Finfo patents with exclusive Fidelity Phasing to produce startling gain on low band—all made possible through newly created physi-
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Price advances on television antennas have already or will shortly be announced by the majority of V antenna manufacturers, according to Elliott March, president of Tescon TV Products Co., Springfield Gardens, N.Y. He attributed the general price rise to increased costs of aluminum, steel and copper materials required for the production of TV antennas.

Increased cost of labor and materials, ranging from 75% to 20%, with an artificial scarcity that currently prevails in the metals market. "Improved production design," Mr. March said, "partly offsets the increase in raw material and labor costs by providing antennas of improved quality and design for today's TV signal conditions. This means that the TV set owner's purchasing power is protected—because he is able to enjoy much better TV reception with only slightly increased antenna cost."

Admiral Corporation has held 109 television training schools since printed circuit wiring was introduced in the company's television receivers in June, 1954, according to Max Schinke, national service manager. The schools acquaint dealer-service men with the newest advances in printed circuits and automation and provide them with the latest information on circuit details of the Admiral TV chassis.

A new concept in television antenna masting has been introduced by Jones & Laughlin Steel Corporation. It enables a television serviceman to assemble in a few minutes on the job a "custom-made" telescoping antenna mast in heights up to 50 feet. The new idea involves the use of J&L's Perma-Tube, the high-strength, corrosion-resistant, electric-welded steel tubing. Perma-Tube will be furnished to distributors in five different sizes, all in 10-foot lengths, with 10 pieces of each size to a carton. The sections range in size, in quarter-inch graduations, from the largest with an outside diameter of 2 1/4 inches, down to the smallest with an OD of 1 1/4 inches. The 2-inch size fits inside the 2 1/4-inch
size, the 1 1/4-inch inside the 2-inch, and so on. These mast sections will have one end expanded and the other end reduced. Slots and holes are provided to receive the hardware fittings. The serviceman may buy the Perma-Tube from his distributor in as many sizes as the job requires. In assembling the mast at the job site, the serviceman merely telescopes the tubing to the length he desires and applies the joint fittings. The mast is then raised to the roof for attachment and guying.

The appointment of Jack M. Gutzeit as National Sales Manager for Rogers Electronic Corp., New York City, has been announced by Louis Rogers, President.

In addition to directing Roger’s sales force, distribution policies and promotion programs, Mr. Gutzeit will institute a national program of servicemen technical forums. He will personally conduct the forums and endeavor to make the company’s resources of experience and technical knowledge available to service technicians.

All advertising and sales promotion of the technical products manufactured by Allen B. Du Mont Laboratories, Inc., are now under direction of Jacob H. Ruiter. He will also supervise all promotional effort by the company’s Transmitter, Mobile Communications, and Technical Sales Advertising Departments. Mr. Ruiter is the author of a number of books and articles dealing with Cathode Ray Instruments and with Television. He is a member of the Institute of Radio Engineers, Montclair Society of Engineers and past president of the New Jersey Chapter of the National Industrial Advertisers Association.

Precision Radiation Instruments Inc., Los Angeles, California, announced September 7 that it has acquired Radio Craftsmen, Chicago manufacturer of fidelity components and equipment. President Leslie M. Norman of Precision announced that their Chicago firm will be operated as a subsidiary under executive management of Precision and will continue to increase output of amplifiers, tuners, filters, and equalizers.

General Electric has started production of a five-transistor pocket radio which will have a suggested list price of $49.95. Shipments of the miniature receivers are expected to be made within a few weeks with advertising and sales promotion aimed at the Christmas market. The G-E transistor portable will be available either in ivory or ebony cases. Both station selector and on-off-volume control may be operated with one finger. The set is equipped

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with both a loudspeaker and a jack into which a hearing-aid type earphone may be attached. Actual overall dimensions of the new G-E portable are 5 3/16 inches long, 3 3/16 inches wide and 1 1/2 inches deep. Complete with battery, the receiver weighs 15 ounces.

Columbia Wire & Supply Company, Chicago, announces that all Columbia 300 ohm Permaline Television Transmission Line is now sold with a written guarantee. The 50 mil will be backed by a 15-year guarantee and the 80 mil by 25 years. Extensive research on Permaline has shown that it will far outlast other types of television transmission line in average use today, based on reports of one of the largest testing laboratories in the country, according to Columbia.

A plane-load of Detroit technicians recently visited the Taco plant at Sherburne, N. Y., to get acquainted with the peculiarities of UHF reception. When educational Station WTVS (Channel 56) Detroit goes on the air, one of the most aggressive and thorough UHF conversion campaigns will swing into high gear. Information transmitted to the service organization representatives who visited the Taco plant will be passed on to other members at meetings to be held in and about Detroit during the coming weeks.

Kay-Townes Antenna Co. of Rome, Ga., this fall is announcing the Super Rear Guard, a new directional television antenna that rejects signals from both the rear and sides.

ANSWERMAN

[from page 38]

ation. At this period in the operation ordinary fuses can open up. The delayed action or slo-blow fuse handles this extra current without opening for a short period of time but still provides protection to the circuit.

In the case of the Stromberg-Carlson receiver it is suggested that a delayed action type, 0.2 amperes fuse be installed after which most probably no further trouble will be encountered. The circuit diagram for this portion of the chassis is shown in Fig. 3.

Dear Mr. Answerman:

I have been wondering if there is any reason for the numerous failures of the 5U4 power rectifier tubes that I have been running into. I know that the high heat and humidity caused a number of components to fail this past summer but I think that an abnormal
The number of 5U4 tubes have also gone bad in the relatively new receivers. Do you know of any reason for this.

A. S. Chicago, Ill.

The tube situation is becoming involved and more complicated than years ago when a 5U4 tube was a 5U4. Nowadays, there is the 5U4G, 5U4GA and 5U4GB. These tubes do not differ radically except in one aspect. The original 5U4 tube is designed as a 225 mA rectifier while the 5U4GA and 5U4GB tubes are rated for 275 mA rectifier operation.

What evidently is happening in a number of cases is that instead of using the proper tube for the receiver, the old 5U4 tube is put in with the result that failures occur very early in the tube's life.

The tube replacement aspect of TV servicing requires caution. There are many places where exact tube designation is imperative; as an example, in replacing tubes in a series filament circuit that employs tubes of the controlled heater type. Indiscriminate tube substitution cannot be practiced without poor results.

SCINTILLATION COUNTERS

[from page 23]

ally indicated on a schematic by its chemical formula, NaI. By adding a small amount of thallium to the sodium iodide crystal, the frequency (color) of the light given off is changed to one which is more effective in operating the photomultiplier tube. The crystal is then called a thallium activated sodium iodide crystal which is indicated by the symbol NaI(Te).

The photograph of Fig. 3 also indicates the position of this crystal. Note that the crystal is sealed in an airtight container. This is necessary because sodium iodide absorbs water vapor very easily, and if left exposed to the air it would soon become useless.

Typical Circuit

Figure 4 is a schematic of commercial Scintillation Detector which will be used for purposes of illustration and circuit discussion. Notice the representation of the photomultiplier tube and the scintillating crystal at the left hand side. Fig. 5 is a block diagram of the unit and will be helpful in our preliminary discussion.

The sequence of operations is as follows. When radioactive rays strike the sodium iodide crystal, it gives off flashes of light. These flashes enter the photomultiplier tube, and produce voltage pulses at the output. It is important to note that the voltage pulses are of varying amplitudes, depending on the strength of the flashes of light responsible for them.

It is desired to have the meter reading represent the rate of occurrence at the ionizing rays. For this reason the pulses at the output of the photomultiplier tube are fed into the "one shot" multivibrator. VT-1 and VT-2 of Fig. 4 are used for this multivibrator. The multivibrators used in TV receivers are of the continuous running type, that is, just one of the tubes conduct while the other is cut off, and then the conditions reverse. This is true whether a synchronizing signal is present or not. In a one shot multivibrator, such as used here, the operation is very similar except that one tube remains cut off while the other conducts continually. The circuit remains in this condition until a triggering pulse is fed in. At this time the circuit will go through one cycle of an ordinary multivibrator action and return to its original condition, resulting in a single pulse at the output. By using this arrangement all the output pulses are of equal amplitude, re-

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Regardless of the size of the triggering pulse.

The equalized pulses are then fed to the block indicated as the pulse integrator. This consists of a resistor-condenser network, the purpose of which is to develop a voltage corresponding to the average value of the incoming pulses. The final stage along this signal path is a vacuum tube voltmeter arranged to give a reading which will be determined by the average value of the incoming pulses. Since the input voltage to the VTVM depends on the scintillation rate, which in turn depends on the strength of the radioactive rays, the meter reading will indicate the strength of these rays. The units used for these measurements will be discussed later.

The remaining stage of this unit is that concerned with the development of the high voltage required by the photomultiplier tube. A unique circuit in this stage produces a voltage of about 10,000 volts from the low voltage batteries used to power this device. A detailed circuit analysis of these stages will be taken up in the next installment.

CAPACITESTER
[from page 19]

be readily revealed by an ohms check, it will in all probability not be great enough to introduce symptoms. This is so because the shunt resistor is equivalent to leakage in the condenser. If the circuit can tolerate the shunt resistor it can tolerate the effective change in its value produced by a small amount of leakage in the condenser.

In capacitive-coupled circuits where a coil alone returns a grid to ground, the ac resistance of the coil is so small that a leak in the coupling condenser will not cause an appreciable ac voltage to be developed between grid and ground. The grid voltage applied to the Capacitester's indicator will be inadequate under such conditions, making an accurate leakage test difficult. Leakage in such a coupling condenser will, when appreciable, cause overheating of the plate resistor to which one side of the coupling condenser generally connects, and may be detected in this way. The Capacitester will function normally, however, in circuits where the "low" end of a grid coil returns to an age line.

ASSOCIATIONS
[from page 27]

noon business session. B. A. Bregenzer, President of the FRASAP was named Chairman Pro Tem and Gordon Vro-
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An unbeatable combination...a CRT tester and rejuvenator in one small, compact, featherweight, low-cost unit. Simple to operate with one-knob control, a large, easy-to-read 4½-inch meter and a neon tube short indicator. And it weighs less than 4 pounds!

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because of its limited frequency response sharp rectangular pulses containing very high frequency components will be somewhat rounded. However, this will in no way hide troubles if they are present.

On the high voltage side of the receiver it becomes necessary to use a high voltage probe in conjunction with the CRT probe provided with the instrument. In this manner the various waveshapes present in this portion of the receiver may also be observed.

**Circuit Analysis**

The circuit diagram of the Probescope Model PO-1 is shown in Fig. 1. The input from the probe is fed into the first half of VI which is a cathode follower feeding the second half of V1, a triode amplifier. The vertical gain control R50 has a comparatively low resistance which in conjunction with C2 (5 μf) helps in maintaining a satisfactory frequency response. The output of this triode feeds V2, a high gain pentode which in turn provides a high gain signal to the vertical deflection plates of the CRT.

A Potter type multivibrator circuit in conjunction with V3 is used as the horizontal oscillator. The ganged vernier control compensates the oscillator tube for the various horizontal operating frequencies so that its amplitude remains constant. The output of this oscillator is directly fed into the first half of V4, the output of which is cathode coupled into the second half of V4. A .1 μf condenser (C15) couples this amplified horizontal sweep signal into the plates of the CRT.

Two power supplies are used. One provides a positive potential of 330 volts and the other a negative potential of −760 volts for a total of 1090 volts. The use of this high voltage reduces the required beam current and consequent possibility of tube burning. The net effect is a high intensity beam.

Servicing of church, banquet hall and theater amplification systems is made easy with the use of the Probescope. Waveforms can be picked up from the output of a crystal pickup or microphone and traced right through to the speaker output. Hum and distortion troubles normally difficult to find are easily traced.

Additional use for the Probescope will be found in servicing of mobile equipment. Receivers and transmitters in boats and cars are usually difficult to remove and when brought into the shop, power for 12 volt and 24 volt equipment is not always available. A Vibrapack power supply separately packaged is available to operate the Probescope at these voltages and servicing of mobile equipment can be made without removing the equipment.

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CONVERGENCE

Fig. 10—Simplified circuit illustrating how Blue Horizontal and Vertical Tilt currents are obtained.

field, and will result in a beam trace which is a vertical line displaced by a distance Y' from the vertical center line. Notice that the green dots are directed upward in an approximate "Ten O'clock" direction except for the extreme ends where the directions are reversed. The locations of the green dots after dynamic convergence will, under ideal conditions, correspond to the locations of the vertical green dots in Fig. 2.

Red Vertical Parabola

Correction of the red vertical trace involves pushing the belly of the red beam trace from left to right as shown in Fig. 9. The same reasoning used in the green vertical trace, when applied to the red vertical trace, indicates that the new vertical line of red dots will be displaced from the center vertical line by a distance Z'. This new vertical line corresponds to the vertical line of red dots in Fig. 2. Notice that the movement of the red dots is now in the approximate "Two O'clock" direction except for the extreme ends where the directions are reversed.

At this point it might be observed that the reversal of direction of the corrective fields at the extreme ends of the beams has been a common characteristic of the corrective dynamic convergence fields for all of the guns, both horizontal and vertical. Close examination of the end results, which are straight line traces, reveals that unless this reversal of direction were included in the corrective field it would be impossible to obtain straight lines at the beam extremities. Electrically, this reversal is merely the effect of the correcting field wave form as it passes through zero and reverses phase.

Tilt

Due to production tolerances in color tubes, seldom if ever do the beam traces take the exact patterns indicated in Fig. 1, after Center Static Convergence, or Fig. 2 after dynamic convergence. This is particularly true of the extremities

Fig. 11—Motion of blue beam trace under influence of saw-tooth voltage applied to convergence coils.

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of beams where the deviation from the ideal is considerable. It will be found that these deviations are not symmetrical, that is, the dots on one side may have to be moved in either direction more than the dots on the other side. For this reason it becomes necessary to introduce additional fields which will provide more flexible control of the convergence adjustments at these extremities.

Such additional fields are obtained by adding sawtooth currents to separate convergence coils mounted on the convergence yoke. For the present we will consider that the various convergence currents are fed through separate coils. In practice it is possible to combine these currents on a single coil and thereby obtain net identical results.

It is necessary that these sawtooth currents be adjustable for control of amplitude as well as reversible in phase. This type of adjustment is indicated in Fig. 10. Thus, six additional currents are made to flow in the coils of the convergence assembly, three for the horizontal and three for the vertical coils. The fields produced as a result of these currents are called Tilt Fields, and their intensity and direction of flow are controlled by Tilt Controls. The tilt voltages producing these sawtooth currents may be applied to the convergence assembly from appropriate sources in the manner shown in Fig. 10.

**Blue Horizontal Tilt**

Referring to Fig. 11 we observe that the blue horizontal beam in the zero tilt position may be rotated in either direction around the center of the screen as a pivot. The direction of rotation depends upon the phase of the sawtooth current flow in L3, this phase being determined by the position of the center arm of the Tilt Control with reference to the center tap of the control. Thus, a wide range of blue dot positioning in a vertical direction may be effected by means of the Blue Tilt Control.

Recalling that the Blue Horizontal Parabola adjustment provides considerable motion of the beam at the center and little near the extremities, the combination of both parabola and tilt provides us with enough control of the blue horizontal beam to effect satisfactory, if not exact, convergence of beams.
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(Signed) S. R. COWAN, Publisher
Sworn to and subscribed before me, this 19th day of September
1955.

HARRY N. REIZES, Notary Public

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this beam with the others.

**Green and Red Horizontal Tilt**

The effects of the green and red horizontal sawtooth tilt fields on the green and red horizontal traces are shown individually in Fig. 12. In (A) we observe the effect of the Tilt Control on the green horizontal beam. Notice that when the arm of the tilt control is set at the midpoint of the control the applied tilt field is zero. Again, as in the previous field patterns, the arrows shown indicate the amplitude and direction of the corrective convergence field. In this case this field is contributed by the sawtooth tilt current in the green horizontal tilt coil. Solid arrows indicate the field forces set up with the tilt control arm in one direction with respect to the midpoint of the control. Dashed arrows indicate opposite field forces set up by the control arm being in the opposite direction. Notice that one half of a line of green dots have forces acting on them in one direction (10 O'clock) and the other half forces acting on them in an opposite direction (4 O'clock). Thus, the complete line of green dots takes different positions between AA' and BB' as it rotates around the central pivot point.

The red horizontal tilt field is shown in Fig. 12 (B). The same principles applying to the green horizontal field applies to the red field except that now the forces are in directions corresponding to "Two O'clock" and "Eight O'clock." Different settings of the tilt control rotate the red beam around the pivot point between positions AA' and BB'.

**Blue Vertical Tilt**

The application of a vertical voltage that produces a sawtooth current in a coil such as L4 in Fig. 10 results in vertical non-linearity of the blue vertical beam trace. The reason for this is that the motion that can be imparted to the blue beam by the static or dynamic fields produced by the convergence assembly is strictly vertical. Inasmuch as the corrective dynamic voltage may be applied at opposite phases depending on the position of the blue vertical tilt control, the dots may be either pulled together or spread apart. Thus, an initial condition is shown in Fig. 13A where the blue vertical dots are equally spaced. The effect of the Blue Tilt Control is shown in (B) and (C) where the extreme dots are either moved together or apart depending upon which side of center the potential...
Fig. 13—Effect of vertical tilt field on blue trace. (A) Assumed initial direction of blue vertical dots to illustrate effect of vertical tilt control. (B) Effect of rotation of Tilt Control on one side of center-tap of control. (C) Effect of rotation of Tilt Control on other side of center-tap of control.

Green and Red Vertical Tilt

The production of green and red vertical sawtooth currents in the respective green and red tilt coils of the convergence assembly results in green and red dots on the screen. A green dot will appear if the green tilt coil is excited and a red dot if the red tilt coil is excited. With the beam centering knobs in the center position, the green dot should be at the right side of the screen while the red dot should be at the left side of the screen.

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The production of the tilt fields in the red and green guns is the same as that in the blue gun except that the direction of the fields are at the discreet angles that are characteristic of the motions of the green and blue dots. These angles are indicated in the figure.

**Conclusion**

The wide range of field control provided by the corrective parabolic and tilt fields provides us with whatever adjustments we require to effect dynamic convergence, and should enable us to obtain the dot pattern illustrated in Fig. 2. From this point the magnetic converging controls are utilized to effect Static Convergence.

**AUTO RADIO**

(from page 10)

Door opener is around 50 feet. This is done to prevent closing or opening the door with a pet or child in a position where injury might be possible. If the transmitter unit is operated out of sight of the garage door accidents could very easily occur.

Use of this type of equipment requires the transmitter be registered with an FCC form 505. A class C Citizens Radio license is issued for type of radio gear. For further information the FCC's "Rules and Regulations Governing the Citizens Radio Service" is obtainable through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. for 10 cents.

From the above overall picture of mobile electronics it is hoped that helpful suggestions has been brought to the attention of service companies who upon occasion have commented about the inactivity of TV servicemen at certain periods of the year.

**WORK BENCH**

(from page 21)

Looked and when this condenser was bridged, the trouble disappeared. C253, was therefore replaced with a new 50 µf filter and the receiver now functioned normally.

Referring to the diagram, it can be seen that the vertical integrating network is tied to the -50 volt buss. Thus a leaky C253 would allow ac into the vertical sync circuits causing the vertical jitter. It can also be seen that the horizontal oscillator, 6SN7, and the horizontal deflection amplifier, 6BG6, are both tied to the -50 volt buss at their cathodes. AC entering the horizontal circuits modulates the saw-tooth so as to cause the left side to appear darker.
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<table>
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<tr>
<th>TYPE</th>
<th>EACH</th>
<th>EACH</th>
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</thead>
<tbody>
<tr>
<td>OZ13</td>
<td>.85</td>
<td>.85</td>
</tr>
<tr>
<td>AR2</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>HG 2</td>
<td>1.35</td>
<td>1.35</td>
</tr>
<tr>
<td>HG78</td>
<td>.75</td>
<td>.75</td>
</tr>
<tr>
<td>LH 3</td>
<td>.20</td>
<td>.20</td>
</tr>
<tr>
<td>LH 4</td>
<td>.15</td>
<td>.15</td>
</tr>
<tr>
<td>LH 6</td>
<td>.05</td>
<td>.05</td>
</tr>
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<td>LH 8</td>
<td>.05</td>
<td>.05</td>
</tr>
<tr>
<td>LH 10</td>
<td>.05</td>
<td>.05</td>
</tr>
<tr>
<td>LH 12</td>
<td>.05</td>
<td>.05</td>
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<tr>
<td>LH 14</td>
<td>.05</td>
<td>.05</td>
</tr>
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<td>LH 16</td>
<td>.05</td>
<td>.05</td>
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<tr>
<td>LH 18</td>
<td>.05</td>
<td>.05</td>
</tr>
<tr>
<td>LH 20</td>
<td>.05</td>
<td>.05</td>
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TO CHECK I.F. ALIGNMENT (with scope)

Excessive sweep input will overload the circuit and cause distortion in the wave form. Check for possible overload by temporarily increasing and decreasing the signal input level and noting any change in the wave form. Excessive signal from the marker generator will also distort the wave form. Be sure to keep the marker at the minimum usable amplitude.

NOTE: Be sure, when checking the I.F. alignment, to set the channel selector switch to a channel where moving the fine tuning control does not affect the shape or position of the I.F. response curve.

<table>
<thead>
<tr>
<th>Sweep Gen. Connected to</th>
<th>Scope Connected to</th>
<th>Bias</th>
<th>Sweep Gen. Set To</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>High side to ungrounded Aluminum Foil around SUB(V3) or SATR(V2).</td>
<td>Junction of C113 and L115</td>
<td>Connect a 3 volt bias battery, negative lead to junction of R117 and C174 (I.F. AGC) and a 4.5 volt bias battery, negative lead to junction of R163 and brown lead going to Tuner (R-F AGC). Connect positive leads to chassis.</td>
<td>Sweep from 40 to 50 megacycles</td>
<td></td>
</tr>
<tr>
<td>Low side to grounded tube shield.</td>
<td></td>
<td></td>
<td>Provide markers as shown on curve.</td>
<td></td>
</tr>
</tbody>
</table>

NOTE 1:
Cut aluminum foil to dimensions shown in Fig. 8. Wrap foil around the tube and take scotch tape and wrap around the foil to hold the foil in place and to insulate it from the tube shield as shown in Fig. 8. Replace the tube and tube shield. Connect the high side of sweep generator to the (ungrounded) foil extending from the top of the tube shield and the ground lead from sweep generator to tube shield.

FIG. 8

SOUND ALIGNMENT

The 4.5 mc. trap (front of L109) must be aligned first, regardless of which procedure is used for the remainder of the alignment. Thus, equipment as in Procedure A or B.

PROCEDURE

with signal from station

<table>
<thead>
<tr>
<th>Step No.</th>
<th>Channel Set To</th>
<th>Adjust</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Any unused channel</td>
<td>Connect a crystal controlled 4.5 MC, 400 cycle amplitude modulated signal (VPM or greater) between pin 7 of V104 and chassis. Connect high side of scope through a detector probe to cathode of picture tube, low side to chassis. Adjust L109 (rear slug) for minimum 400 cycle indication on scope.</td>
<td>Remove signal generator and scope from the receiver.</td>
</tr>
</tbody>
</table>

Proceed with the remainder of the Sound Alignment, using either a signal from a TV station as in Procedure A, or alignment equipment as in Procedure B.
### I. F. ALIGNMENT

All lead connections from the signal marker generator and sweep generator must be shielded. Keep exposed ends and ground leads as short as possible (about one inch). Always locate the ground lead connections as close as possible to their respective "hot" leads in the television receiver chassis. The sweep generator output, signal generator output, and contrast control must be kept low enough to prevent overloading the television receiver circuits.

**CAUTION:** One side of the chassis is connected to the power line. Therefore, test equipment should not be connected to the receiver unless an isolation transformer is used between the power line and the receiver. DO NOT GROUND THE RECEIVER CHASSIS UNLESS AN ISOLATION TRANSFORMER IS USED.

The front side of the chassis as referred to below means the side opposite the tubes. The rear side of the chassis means the side on which the tubes are mounted.

#### VIDEO I.F. ALIGNMENT (with VTVM)

<table>
<thead>
<tr>
<th>Step No.</th>
<th>Connect Signal Generator Through a .01 Capacitor</th>
<th>Signal Generator Freq. M.C.</th>
<th>Connect VTVM</th>
<th>Miscellaneous Connections and Instructions</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Test Point No. 2, wire protruding from Tuner next to 5AT8(V2). Chassis 466 only. Wire protruding from Tuner next to 5UB (V3). (Chassis 467 only.)</td>
<td>44.3 mc.</td>
<td>Junction of C113 and L115 and chassis.</td>
<td>Connect a 3 volt bias battery, negative lead to junction of R117 and C174 (I.F. AGC) and 4.5 volt bias battery, negative lead to junction of R163 and brown lead going to Tuner (H-F AGC), positive leads to chassis.</td>
<td>T101 for maximum indication on meter, limit input to make peak - 2 volts D.C. on VTVM. Use first peak from tinnerman clip end of coil.</td>
</tr>
<tr>
<td>2.</td>
<td>&quot;</td>
<td>42.7 mc.</td>
<td>&quot;</td>
<td>&quot;</td>
<td>L103 (rear slug) for maximum. Use first peak from tinnerman clip end of coil.</td>
</tr>
<tr>
<td>3.</td>
<td>&quot;</td>
<td>41.25 mc.</td>
<td>&quot;</td>
<td>&quot;</td>
<td>L103 (front slug) for minimum. First null when running slug into winding from open end is correct tuning point.</td>
</tr>
<tr>
<td>4.</td>
<td>Repeat steps 2 and 3.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Test Point No. 2.</td>
<td>45.5 mc.</td>
<td>&quot;</td>
<td>&quot;</td>
<td>L102 (rear slug) for maximum. Use first peak from tinnerman clip end of coil. Do not use more input than repaired for -2 volt D.C. indication on VTVM.</td>
</tr>
<tr>
<td>6.</td>
<td>&quot;</td>
<td>47.25 mc.</td>
<td>&quot;</td>
<td>&quot;</td>
<td>L102 (front slug) for minimum. First null when running slug into winding from open end is correct tuning point.</td>
</tr>
<tr>
<td>7.</td>
<td>Repeat steps 5 and 6.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Test Point No. 2.</td>
<td>45.5 mc.</td>
<td>&quot;</td>
<td>&quot;</td>
<td>L101 (rear slug) for maximum. Use first peak from tinnerman clip end of coil.</td>
</tr>
<tr>
<td>9.</td>
<td>&quot;</td>
<td>47.25 mc.</td>
<td>&quot;</td>
<td>&quot;</td>
<td>L101 (front slug) for minimum. First null when running slug into winding from open end is correct tuning point.</td>
</tr>
<tr>
<td>10.</td>
<td>Repeat Steps 8 and 9.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Test Point No. 1, wire protruding from Tuner next to 4647A (V1). (466 Chassis only).</td>
<td>45.5 mc.</td>
<td>&quot;</td>
<td>Connect dummy load (consisting of 100 ohm resistor and 100 mmf capacitor in series) from grid of V101, pin 1, to chassis.</td>
<td>L10 on the Tuner for maximum. (466 Chassis only)</td>
</tr>
<tr>
<td>12.</td>
<td>Test Point No. 1, Wire protruding from Tuner above 5UB (V3). (467 Chassis only).</td>
<td>48 mc.</td>
<td>&quot;</td>
<td>&quot;</td>
<td>L12 on the Tuner for maximum. (467 Chassis only)</td>
</tr>
</tbody>
</table>
**HEIGHT CONTROL** - This control increases or decreases the height of the upper portion of the picture.

**VERTICAL LINEARITY CONTROL** - This control increases or decreases the height of the upper portion of the picture.

**BRIGHTNESS CONTROL** - Turn clockwise to increase brightness. To decrease brightness, turn counter-clockwise.

Note: The Brightness Control has an extended shaft that permits adjustment from the rear of the cabinet without removing the cabinet back.

**AREA SWITCH** - See Panel Controls.

**LOCAL AREA CONTROL** - This control, which is effective only when the AREA SWITCH is in the LOCAL position, should normally be set for maximum gain (maximum tuning sensitivity). However, where extremely strong signals tend to cause overloading at this setting, turn the control away from maximum sensitivity to the position that gives the maximum picture sharpness without overload on the strongest signal. Should it be turned too far in this direction, it could adversely affect the reception of other local stations.

**FOCUS ADJUSTMENT** - On the terminal board located to the right of the deflection yoke, move the blue lead from one lug to another until the sharpest picture or sharpest horizontal lines are obtained. Note that the position of the lead may need to be changed if a replacement picture tube is installed.

**DEFLECTION YOKE ADJUSTMENTS** - The deflection yoke must be positioned as far forward as possible on the neck of the picture tube and centered around the picture tube neck at the same time. To make this adjustment, loosen screws "A" and "B" enough to permit the yoke bracket to be pushed forward. While holding the yoke in this position, tighten screws "A" and "B". If the picture is tilted as illustrated at right, loosen wing nut "C" on the top side of the yoke. Then, rotate the yoke to left or right as required to make the picture parallel with respect to top and bottom of window frame. Be sure to hold the yoke in position while tightening the wing nut.

**CENTERING MAGNET ADJUSTMENT** - If the picture is off center and/or has neck shadow as shown in the illustration at the right, rotate either or both centering magnet levers to the right or left until the picture is centered on the screen and the picture is free of all neck shadow. Then readjust the Ion Trap.

**HORIZONTAL FREQUENCY ADJUSTMENT** - If the Horizontal Hold Control is insufficient to lock in a single station picture, the Horizontal Frequency Adjustment will require adjustment. See "Horizontal Blocking Oscillator Alignment".

**HORIZONTAL LOCK** - If the range of the Horizontal Hold Control is insufficient to lock in a single station picture, the Horizontal Lock trimmer will require adjustment. See "Horizontal Blocking Oscillator Alignment".

**BUZZ CONTROL** - See "Sound Alignment"

**NOISE GATE CONTROL** - With this control, it is possible to obtain improved picture stability in the presence of electrical interference (noise). To adjust, first turn the control completely counter-clockwise, where its effect is minimized. Then advance the control clockwise only far enough to stabilize the picture. If the control is adjusted on a signal of one strength, it may require readjustment when a signal of different strength is received, or when the setting of the Area Switch is changed. The final adjustment of this control should be made on the strongest signal received. The limiting factor in this adjustment is the loss of sync stability or the introducing of buzz into the sound.
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