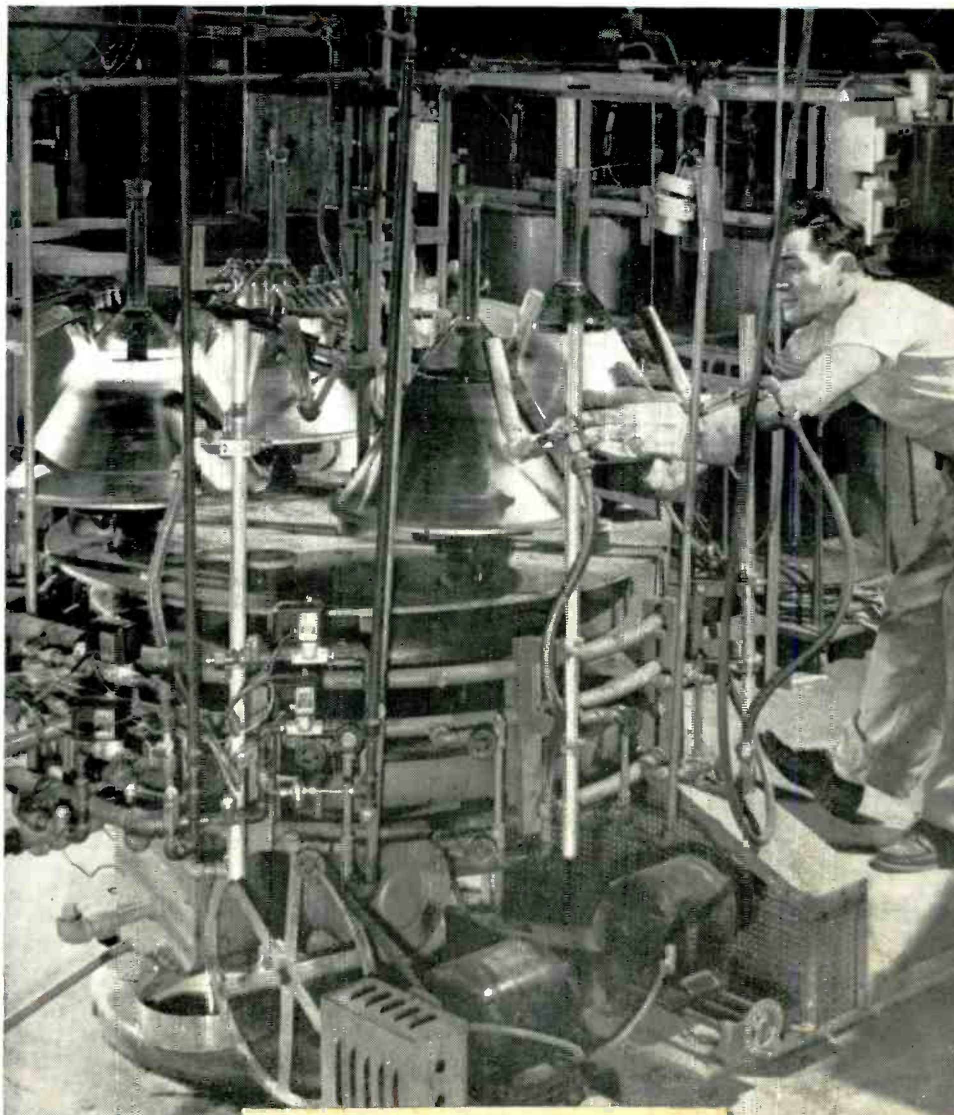
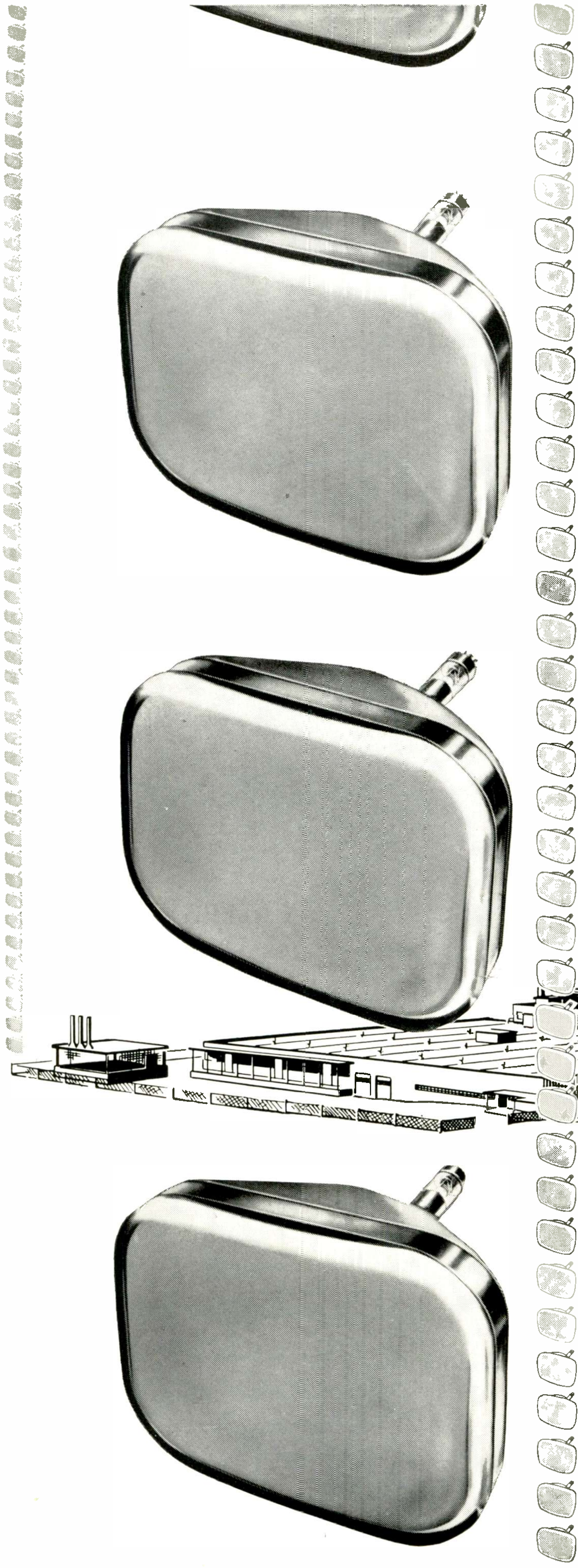
RADIO and TELEVISION maintenance



CATHODE RAY TUBE ISSUE

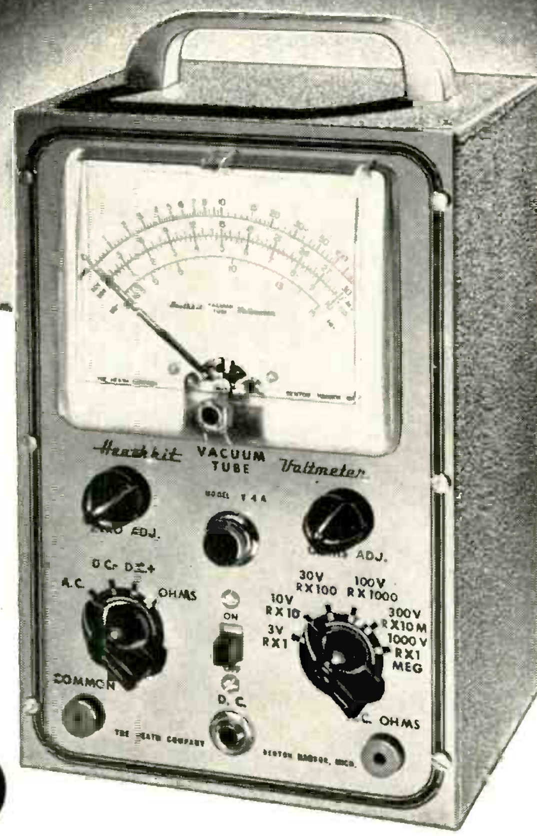
DECEMBER 1950



New 1951 • • MODEL V-4A

Heathkit VTVM KIT

HAS EVERY EXPENSIVE *Feature*



★ Higher AC input impedance, (greater than 1 megohm at 1000 cycles).
★ New AC voltmeter flat within 1 db 20 cycles to 2 megacycles (600 ohm source).
★ New accessory probe (extra) extends DC range to 30,000 Volts.
★ New high quality Simpson 200 microampere meter.
★ New ½% voltage divider resistors (finest available).
★ 24 Complete ranges.
★ Low voltage range 3 Volts full scale (⅓ of scale per volt).
★ Crystal probe (extra) extends RF range to 250 megacycles.
★ Modern push-pull electronic voltmeter on both AC and DC.
★ Completely transformer operated isolated from line for safety.
★ Largest scale available on streamline 4½ inch meter.
★ Burn-out proof meter circuit.
★ Isolated probe for dynamic testing no circuit loading.
★ New simplified switches for easy assembly.

New **LOW PRICE** **$23.50**

The new Heathkit Model V-4A VTVM Kit measures to 30,000 Volts DC and 250 megacycles with accessory probes — think of it, all in one electronic instrument more useful than ever before. The AC voltmeter is so flat and extended in its response it eliminates the need for separate expensive AC VTVM's. + or − db from 20 cycles to 2 megacycles. Meter has decibel ranges for direct reading. New zero center on meter scale for quick FM alignment.

There are six complete ranges for each function. Four functions give total of 24 ranges. The 3 Volt range allows 33⅓% of the scale for reading one volt as against only 20% of the scale on 5 Volt types.

The ranges decade for quick reading.

New ½% ceramic precision are the most accurate commercial resistors available — you find the same make and quality in the finest laboratory equipment selling for thousands of dollars. The entire voltage divider decade uses these ½% resistors.

New 200 microampere 4½" streamline meter with Simpson quality movement. Five times as sensitive as commonly used 1 MA meters.

Shatterproof plastic meter face for maximum protection.

Both AC and DC voltmeter use push-pull electronic voltmeter circuit with *burn-out* proof meter circuit.

Electronic ohmmeter circuit measures resistance over the amazing range of 1/10 ohm to one billion ohms all with internal 3 Volt battery. Ohmmeter batteries mount on the chassis in snap-in mounting for easy replacement.

Voltage ranges are full scale 3 Volts, 10 Volts, 30 Volts, 100 Volts, 300 Volts, 1000 Volts. Complete decading coverage without gaps.

The DC probe is isolated for dynamic measurements. Negligible circuit loading. Gets the accurate reading without disturbing the operation of the instrument under test. Kit comes complete, cabinet, transformer, Simpson meter, test leads, complete assembly and instruction manual. Compare it with all others and you will buy a Heathkit. Model V-4A. Shipping Wt., 8 lbs. Note new low price, $23.50

New 30,000 VOLT DC PROBE KIT

Beautiful new red and black plastic high voltage probe. Increases input resistance to 1100 megohms, reads 30,000 Volts on 300 Volt range. High input impedance for minimum loading of weak television voltages. Has large plastic insulator rings between handle and point for maximum safety. Comes complete with PL55 type plug.

No. 3366 High Voltage Probe Kit.
Shipping Wt., 2 pounds **$5.50**

Heathkit RF PROBE KIT

Crystal diode probe kit extends range to 250 megacycles = 10% comes complete with all parts, crystal, cable and PL55 type plug.

No. 309 RF Probe Kit.
Shipping Wt., 1 lb. **$5.50**

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NEW YORK CITY (16)
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The **HEATH COMPANY**
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VOLUME VI NUMBER 12

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DECEMBER, 1950

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FEATURES

DEPARTMENTS

DEVOTED TO SERVICE OF RADIO-AUDIO-VIDEO

RADIO INDUSTRY NEWSLETTER

DU MONT CONTRACTORS TO BACK AGREEMENTS

Authorized service organizations for Allen B. Du Mont Laboratories will be required in the future to maintain escrow accounts to cover contract customers. This specification, announced by Ernest A. Marx, Du Mont receiver sales manager, is intended "to protect owners of Du Mont television sets from financial failure of service organizations."

COBALT SHORTAGE GETTING CRITICAL

A defense priority order for cobalt, vital in the production of Alnico, used in speaker magnets, has brought forecasts of plant shutdowns and widespread cutbacks in the early part of 1951. It is hoped that the National Production Authority will allocate enough of the critical metal to keep the speaker industry going.

NO COLORCASTS YET; RCA WINS 1ST ROUND

An effective halt to the color TV broadcasting plans of CBS was made last month when a Chicago court put out a temporary injunction, preventing the network from beginning sponsored colorcasts on Nov. 20. CBS continued, however to draw crowds at daily free demonstrations of color TV in New York. Anxious to prevent the color broadcasts from ever beginning on a commercial basis, several more TV manufacturing firms joined RCA in the fight to enjoin FCC from enforcing its order accepting the CBS system. The Chicago judges pushed back the starting date a month, indicated that the case might have to go to the Supreme Court.

TV OUTLOOK OR 1951 CONFUSED

Forecasts of the television production for 1951 conflicted, with some spokesmen, such as RCA's promotion manager, W. L. Lawrence, predicting that the industry will double in volume within 14 months, and others reporting that, with shortages becoming more critical by the day, TV makers won't be able to put out much more than half as many sets as were produced this year.

LANDLORD CONVICTED FOR TV TAMPERING

A Brooklyn, N. Y. court set an interesting precedent recently by convicting an apartment landlord of mischief, when he cut down a tenant's TV antenna. The tenant had erected the aerial without the landlord's permission, and the house owner climbed a ladder and cut the lead wire. A higher court upheld the decision against the offender when he appealed.

RTMA PLANS TV AD STANDARDS

The Radio-Television Manufacturers Association has suggested that advertising standards for TV receivers be established, with a regular conference setup to administer the standards. The proposed scheme would work in much the same way as the Federal Trade Commission regulation of radio, a report said. Purpose of the standards would be to protect the public from misleading claims as to picture size and other descriptive data on new sets.

HINTS OF COLOR CUT SET SALES

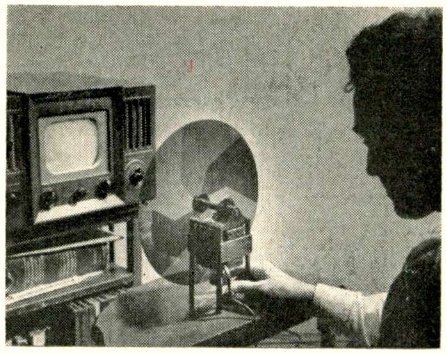
Shortages were not the only factors affecting TV set business during November. The buying public, frightened out of buying new sets by color TV possibilities, withheld purchasing to the extent that some dealers reported a sales drop of 60 to 70 percent. Even the temporary restaining order, which might lead to eventual outlawing of the CBS color system, did not help sales of black and white receivers, it was reported.

IMPROVED B&W TV DEVELOPED BY GE

Another development from General Electric Company which has just been submitted to the FCC is a new "high definition" system of black and white TV broadcasting. Worked out by R. B. Dome, inventor of GE's color system, the arrangement sends fine details and super-fine detail alternately. Most of the more complex equipment for the system, Dome said, would be at the transmitter, and use of the system would not interfere with reception on ordinary receivers. From results of laboratory tests, Dome reported that the picture obtained has "excellent texture in the sense that no dot structure should be visible" when the system is applied to home sets.

New Developments

CONVERTER FOR CBS COLOR TV



The author views color television through a Celomat wheel. (Photo courtesy of Pop. Sci. Monthly)

By NORMAN L. CHALFIN

THE complete conversion of a receiver for reception of CBS Field Sequential Color TV requires two devices. The adapter, the first of these, may be only an internal circuit change as was shown in last month's RADIO AND TELEVISION MAINTENANCE, or it may be a separate unit, like that diagrammed in Fig. 1. This is the adapter unit for an RCA 9T246 10" receiver. The set has "synchroguide" AFC for horizontal deflection. The adapter substitutes a new horizontal sweep system and flyback high voltage setup for the circuits in the set, tubes and all. The vertical substitution is accomplished by slipping suitable cables under the vertical oscillator and amplifier, using the original tubes, but new circuits for monochrome or color, by means of a selector switch in the adapter.

The ten inch receiver will now be a "bracket standards" set. That is, it will operate at the present black and white deflection rates of 15,750 cycles for horizontal and 60 cycles for vertical, and can be switched to the corresponding color deflection scanning rates of 29,160 for horizontal and144 for vertical. Commercial versions of this unit are adaptable to certain other models of rerceivers.

Color Disk

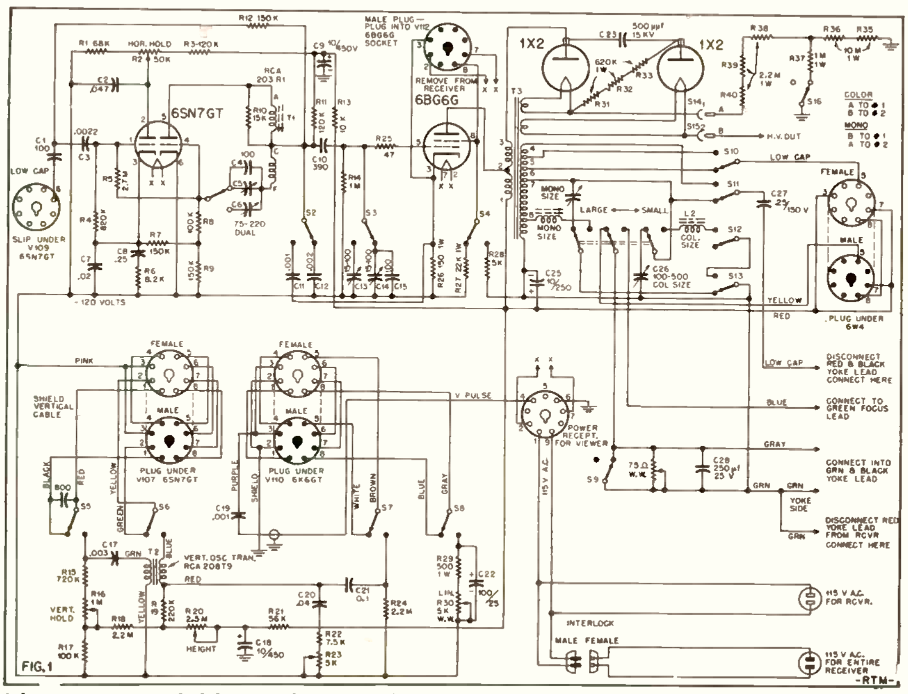
To get the image in color, it is necessary to have a color wheel which rotates in front of the CRT screen. This is the second device.

In the CBS system, colors are changed after each vertical scanning period or field. There are 144 fields per second and, as in black-and-white, 2 to 1 interlacing is employed. The number of lines per frame is 405, or 202.5 per field (262.5 in black-and-white). There are 24 complete frames per second, (30 in black-and-white). Thus, the total number of lines per second, or horizontal line frequency, is 24 frames x 3 colors x 405 lines = 29,160 cycles per second. This is slightly less than twice the black-and white horizontal line frequency, which is 30 frames x 525 lines = 15,750 cycles per second.

The colors are transmitted in the following sequences: red, blue and green.

Each colors lasts for 1/144th of a second, and the color sequence repeats itself after 1/48th of a second. This period is a color field. Since only one-half the number of lines will have been scanned in all colors in 1/48th of a second, twice this period, or 1/24th of a second, is required for all lines to be scanned in all colors. This period of 1/24th of a second is a complete color frame.

The field sequential system can utilize all-electronic as well as mechanical means for color selection. Thus far, the simplest and least expensive method is the use of the color disk because all-electronic color tubes are still in a laboratory stage. The color disk rotates in front of the receiver tube at the rate of 1440 rpm. When six color filters are employed, two sets of red, blue and green filters are used. In addition to the tube size, the shape of the filters determines the size of the color disk.



Adapter recommended by CBS for use with RCA 10-inch set, Model 9T246. It may be used with other sets with slight modications.

Color Filters

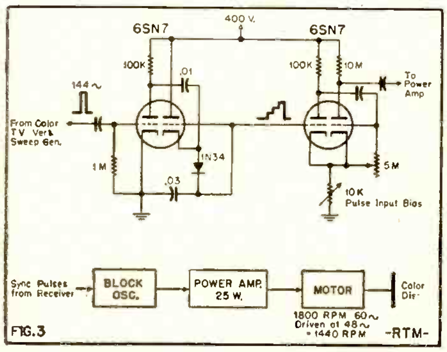
Color filters can be chosen from commercial types. For instance, for red, Wratten #26 is suitable; for blue, Wratten #47; and for green, Wratten #58. There are possible variations, but the filters just mentioned are shortly to become standard stock items with Eastman Kodak Company under the name "color television filters." They will be available on 10-mil acetate stock, the color gelatin being protected by additional thin acetate coating. Celanese Corporation of America has prepared a set of filters which include the CBS primaries.

Transmission of Color

The color transmission process works as follows: At the camera, which is more or less of conventional design, a single image is produced by means of a lens on the light-sensitive surface of the pickup tube. A color filter disk, fully enclosed, rotating in front of this pickup tube, contains a series of color filters in the order of red, blue, and green. If the camera disk has 12 filters (4 red, 4 green and 4 blue) the disk rotates at 720 rpm. Every 1/144th of a second, the camera scans electronically the image to be transmitted from top to bottom, while one of the colors in the filter disk permits, let us say, only the red components of the scene to be picked up. The next 1/144th of a second, the blue filter is between the lens and the camera tube, and only the blue components of the scene are scanned. Finally the same happens to the green components of the scene are used. components. The vertical scanning rate of 1/144th of a second is synchronized with the disk rotation and, in addition, an extra pulse is inserted in the transmitted signal every other red field (or every 1/48th of a second).

Receiver Operation

At the receiver, a color disk rotates in front of a cathode ray image tube. This disk usually has six filters, two sets of red, blue and green, and rotates at 1440 rpm. The disk is synchronized with the vertical scanning so that when the red filter is in front of the camera tube the red segment is also in front of the receiver tube. The impulse inserted every 1/48th of a second at the transmitter permits the receiver disk to be phased automatically, if so desired. The rapid rate of color changes, namely 144 times per second, creates a complete fusion in the viewer's eye at the receiver, so that he sees a smooth, steady color image, which is actually transmitted as a sequence of black-and-white pictures.



Frequency divider and multivibrator for synchronizing motor speed with color signal. (top). Block diagram of hookup is shown at bottom.

Disc Shapes

Fig. 2 shows the contours of the segments of the color wheels used in CBS demonstration equipment. Note that for the 7-inch tube a 15½-inch wheel is used. For a 10-inch tube, a 24-inch wheel is indicated, while a 27½-inch wheel would be used on a 12-inch tube. The only case that follows the CBS drawing exactly is the 15½-inch wheel. The others are our own impressions from information supplied at the New York City color demonstration given by CBS,and by interpolation of the data.

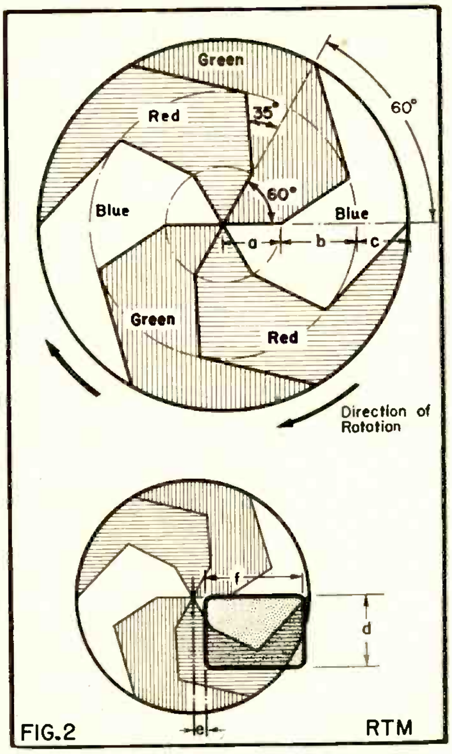
A commercial disk and motor are sold by Celomat Corp. in New York. The photograph shown illustrates the Celomat unit used in front of a converted 7-inch Teletone. This wheel, only 12 inches in diameter, can be used with any size receiver if it is employed in the manner illustrated. That is, looking through the wheel while the wheel is placed at a distance from the receiver. There is a disadvantage to this, in that you must sit still. Moving from side to side gives a shift in color phase, so that lips turn blue or green, for example. When the wheel is placed against the receiver, this doesn't happen, unless the motor is out of sync with the transmitter motor.

Motor Types

The type of motor required will depend largely upon the wheel size. The larger the wheel, the greater the horsepower required. A synchronous 1800 rpm motor with a 5 to 4 step down pulley ratio will operate the second pulley at 1440 rpm. In the same line voltage and frequency system as the transmitter it will hold sync very well. This is the technique employed in the demonstration equipment shown in New York.

Sync Control

A push button which momentarily opens the circuit to the motor can be used as a simple sync control device. Other methods of sync control are illustrated in Fig. 3. These include multivibrator or blocking oscillator amplifier combinations which are synchronized by means of frequency dividers from the transmitter 144 cycle vertical pulse system. It is also possible to control the motor speed through a saturable reactor technique, in which the wheel has a magnetic segmented section delivering 1440 pulses per minute. These pulses compare with the motor frequency and the difference is employed in a vacuum tube system to saturate a reactor, which in turn controls the motor speed. Spellman Television reports that such a device is in production for color use.



Color wheel dimensions: for seven-inch tube, a-2½", b-2", c-3¼", d-3¾", e-1¼", f-5". For 10-inch tube, a-3¾", b-3", c-5¼", d-6", e-2", f-8". For a 12½-inch tube, a-4½", b-3½", c-6¼", d-8", e-2", f-10". Colors specified for the plastic segments of the wheel are Eastman Kodak Wratten No. 26 for red, 47 for blue, and No. 58 for Green, all of them viewed through No. 6 Yellow. Plexiglas Nos. 159 or 160, 263, and 260 or 2004 for red, blue, and green respectively are being supplied by some filter makers for the wheel, as are Lucite Nos. H10539, H7456, and H3526 for red, blue, and green respectively.

In all the equipment demonstrated by CKS, the disks were concealed inside the cabinet or in suitable covered housings. Where the housing is a separate unit, it can be slid away from the receiver picture tube when black and white is being received.

New Developments

A NEW TV FIELD STRENGTH METER

Simplifies Set Installation

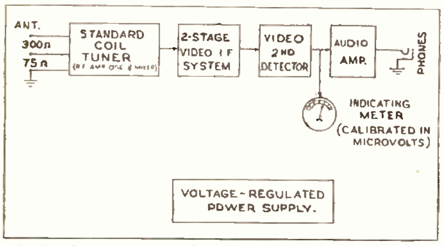
By W. B. COON

NO television receiver is better than the antenna system to which it is connected. By the same token, no matter how elaborate the antenna is, unless it is positioned where it can intercept the maximum amount of signal, it will be unsatisfactory.

All of which boils down to one pertinent question. In erecting any antenna, how can you be sure that it is being placed where the signal is strongest? The best answer, to date, is a field strength meter, such as the Simpson unit illustrated. A field strength meter is essentially a miniature receiver. The television signal from the antenna is fed into the input terminals of the instrument where it goes through the same processes of amplification, conversion, and detection as it would in a normal set. The voltage which this signal develops at the output of the second detector is then applied to a meter calibrated in microvolts. By calibrating the meter in terms of input voltages, rather than the actual voltage developed at the detector, we can read directly the strength of the signal at the antenna.

Full Scale on 50 Microvolts

The meter used in the Model 488 meter has a 4½-inch scale, calibrated evenly from 0 to 50 microvolts. Fifty microvolts input will produce full-scale deflection, a desirable feature for those concerned with fringe area installations



Block diagram of the Simpson Field Strength Meter. Tuner is Standard Coil unit identical with that found in TV receivers.

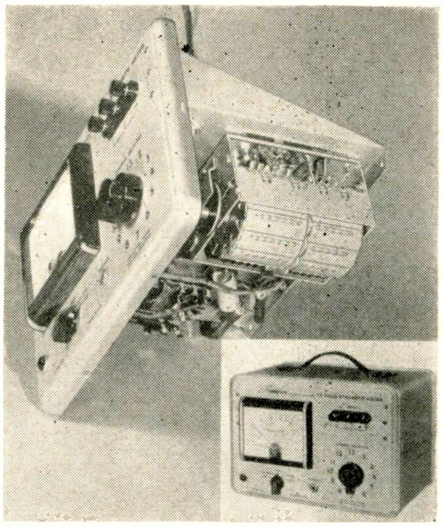
where maximum efficiency must be attained. By means of a multiplying switch, the meter can be converted to read up to 500, 5,000, or 50,000 microvolts, extending the usefulness of the instrument into areas where the signal strength is high.

The manner in which a field strength meter is used is quite simple. The transmission line from the antenna which ordinarily goes to the receiver is attached to the input terminals of the instrument. There is provision for a 300-ohm balanced line or for a 75-ohm unbalanced, coaxial line, as the case may be. With the meter power on, the antenna is moved about until the point is found where the signal level is greatest. This is governed by the orientation of the antenna and the height of the antenna. While it is generally true that the higher your antenna is, the greater the signal developed will be, it will also be found, in many places, that as the antenna is raised, the signal will go through successive maxima and minima.

With the meter connected to the receiver end of the transmission line, you know exactly what the television set receives. This is important, because it is only the voltage which actually reaches the receiver that is responsible for the picture you see. There may be 1,000 microvolts at the antenna, but if your set only obtains 50 of these microvolts, the picture developed will be snowy or otherwise defective.

Fringe Area Work

It is common practice for installation men to judge the comparative strength of the signal received in various locations by observing the quality of the picture. This is satisfactory where the difference is signal strength is large and the signal intensity is high. It is quite unreliable, though, where the available signal is weak. And to the man living



Front panel and underchassis views of the meter.

in a weak signal area, every microvolt is important.

Field strength meters have also been profitably used in customer relations. Servicemen who come in frequent contact with the public they serve know only too well that every service call is, in part, set servicing and, in part, customer servicing. Sometimes it is difficult to say which is most important. It is not unusual for a retailer to blame a poor antenna installation for a poor picture—or for an installation crew to blame the set. A field strength meter will resolve such disagreements once and for all. The meter here serves the customer in the same manner as a counter tube tester.

One Man Can Do Job

A money-saving application of the meter is to permit wider use of one-man installation crews. It is customary in most organizations to have two men install an antenna. One man walks about the roof with the antenna while the other man sits at the set and observes the picture. When the best picture is obtained, the man at the set relays this information to the man on the roof and the antenna is erected at the designated spot.

However, the rapid rate of television expansion, coupled with the current expansion of the armed forces, and the increase in war work have combined to reduce the number of men available to the television service industry. One solution to this shortage is a number of one-man installation crews equipped with field strength meters. With a meter, one man can readily locate those points where the signal intensity is

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SERVICING *FLYBACK* HIGH VOLTAGE SUPPLIES

By NATHAN SCHWARTZ

THE first symptom which indicates lack of high voltage on a television picture tube is "no raster." It can result from loss of B plus or from low voltage. These possibilities can be discarded if the sound circuits are still functioning. Where there is sound, but no raster, the analysis narrows down to (a) faulty CR tube, (b) faulty grid, cathode or accelerator electrode circuits, or (c) insufficient or no high voltage. The last of these possibilities is naturally the easiest to check. To do this, merely remove the high voltage lead from the CR tube and hold the button very close to some part of the chassis. This should result in a bright arc, accompanied by a loud, sharp report. This is just visual and aural inspection, of course, and subject to error, but with a little practice the serviceman can become a good judge. If you try this method on receivers known to be functioning properly, you will soon know the kind of results to expect in receivers suspected of having faulty high voltage circuits.

No High Voltage

If it can be established that there is no high voltage, turn off the set. Remove the cap from the high voltage rectifier tube (1B3, 1X2, etc.) Turn the set back on, and then, with a plastic-handled screwdriver, see if you can draw an arc from the cap connector just removed from the 1B3. (*Warning:* Under no circumstances should you ground this lead to the chassis.) It should be possible to maintain an arc at least a quarter of an inch long. If you do have such an arc, replace the high voltage rectifier with one known to be good. (Note: Be careful to turn the set off whenever making changes of *any* kind on the high voltage circuit.) Turn the set on and check to see whether there is high voltage as explained above. If there is an indication of sufficient high voltage, it should be possible to put the set back into operation. If there is no indication of high voltage, measure the resistance from the high side of the high voltage filter condenser (C_1 in Fig. 1) to the high voltage CR tube cap connector. The resistance should be approximately ½ megohm. If you get an "infinite" reading, the high voltage filter resistor (R_1 in Fig. 1) should be replaced. If the reading is correct, then replace the high voltage condenser.

Measure Plate Voltages

When you try to draw an arc from the cap connector of the 1B3, if you obtain no results, measure the DC plate voltages at the caps of the 1B3 and horizontal output tubes (6BG6, 6CD6, 6BQ6, etc.); both of these voltages should be the same. If there is approximately 400 v. DC at the plate of the 6BG6 but none at the 1B3 plate, then in all probability (in most sets)

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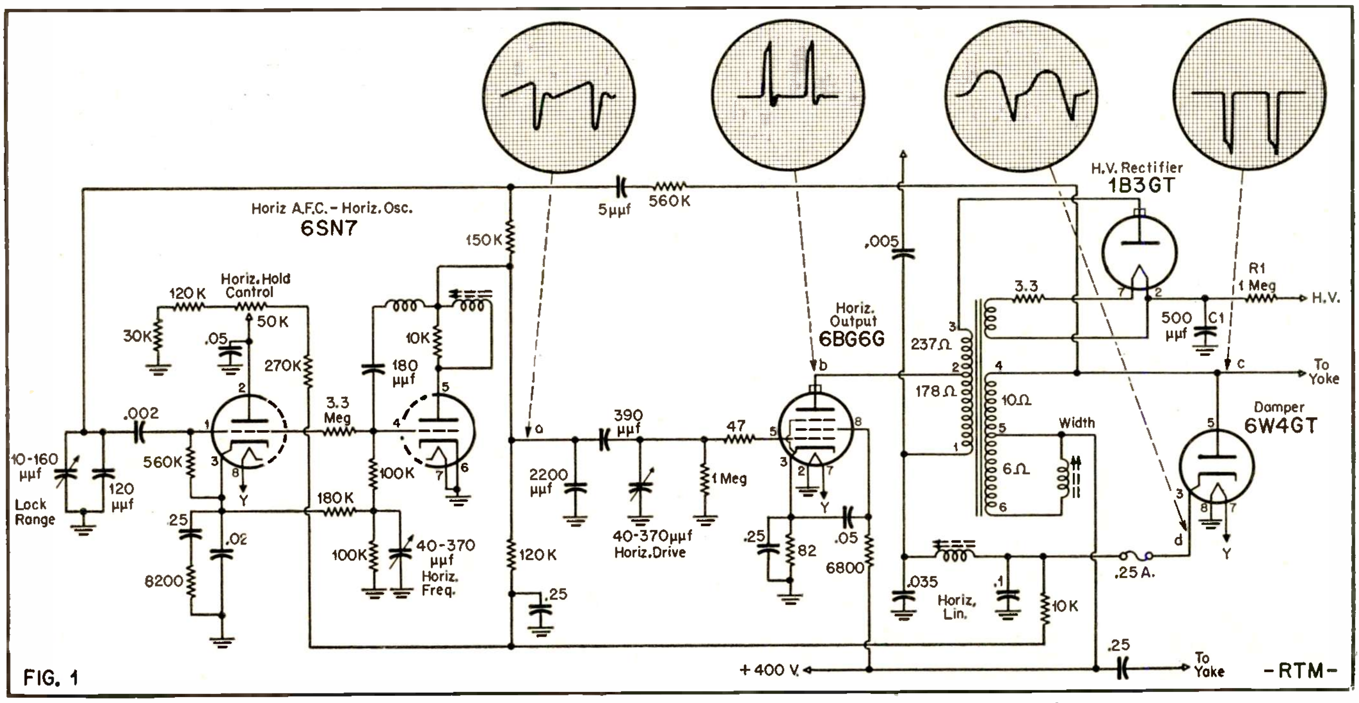


FIG. 1

Test points and proper waveforms to be found when checking flyback HV supply.

LIGHTNING PROTECTION FOR TV INSTALLATIONS

It pays to make sure an installation is protected

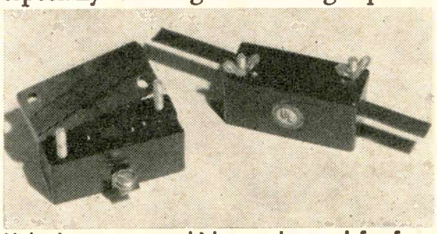
By RUFUS P. TURNER

IT IS disturbing to note that very few television installation technicians pay any attention at all to lightning protection. This is in strong contrast to the early days of radio when lightning protective devices were installed *as a matter of routine* with every outside antenna. The public at that time, probably because of a slight fear of electricity in general, seemed alarmed by any installation which might "draw lightning."

A large portion of the United States is visited seasonally by severe electrical storms. In some of the susceptible localities, storms even come out of season. I have seen lightning damage in winter in as cold a section as New England. And in Southern California, where freedom from electrical storms is widely publicized, I have seen surprise attacks which ran up an appreciable toll of human life and property damage.

Hits High Object

Lightning damage is no joke. Anyone who has surveyed the havoc created by a stroke will support that statement. Lightning has a particular affinity for high objects and prominent ones. It will go after those objects which stick up above others in the vicinity even when they are not high above the ground. This is doubly true when the protruding object is metallic. Along a row of roof tops, television antennas stick up prominently and are an invitation for lightning to strike. Furthermore, as any high-voltage man knows, the slender, almost pointed, tubes which make up the TV antenna assembly are especially enticing to the high potentials packed by thunderclouds.



Lightning arrester which may be used for four-wire rotator control line or for standard 300-ohm twinlead.

No TV antenna installation should be considered completed until a lightning safety device has been installed. The customer should not be compelled to make a special request for this protection which is due him, but in the interest of his own property and safety he certainly should demand that the lightning rod called a TV antenna on top of his house be given adequate ground paths through some protective device. The telephone companies would never bring lines into buildings without providing lightning protection.

Lightning Arresters

The simplest protective device, and the easiest to install is the *lightning arrester.* The working part of this device consists of two tiny spark gaps. Each gap is connected between one conductor of the antenna transmission line and a good ground. A heavy static charge, such as would accumulate on the antenna during or just before a thunderstorm will jump the gaps and flow to earth. Some arresters accompish the same effect with static-draining resistors, others with neon lamps. A fourth variety employs a combination of spark gaps and resistors.

The old-fashioned lightning arrester, of which quite a few still are on the market, is not recommended for use with TV and FM antennas. The old type must be used in pairs to take care of both leads in the TV lead-in. Such

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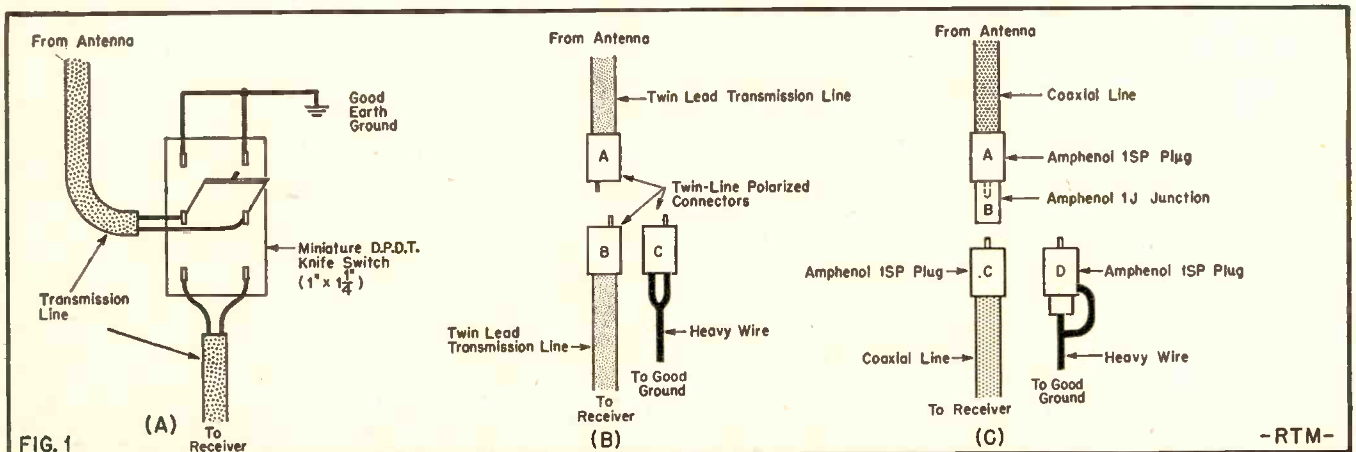
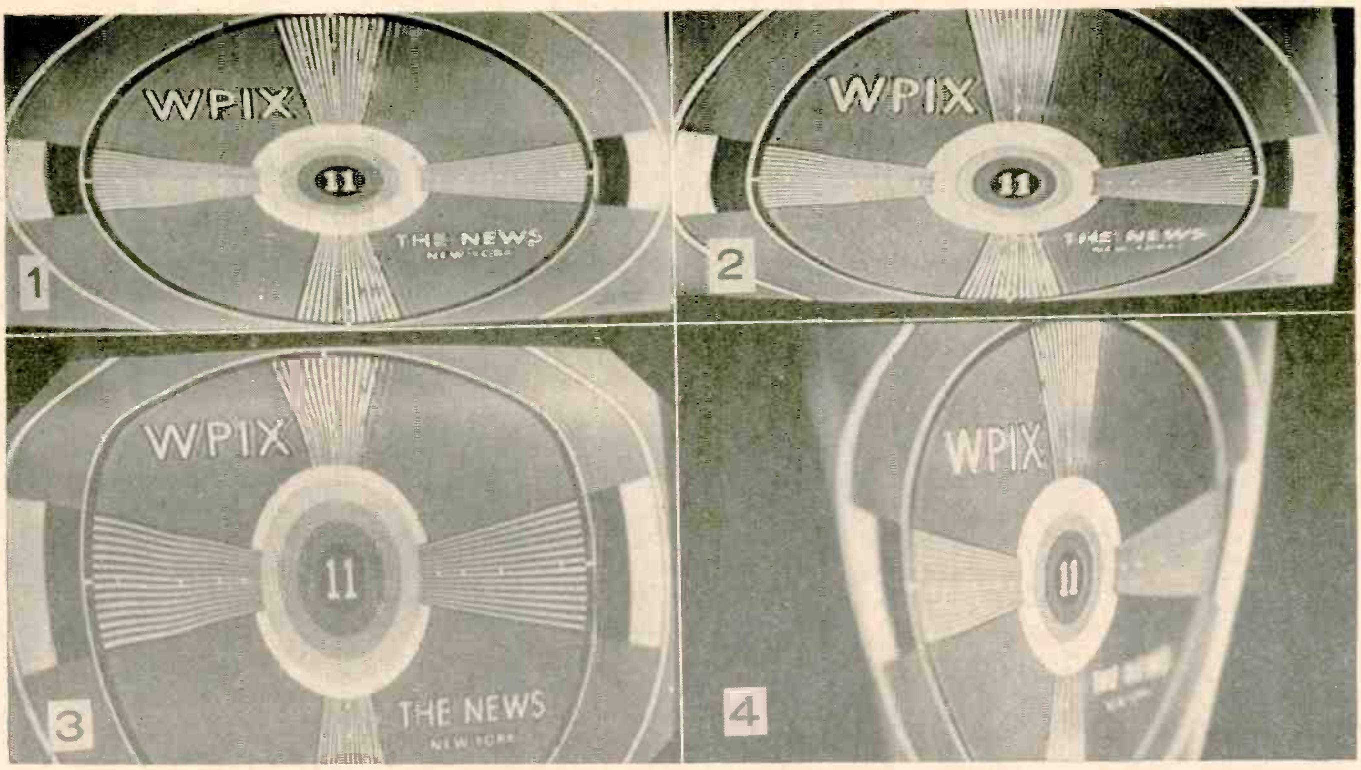


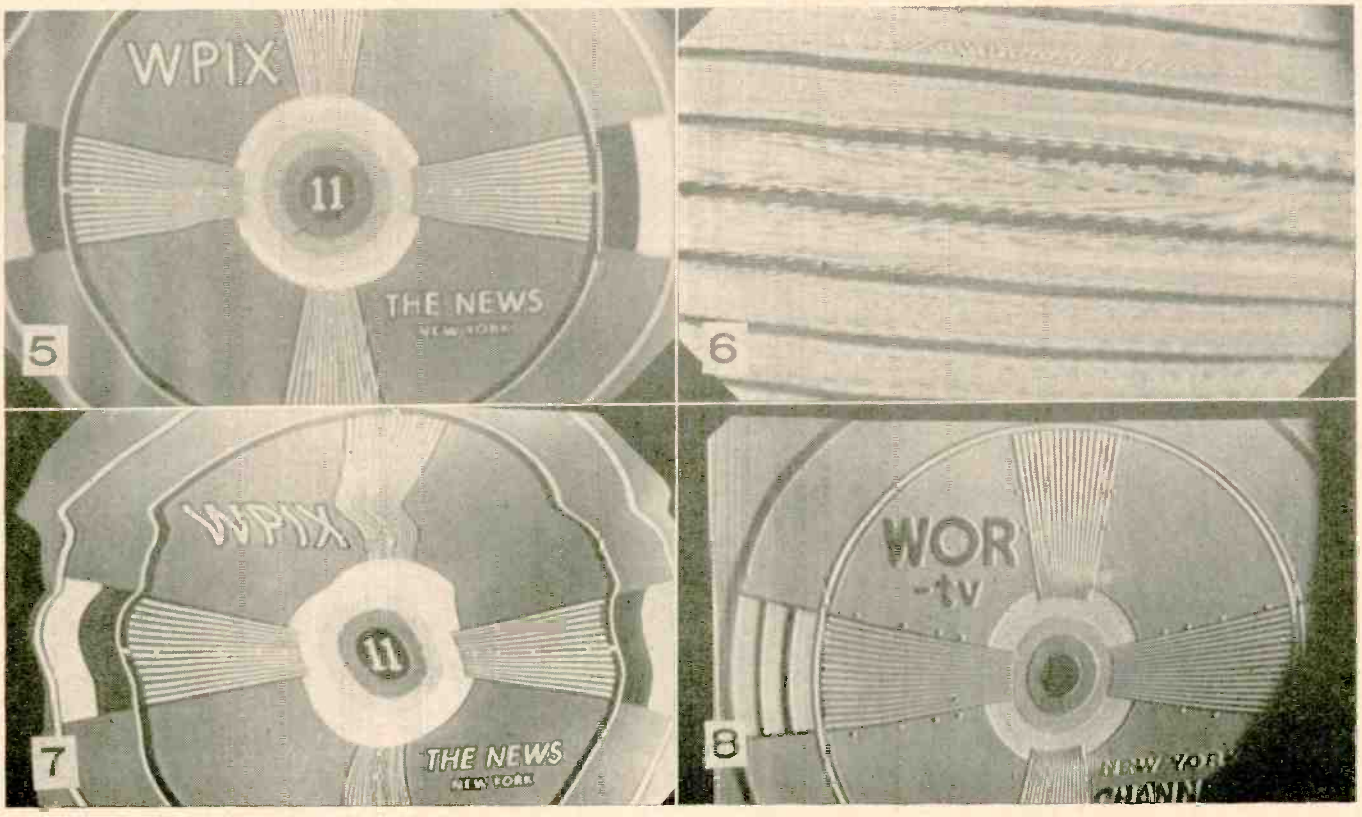
Methods of switching downleads to connect directly to ground during thunderstorms.



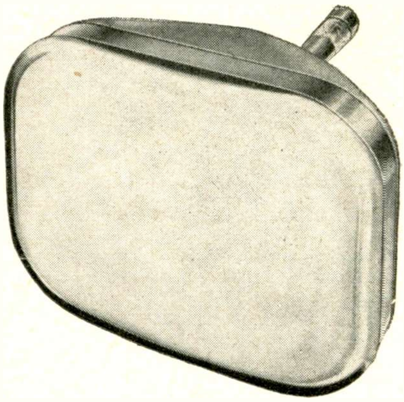
GUIDE TO LINEARITY DEFECTS

Figure 1: Linear image reduced in vertical size. Can be caused by increase in height control vertical size) resistance value, or by opening in variable contact section of control, so that no height adjustment is possible. 2: Reduction in height; non-linearity in low half of picture. Can be due to misadjusted height and linearity controls, defective vertical deflection transformer (on primary side.) 3: Vertical non-linearity; top of picture flattened. Caused by shorted peaking resistor in vertical oscillator. 4: Horizontally keystoned pattern. Caused by short in lower half of horizontal deflection yoke (short in upper half would give similar effect with wider dimension at the bottom.) 5: Vertical bars, or wrinkled exect, at left side of picture. Due to open capacitor, or wrong value of capacitor at top half of horizontal deflection coil. 6: Horizontal sync failure. Can be horizontal AFC inoperative, improper horizontal hold or AFC adjustment, or defective horizontal oscillator tube. 7: Vertical lines wavy. Caused by excessive hum pickup in the sync or deflection oscillator circuits. Look for open or inadequate filter condensers in the B suuply, or grid leads dressed too close to filament wiring. 8: Darkened lower right hand corner, with general grayness in image. Due to mislocation of ion trap magnets. Readjust for brightest image and removal of defect.

(Photos by L. F. Ankerson—courtesy Sylvania Electric Products, Inc.)



R&TM Survey



Here's What You Have to Know to Substitute One Tube for Another

INTERCHANGEABILITY OF TV PICTURE TUBES

By ROBERT G. SCOTT

ONE of the greatest problems facing television servicemen today is the replacement of TV picture tubes which have become obsolete or are in very short supply. Often it takes five or six weeks, if not longer, for the technician to find a duplicate of the original unit, and no set owner wants to wait that long before he can use his receiver again.

Tube manufacturers are having great difficulty in maintaining a supply of all picture tube types. This trouble is partly due to the shortages of blanks for certain types, and partly because of a lack of production facilities. Whenever possible, the tube makers try to build up stockpiles of the older types for replacement supply, but these quantities frequently are not large enough to meet the demand.

Diameter, Deflection Angle

Consequently, when a direct replacement cannot be found, the serviceman must use the nearest type to it. Unfortunately many tubes that are registered as the same size vary in diameter and in deflection angle. These two differences cause the greatest trouble in interchanging, the first mechanically, and the second electrically. The list given here has been prepared with an eye to keeping types employing different bulb designs in different groups, so that varying diameters and deflection

Tube Type	Overall Length	Ion Trap	External Coating	Focus Current	Anode	Deflection Angle	Bulb Diameter
10BP4 10BP4A	17 5/8"	Double	Yes		Cavity	50°	10 1/2"
to							
10CP4	—1"	None		+30%	Ball		
10EP4			No		Ball		
10FP4 10FP4A		None	No	—12%			
*10DP4		None	No				
*10MP4 *10MP4A	—5/8"			+12%			
12JP4	17 1/2"	None	No		Ball	56°	12"
to							
12RP4		Single					
12KP4 12KP4A	+1/8"		Yes	—11%	Cavity	54°	12 7/16"
12LP4 12LP4A	+1 1/4"	Double	Yes	—28%	Cavity	54°	12 7/16"
12QP4 12QP4A		Single		— 6%		54°	12 7/16"
12TP4	+1 1/4"	Double		—28%	Cavity	54°	12 7/16"
*12VP4 *12VP4A	+1/2"	Double		—10%	Cavity	54°	12 7/16"
14BP4	16 13/16"	Double	Yes		Cavity	70° diag.	9 11/16" x 12 1/2"
to							
14CP4	—1/16"	Single					
14DP4	—1/16"		No				
14EP4	—11 /16"	Single		+15%			
14FP4	—11 /16"	Single	No	+15%			
15AP4	20 1/2"	None	No		Ball	57°	15 1/2"
to							
15CP4	+1"	Double		—16%	Cavity		
15DP4		Single		—12%			
16FP4	20 1/4"	Single	No		Ball	60°	16 1/8"
to							
16JP4 16JP4A	+1/2"	Double	Yes	—14%	Cavity		
16MP4 16MP4A	+1 1/2"	Double	Yes	—21%	Cavity		

angles are eliminated within each group. An exception is the group of 12 and 12½-inch types, which are listed together.

Bear in mind, when it is necessary to substitute one tube for another, that tubes of the same type, but with different suffix letters (example: 19AP4, 19AP4A, 19AP4B, etc.) are completely interchangeable.

Metal Tubes

In the case of metal tube types, no substitutions are readily available. It is possible to use other types as replacements for these units, but major mechanical and electrical changes must be made. This classification includes the 12UP4, 12UP4A, 12UP4B; 16AP4, 16AP4A; 16PG4; 16EP4, 16EP4A; 19AP4, 19AP4A, 19AP4B, 19AP4C, 19AP4D; 22AP4, 22AP4A; 24AP4, and 24AP4A.

When glass tube types have no suitable replacement, they are designated "No Similar Type." Types marked with an asterisk (*) require a change in basing in order to be substituted for the original tubes.

The table is divided into eight columns and into a number of groups. Each group lists pertinent information on all tubes of a similar type and is headed by the earliest tube type in the group. Information on that tube is listed in the appropriate column. The remainder of the tubes in each group are designated as to their difference with respect to the tube at the head of each group.

Tube Type	Overall Length	Ion Trap	External Coating	Focus Current	Anode	Deflection Angle	Bulb Diameter
16DP4 } 16DP4A	20 3/4"	Double	No		Cavity	60°	15 7/8"
to							
16HP4 } 16HP4A	+1/2"		Yes	—14%			
16CP4	21 1/2"	Double	No		Cavity	52°	15 7/8"
to							
16LP4 } 16LP4A	+3/4"		Yes	—15%			
16ZP4	+3/4"	Single	Yes	—15%			
16SP4 } 16SP4A	17 5/16"	Double	Yes		Cavity	70° diag.	15 7/8"
to							
16VP4	—1/8"	Single	No				
16WP4	+7/16"		No	—12%			
16WP4A	+7/16"		Yes	—12%			
16KP4	18 3/4"	Single	Yes				
to					Cavity	70°	11 1/2 x 14 3/4"
16QP4	+3/8"	Double	No	— 5%			
16RP4		Double					
16TP4	—5/8"			+ 7%			
16UP4	—5/8"		No	+ 7%			
16XP4		Double					
17AP4	18 5/8"	Single	Yes		Cavity	70° diag.	12 1/4" x 15 3/8"
to							
17BP4	+5/8"		No	— 5%			
17BP4A	+5/8"			— 5%			
19DP4 } 19DP4A	21 1/2"	Double	Yes		Cavity	66°	18 7/8"
to							
19FP4	+1/2"		No	— 5%			
19GP4	—1/4"	Single	No	+5%			
20BP4	No Similar Type						
20CP4	21 7/16"		No		Cavity	70° diag.	18 11/16" x 14 15/16"
to							
20DP4	+5/16"		Yes	—3%			

Explanation of Column Headings

1. TUBE TYPES: These are divided into groups using the same bulb. Each group is headed by the first tube to be registered.

2. OVERALL LENGTH: The overall length of the first tube of each group is listde. The remaining tubes in the group are listed by *differences* in length from the lead tube, longer being designated by (+) and shorter by (—).

3. ION TRAP: This columns tells whether a single, double, or no ion trap is used with each tube type.

4. COATING: This column tells whether an external conductive coating is employed with each tube. In changing from a tube with coating to one without, it may be necessary to add extra filter capacity in the high-voltage supply. In substituting a type with coating for one without coating, means must be provided for grounding the coating. A piece of spring wire is commonly used.

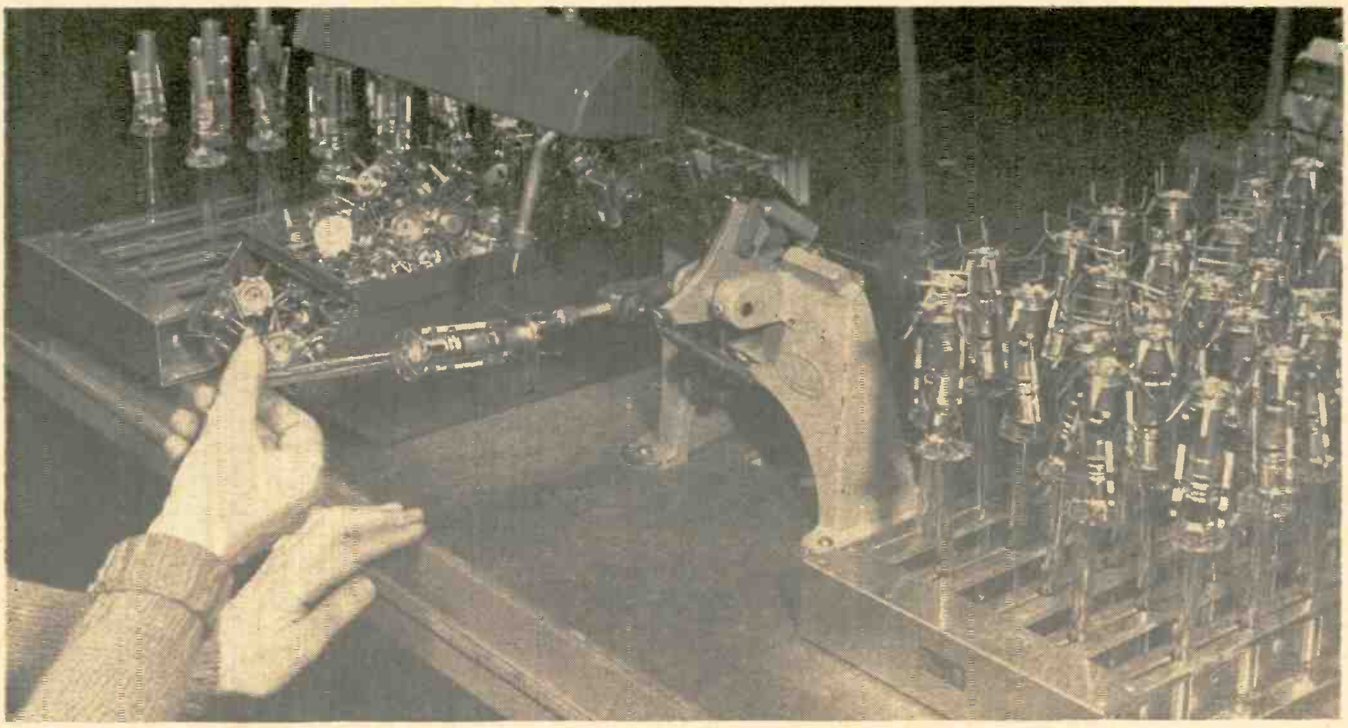
5. FOCUS CURRENT: The actual focus current is not listed here. This value depends on the anode voltage and the particular focus coil used. The percentage *change* from the lead tube in the group is listed, with the focus current of the lead tube given the value of 100 percent.

6. ANODE CONTACT: There are two types of anode contacts used, the recessed small ball-cap, used on many Du Mont types, and the recessed cavity used by most other manufacturers. Since a different anode connector is required for each, the anode contact type is listed.

7. DEFLECTION ANGLE: This is the deflection angle for the full width of round tubes and for the diagonal measurement of rectangular tubes.

8. BULB DIAMETER: This is the maximum diameter of the bulb. In the case of rectangular tubes the width and height of the bulb are given. With the exception of the 12-inch group, the diameter does not change within the group.

Wherever there is a blank space in the data, the tube concerned is the same, in that respect, as the lead tube in the group.

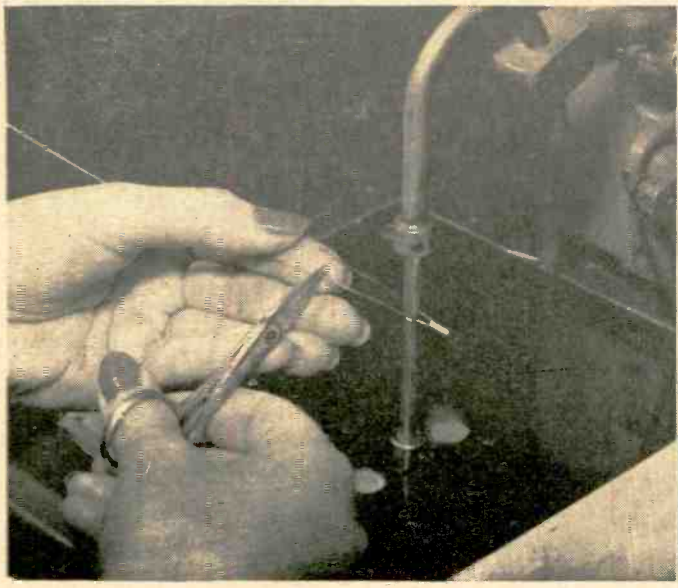


One of the many critical process in the manufacture of bent-gun assembly for Du Mont kinescope tubes is the welding of spacers to the body of the unit. Spacers keep the electron emitter in the precise position necessary to insure accurate sweep over the entire face of the tube, and to prevent neck shadows, which can be caused by mechanical misplacement of the gun. Guns with the operation completed are shown at right, while those without spacers are at left.

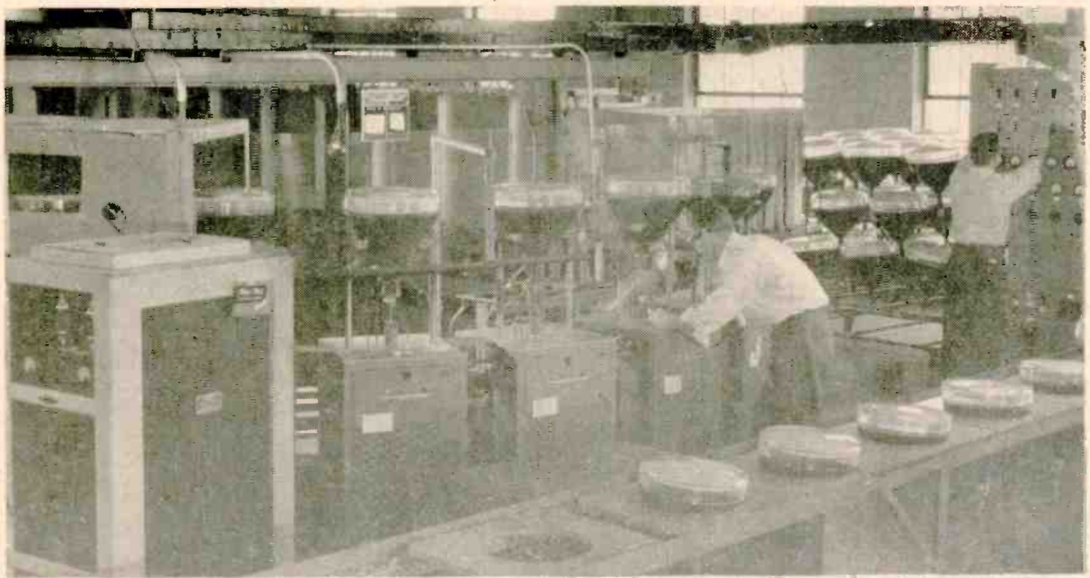
INSIDE THE PICTURE TUBE

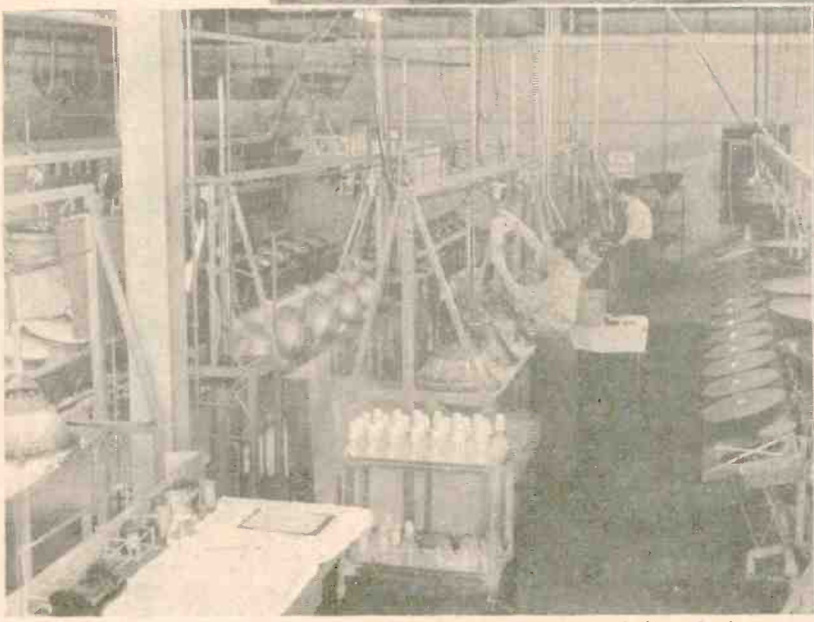
Delicate Processes in Du Mont's Allwood Plant Produce Cathode Ray Tubes for Television Sets

Manicure scissors are used as shears for the delicate, thread-like leads to the heater of a cathode ray tube (left.) This operation on the production line is speeded by clipping the leads to the correct length while spot-welding electrodes weld lead to the heater and act as a vise to hold the fragile component in place. At right, the assembly operation of the basic parts of the bent-gun emitter is shown. Bent-gun design eliminates need for bending beam twice in ion trap action.



With all the inside parts in place, the CR tube, near completion, is evacuated and the exhaust tip sealed off in one operation (right.) Extremely high vacuum must be attained, in order not to impede the stream of high-velocity electrons. This process must result in vacuums much nearer to 100 percent than are needed in ordinary tubes.





Fluorescent screen phosphor material is deposited on the inside of the faceplates of picture tubes in the stage shown at left. Solid phosphor settles gradually out of its liquid suspension, so that coating is perfectly even, for equal brightness of image throughout the picture. At right, the grid-to-cathode spacing in the electron gun is carefully checked with a microscope gauge. Tolerances are strict in this assembly.

The new Du Mont 30-inch picture tube, shown at left, is not yet available in sets. It is said to be the largest picture tube made. Center: The last of 35 inspections made on every CR tube made in the plant checks characteristics and operation of the finished product, which is then made ready for shipping. At right, the face plate for a large round metal tube is carefully inspected by an examiner. Plate must be perfect, for both optical clarity and sufficient strength to withstand the tremendous outside atmospheric pressure.

KEEPING IONS FROM THE CR TUBE SCREEN

A GOOD trapping yarn should be appropriate for right now, the middle of the trapping season; and so, we are going to describe How to Catch an Ion.

Ions are somewhat like starlings: you never heard much about their being a nuisance until fairly recently. Today, however, every TV service-man is quite aware that many television picture tubes have a gadget called an "ion trap" at the rear of the tube neck that *must* be properly adjusted if the receiver is to operate properly.

Ions and electrons are very closely related; in fact they are both blood relatives of Old Father Atom. An atom, as you should know, consists of a positive nucleus about which circle a varying number of negative electrons. The total negative charge of these electrons is just equal to the positive charge of the nucleus in a proper atom, making the grand total charge exactly zero. If you disturb this nice balance of the atom by adding or subtracting electrons, you create electrified particles called *ions*. If electrons are lost, the particle is positively electrified and is called a *cation,* because of its tendency to be attracted to the cathode.

If electrons are added to the atom, the resulting particle is negatively electrified, takes the name of an *anion,* and tends to go toward the anode.

JOHN T. FRYE

Ions Always Present

There are always some ions in the electron stream issuing from the cathode of a CR tube. Their presence is partly due to the gases that can't be completely evacuated from the tube and partly to the fact that some of the cathode material itself breaks loose from the cathode surface.

Positive ions cause no trouble. They are simply repelled back into the cathode by the high positive potentials existing on the various elements of the electron gun. Negative ions, though, have the same negative charge that the electrons do, and they tend to move through the tube in the same paths the electrons follow. It is their huge size—they have from 2,000 to 100,000 times the mass of an electron—that makes them cause trouble.

As long as only electrostatic deflection was used, these king-sized particles were only a minor nuisance—like lumps in the gravy—for they could de deflected right along with the electron stream and were not permitted to strike a particular portion of the screen often enough for their impact to do any appreciable damage.

Unaffected by Magnetic Deflection

When we started using magnetic deflection, however, the story was different. An ion is as unaffected by magnetic deflection as a melodrama villain is by the sight of the heroine's tears. The reason lies in this: the amount of deflection of an electrified particle passing through an electro-magnetic deflecting field depends, among other factors, upon the speed of the particle; the lower the speed the less deflection. A field strong enough to deflect a fast-moving electron to the limit of the screen has practically no effect on the heavy, lumbering ion, which plows straight ahead to strike the middle of the fluorescent screen.

The repeated impact of these ions, which are now concentrated in a small area instead of sprayed all over the face of the tube, as was the case with the electrostatically-deflected tube, soon burns a brown spot in the phosphor coating—a spot that is then permanently "dead" to any fluorescing effect. Since in four out of five tubes this "ion spot" appears after only 30 to 40 hours of operation, and since the only remedy lies in replacing the tube, ions can be quite a costly nuisance.

Aluminum Screen

The obvious solution lies in devising some method of preventing the ions from reaching the phosphor screen. One way of doing this is to place a very thin aluminum sheet on the rear of the phosphor coating. The aluminum has thousands of tiny openings in it through which electrons can pass and activate the fluorescent material, but the loutish ions are stopped cold by the aluminum barrier.

Another method employs the ion trap. Such a trap consists of (1) certain arrangements of the gun structure of the CR tube, and (2) external magnets placed near the neck of the tube. In some designs the gap between grid number two and the anode is not at right angles to the tube axis but is cut on a slant. As a result, the electrostatic field in this gap—produced by the potential difference between the highly-charged positive anode and the much lower potential on the grid—does not act along the axis of the tube but tends to pull both electrons and ions toward the projecting lip of the anode.

A magnet, usually of the permanent

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Service Technique

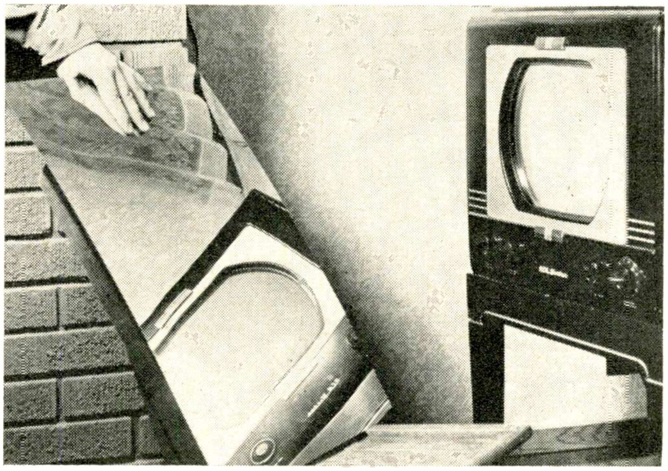
The CARE and HANDLING of CATHODE RAY TUBES

By HARRY F. LEEPER

WITH the recent tremendous increase in the use of cathode ray tubes, both in television and in oscillography, technicians who only rarely handled or used them, years ago, are now finding it necessary to work almost daily with these large and bulky, yet fragile components.

Among factors present in cathode ray tubes, which could almost be overlooked when using ordinary receiving tubes, are, primarily, the size of the units and the high vacuum attained within the envelope. The high accelerating voltages necessary for proper maintenance in certain types of cathode ray tubes present another hazard to the careless technician. All these characteristics mean that "special handling" is always necessary when dealing with kinescopes. One important thing to remember when installing a CR tube is that it should be thoroughly clean. The best way to make sure it is, of course, is to avoid touching the tube with the bare hands, and to wear gloves whenever you install a tube. Sometimes, even this won't prevent soiling the tube, and it is necessary to clean it. In that case, use a good window cleaner for the face of the tube, and carbon tetrachloride to clean the neck. Absolute cleanliness around the neck of the tube is especially important, since greasy smudges might carry leakage currents from the coils surrounding it.

Even if it weren't important to keep cathode ray tubes clean on the surface, it is always a good idea to wear gloves when handling them. The total atmospheric pressure on the surface of a 12-inch tube is more than 1600 pounds. On a 19-inch tube, it is more than two tons. Any scratch, however slight, in the glass of a picture tube is a weak



spot. It is potentially a cause of implosion, the results of which can be disastrous. Such an implosion could kill anyone standing near by.

Always keep CR tubes that are not in use in their shipping cartons. When you have to dispose of a used tube, drill a hole in the base locating lug and break off the exhaust tip, to let in the air slowly.

When installing a picture tube, or replacing one, it is a good idea to use a photographer's ferrotype plate in place of a mirror to see what the face of the tube, or a test pattern, looks like when you are adjusting the receiver from the rear. The highly polished plate provides excellent reflection, and will stand much more abuse than an ordinary mirror.

Lightning Protection For TV Installations

→ from page 10

a setup upsets the transmission line impedance and causes ghosts. Modern arresters now are manufactured expressly for TV applications. Capacitances in these new units are kept low, and the units are easily installed. A typical lightning arrester is illustrated.

Commercial Arresters

Following is a brief description of several TV lightning arresters obtainable at jobbers:

AMPHENOL Type 155-338: This unit is designed for 300-ohm lines. No stripping of insulation from the lead-in is necessary, since the contact screws have teeth which bite through the insulation and make contact with the conductors.

CLETRON: No cutting or stripping of insulation necessary. Designed for twin-lead transmission lines.

JFD AT102: Accommodates twin-lead transmission line.

JFD AT103: Accommodates jumbo oval and tubular twin-lead transmission lines.

JFD AT105: A combination type which accommodates both regular and jumbo oval twin-lead transmission lines. No stripping or cutting of line required.

RCA 206X1: For twin-lead transmission lines. A feature of this arrester is its attached rust-proof metal strap for fastening around a ground pipe.

VEE-DX RW-300: This type requires stripping the insulation of the transmission line for contact to the arrester terminals. Has hermetically sealed chamber to prevent carbonizing of spark gap points.

VEE-DX RW-204: A special arrester for 4-wire control cable. Requires no stripping of lead insulation.

Arrester Location

The best place to install a lightning arrester is outside of the house or building in which the television receiver is located, at the point where the transmission line enters the building. It may be mounted on a window sill, on the ouside of the window frame, or on the side of the building. Most of the units are small and inconspicuous.

The ground connection employed must be the best obtainable. A cold-water pipe is a good bet, but the connection should be made as close as possible to the point where the pipe enters the earth. Connection to the pipe must be tight and solid. Ground clamps, such as that made by Blaco, are available for this purpose. The ground lead from the lightning arrester must be of heavy insulated wire, No. 10 or larger, for maximum safety.

If a cold-water pipe cannot be reached conveniently, drive a stout iron pipe several feet in length into the ground, preferably at a spot which usually is damp. A good location for such a pipe is in the region where a downspout discharges rain water. A ground pipe driven into the ground should be as long as possible, so as to reach into the damp earth deep below the surface. The deeper the pipe is sunk into moist earth, the lower will be the resistance of the ground connection and the more effective it will be as a safety ground.

I do *not* recommend use of the rooftop end of a plumbing vent pipe as a lightning ground. This pipe passes down through the building. *Never* make a safety ground connection to an illuminating gas pipe.

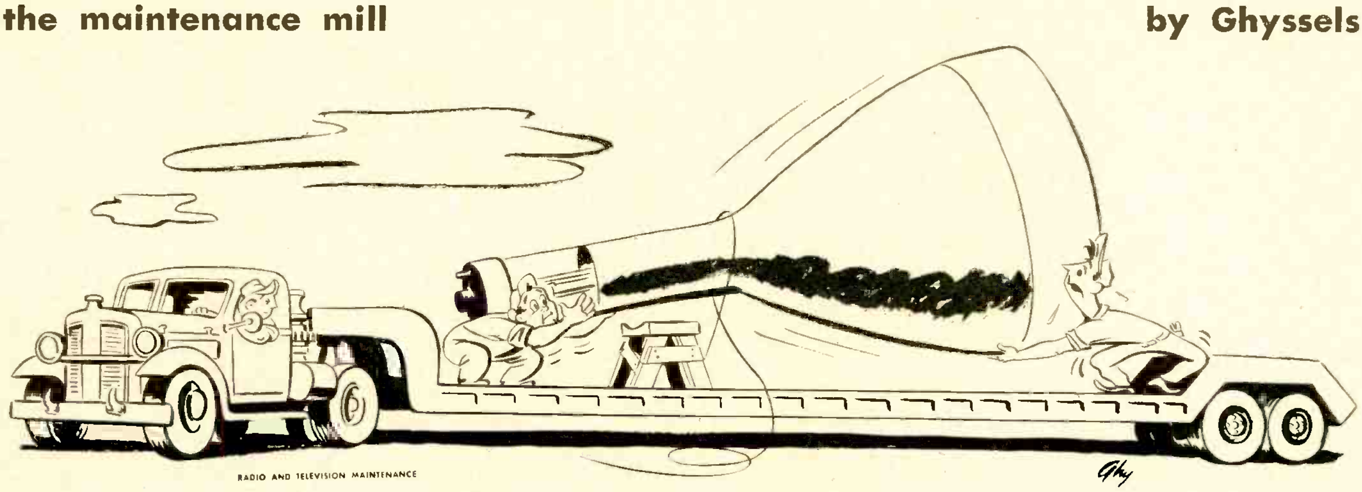
In order to obtain an effective ground in an extremely dry, rocky, or sandy area, it may be necessary to dig a deep pit and bury a sheet of wire screen, a metal plate, or large interconnected pieces of metal scrap. The ground lead is then attached to the buried metal. In arid sections where little rainfall occurs, long wires running in deep trenches make a fairly effective ground system, especially if the trenches are irrigated occasionally.

Lightning Switches

The lightning arrester is automatic in action. It accordingly needs no manipuation. In spite of its reputation for faithful service earned over years of use in the electrical field, however, some technicians do not completely trust a device which does not actually disconnect the receiver during electrical storms. The *lightning switch,* on the other hand, allows the antenna to be disconnected completely from the receiver and simultaneously reconnected to the safety ground whenever the set is not being used. Although the switch must be operated by the set owner who already has knobs and dials to manipulate, some technicians (and set owners, too) feel that a certain increased peace of mind afforded by the switch justifies the required labor and habit pattern.

A typical lighting switch arrangement is shown in Fig. 1(a). The double-pole, double-throw switch allows the two leads of the antenna transmission line to be connected either to the re-

the maintenance mill **by Ghyssels**



"If you think *this* is tough, just wait till the color wheel arrives."

ceiver input terminals or to the safety ground.

The switch must be small in physical size, to minimize its tendency to upset the line impedance. Miniature knife switches, having base dimensions of only one by 1¼ inches, are available. As a rule, lightning switches of this type operate better in twin-lead transmission lines than in coaxial cables. Before making a permanent switch installation, the technician must make a careful check of the receiver on all channels, in order to establish that presence of the switch in the line does not create ghosts or decrease signal strength.

Like the lightning arrester, the best place to install a lightning switch is outside of the building. In many installations, however, an outside switch introduces a maintenance problem, since its contacts eventually become corroded or soiled and must be cleaned.

Alternate Arrangements

Switching arrangements which maintain the transmission line impedance and introduce very little signal loss are shown in Fig 1(b). The line coming in from the antenna is connected to a polarized twin-line connector (a). The length of line from the receiver is connected to a matching connector (b), and the safety ground wire is connected to both terminals of a third matching connector (c). When the receiver is to be operated, connector *a* is plugged into connector *b*, thereby connecting the antenna to the set. When the set is idled, connector *a* is shifted to connector *c*, grounding the antenna.

Fig. 1(c) shows a similar scheme for coaxial transmission lines. Here, AN-type coaxial fittings have been substituted for the flat connectors used in Fig. 2. Three male plug connectors (Amphenol type 1SP) and one double-ended female barrel junction (Amphenol type 1J) are required. The junction (b) is screwed tightly into plug A where it remains permanently to provide a female receptacle for the insertion of either plug C or plug D. The safety ground lead is connected to *both* the outer shell and center contact of plug D in order to ground both the inner and outer conductors of the coaxial cable.

To put the receiver in operation, screw plug C into the free end of junction B. This connects the antenna to the set. To ground the antenna when the receiver is not in use, unscrew plug C, and screw plug D into junction B.

Ground Antenna Frame

The antenna mast itself is as much of an attraction to lightning as the array and must be permanently grounded. This can best be done by bonding a heavy, insulated lead tightly to the base of the mast and running it by the shortest and most direct route possible to the safety ground. The lead must be insulated from, and preferably supported away from the building throughout its length.

Many TV technicians believe it is sufficient to fasten the antenna mast to the plumbing vent pipe which sticks through the top of the roof. In this way, both mechanical support and electrical safety grounding are obtained. Nothing about this line of reasoning as such can be condemned. However, I do not approve of use of the vent pipe as a lightning ground, because the pipe enters the house. I urge that both support and grounding be obtained otherwise.

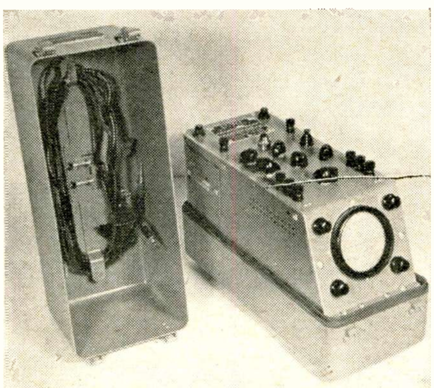
Products for the Trade

Some of the interesting new items being made available currently in the Radio and TV service field are presented in this column. For further information, write to: Products Editor, RADIO AND TELEVISION MAINTENANCE, P. O. Box 867, Atlantic City, N. J.

MINIATURE 'SCOPE

A nine-tube miniature oscilloscope, six inches wide and 14½ inches long, which measures just nine inches high, and weighs 17 pounds, is now in production by the Hycon Mfg. Co.

High sensitivity is claimed for the instrument, which is being manufactured in quantity for the Navy and Air Force. It also has a water-tight outside case. Sweep frequency range is from three to more than 50,000 cps. Vertical amplifier response is flat within three Db from DC to two Mc, and horizontal response is flat within two Db from DC to 100 Kc. Direct-coupled



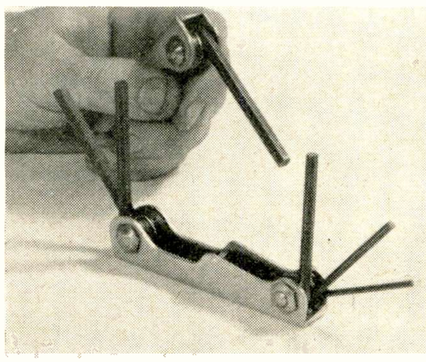
amplifiers are employed, a feature which the maker says is unique in portable scopes.

Blanking amplifier and synchronizing amplifier are included in the device, as is a circuit feature providing that return time ratio will be not less than five to one at all frequencies. Deflection sensitivity is greater than ½ volt per inch at all line voltages from 105 to 125, and at all line frequencies from 50 to 1,000 cycles.

With direct connection to the deflection plates, spiked radar pulses up to several hundred Mc in frequency can be displayed on the screen, the manufacturer states.

MULTIPLE SOCKET WRENCH

Five of the most-often-needed sizes of hex socket wrenches are combined in the "Smitty," a pocket tool recently put in production.



The wrenches fold into the handle of the device jack-knife fashion, so that the tool, when folded is small enough to fit the pocket, but provides good leverage when open.

Individual bits are made of tempered steel.

—RTM—

PICTURE TUBE TEST ADAPTER

Shorts, leakage and open heaters in electromagnetic picture tubes can be readily discovered without removing the tube from the receiver, with the aid of a new cathode ray tube testing adapter produced by Sylvania.

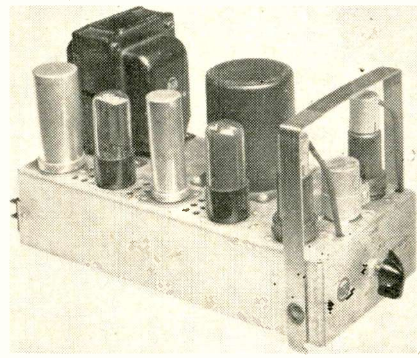
The adapter is used with a tube tester to detect about "85 per cent of the causes of failure or erratic operation" of picture tubes according to the company. When used with a tube tester, the adapter also helps in showing heater-cathode leakage. In the case of cathode ray tubes with accelerating anodes, the device will indicate relative emission.

—RTM—

CUSTOM AMPLIFIER

For custom sound installations, RCA has announced a new plug-in line amplifier with a self-contained power supply, designed for shelf mounting.

Applications for the unit include use as a master mixer for up to four pre-amplifiers, a booster for supplying zero level to a telephone line, an amplifier for operation from a telephone line, a



driver supplying voltage for power amplifiers, a monitor to supply audio power up to two watts for a speaker, and a bridging unit for a low impedance line.

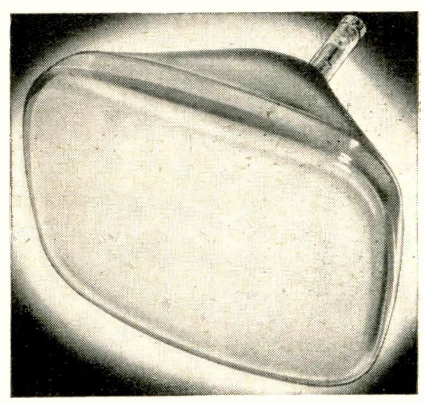
Reportedly capable of providing good response from 30 to 15,000 cycles with low distortion, the amplifier has inverse feedback control, voltage-regulated power supply, and an interstage gain control.

Normal power consumption of the unit is 75 watts. The unit, which weighs slightly more than 11 pounds, is 5⅛ by 13 by 6⅞ inches.

—RTM—

20-INCH TELETRON

The tube division of Allen B. Du Mont Laboratories is now delivering the new Du Mont 20CP4 rectangular Teletron. The new tube features the



bent-gun, said to result in sharper overall trace. Among other features is a dark face plate, which enhances contrast and reduces reflections, according to the company.

The unit is being delivered to manufacturers as original equipment for their receivers, and is also being distributed through Du Mont jobbers as a conversion item.

Association NEWS

Schedule Washington Meeting For Technicians' Group, Jan. 28

NEW YORK—Another step in the direction of forming a national association of electronic technicians was taken here last month when representatives of nearly 30 local groups met at the Victoria Hotel to discuss formation of such an organization.

Preliminary plans for a national convention of the new group were made. The meeting will be in Washington, D. C., on January 28, 1951. Further details may be obtained from Norman R. Salinger, Dorchester House, 1635 Kalorama Rd., N. W., S. Washington, D. C. Salinger is vice-president of TV Associates of Washington, and a member of the arrangements committee for the January meeting.

Chairman of the committee which will handle details of the Washington conclave, is Dave Krantz, Philadelphia. Krantz is also chairman of the board of directors of the Federation of Radio Servicemen's Associations of Pennsylvania, which is the oldest and one of the largest state federations in the country. Vice-chairman of the temporary committee is Max Leibowitz, president of Associated Radio Servicemen of New York City, and president of the Empire State Federation of Electronic Technicians' Associations. RADIO AND TELEVISION MAINTENANCE Eastern Editor Norman L. Chalfin, who is executive secretary of ARSNY, is secretary of the committee.

One of the local groups cooperating in the formation of the national association, the Blair County Association of Radio Service Engineers, listed as potential aims of a nationwide group, that the national organization should raise the standard of the radio and TV serviceman to the level of other professional men, and that it should "guide the industry, through the servicemen, in its dealings with the various manufacturers, jobbers, distributors, and dealers."

In a letter to its members, the New York state federation pointed out that several attempts at forming a national technicians' organization on the level of individual membership have failed, and that successful administration of a group of the size of the proposed association could be carried out only through "local standpoints of majority rule"—that is, through local associations and state federations.

—RTM—

Found National Group of Radio-TV Technicians

WASHINGTON—A positive move towards instituting a national organization of television servicemen was made recently, when Frank J. Moch, president of the Television Installation Service Association, Chicago, called a meeting at the Statler Hotel here of service association officers from all over the country.

Representatives of 10 service groups from New York to Omaha gathered to elect officers, an executive committee and a 24-man board of directors. Until the activities of the new association, which is called the National Alliance of Television and Electronic Service Associations, are wide enough in scope to justify engaging a full-time manager, Mr. Moch will be executive officer.

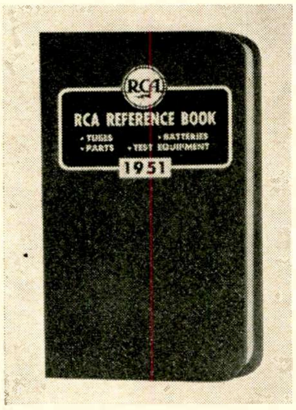
Eventually, the organization plans to establish group offices in Chicago. Legal counsel has already been retained to voice the opinions and uphold the rights of servicemen throughout the nation.

—RTM—

POCKET DIRECTORY

RCA's Tube Department has just put out the 1951 edition of the RCA Reference Book, a "pocket directory," containing data on RCA tubes, components, test equipment, batteries, and miniature lamps.

Much new service data for television and new information on other equipment is included in the booklet, which



has been considerably enlarged during the revision.

One feature not included in earlier versions of the manual is an article on television trouble-shooting by John Meagher, RCA TV specialist in the tube department.

Charted information in the volume lists tables on TV channel and carrier frequencies, TV signal data, procedures of TV receiver alignment, test-pattern analysis, and air-path distance of reflected signals.

A general information section in the book contains 16 pages of color world maps, day-to-day diary, 1951 calendar, and a date-and-memo section. The booklet will soon be available through RCA tube and parts distributors.

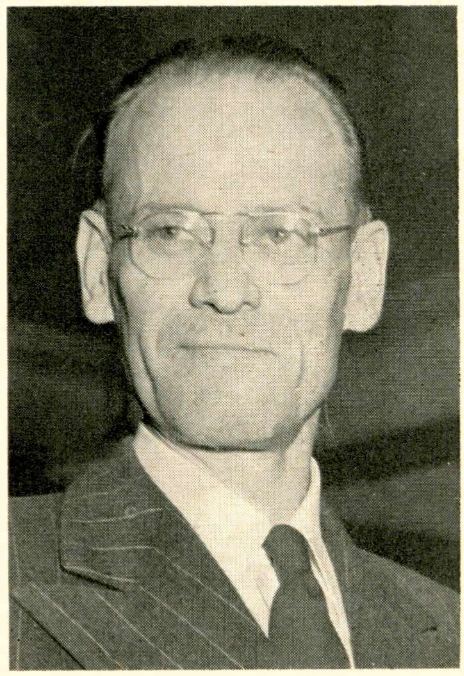
—RTM—

FARNSWORTH DEVELOPS 'MEMORY' CR TUBE

By COURTNEY COTTAM

REVOLUTIONARY in scope is a new "memory tube" invented by Philo Farnsworth, television pioneer.

Clamied for this tube is a greatly reduced cost of manufacturing, the possibility of three-dimensional pictures on home receivers, and simplifications of the projection of color.



PHILO T F.ARNSWORTH

Mr. Farnsworth, who was born 44 years ago, made his first drawing of the cathode ray tube which made modern television possible, while he was a high school student in 1922.

He told the National Patent Council recently that his new tube "remembers" an image during the one-thirtieth of a second it takes to be printed in dots of light. The tube then projects it on a screen as a whole picture.

The new device will eliminate interline flicker, he explained. This results from the present method of projecting an image on the screen one-two hundred fifty thousands part at a time. He also claims that his new method of projection will also simply color video, no matter which of the current systems of color transmission is used.

Although the tube will be available in new television sets and will be on the open market in about two years, it will not render present television sets obsolete. The new tubes can be made as replacements of pictures tubes now in use. Also, this new tube can be manufactured at a smuch smaller cost than the tube now being used, Farnsworth says.

Farnsworth, who is vice-p esident in charge of research for Capehart-Farnsworth Corporation, Fort Wayne, Ind., is credited with inventing electronic television and with transmitting the first television picture at San Francisco in 1927.

He predicts that within five years all screen images will be three-dimensional and in full color; all programming will be on an international basis.

Fix on the Facts

→ from page 16

type, is placed near the grid and arranged so that its field tilts the electron beam in the opposite direction. The ion beam, being very little affected by the magnetic field, continues down and strikes either the sides of the anode or the rear of the limiting aperture disk, leaving the ions effectively trapped. The electron beam, on the other hand, under the double influence of the electrostatic and the electromagnetic fields, continues more or less along the axis of the tube. A second, weaker, magnet, with a field directly opposite that of the first one, corrects the slight upward angle of the electron beam and sends it shooting neatly through the small opening in the far end of the anode.

Bent-Gun Designs

It is not really necessary to bend the electron beam twice in this manner if we point the electron gun at a slight angle with the axis of the tube. In this case, the ion stream is already aimed at the sides and end of the anode; so all we need is a single magnet that will provide a way to tilt the electron beam toward the axis of the tube and permit it to pass through the beam-limiting aperture in the end of the anode.

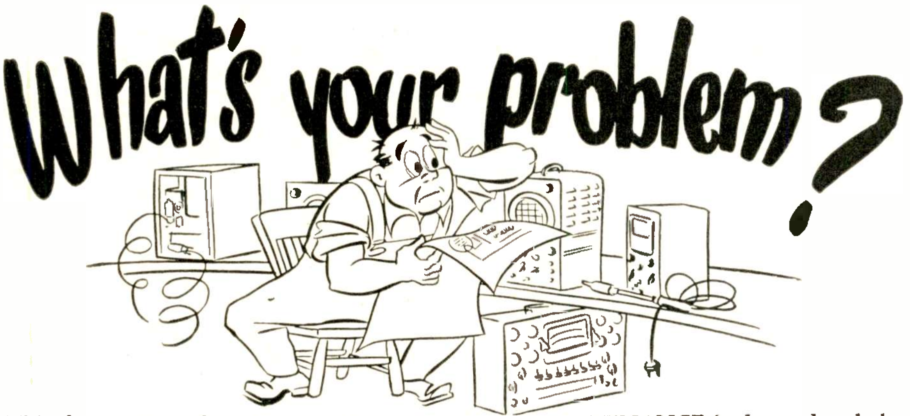
In practice, the ion trap magnet or magnets are placed on the neck of the tube in compliance with the instructions given by the manufacturer and the magnet assembly is moved forward and backward and rotated slightly until the brightest raster is obtained on the face of the tube. Obviously, this bright raster is produced by the maximum number of electrons passing cleanly through the aperture in the anode.

Brightness Control Setting

It is extremely important that the brightness control be set at a low value while these adjustments are being made; otherwise the tube can be badly damaged in a very short time. If a high-velocity beam is permitted to strike the edge of the aperture, even if it is for only a few seconds, it may actually tear away a portion of the anode and hurl it ahead to deposit it on the screen of the tube.

Even though the screen is not darkened in this manner, the enlarged and irregular aperture will permanently impair the ability of the tube to focus the beam sharply.

A recent development of one CR tube manufacturer promises to make this ion



This department of RADIO AND TELEVISION MAINTENANCE is devoted to helping to solve the difficult service problems of our readers. Tough ones of general interest will be printed, and readers will send in answers. The best solutions will be printed in later issues. If only one answer to a problem appears here, its originator will receive $5.00 in cash. If two or more different ways of beating the poser are of nearly equal merit in the opinion of RTM editors, the second best will be worth $3.00 to the man who submits it, and the third best will bring home $2.00. Send your question or solution to: Problem Editor, RADIO AND TELEVISION MAINTENANCE, P. O. Box 867, Atlantic City, N. J.

CONVERSION DIFFICULTY

In the November issue of RTM, this department included a solution to the conversion difficulty of Reader John G. Strong, who couldn't make the raster of a TV receiver designed for a 10BP4 picture tube fit the screen of a 16KP4A. He extended the horizontal scanning without any trouble, but found that it wasn't so easy to make the vertical sweep go all the way to the top and bottom of the tube.

Because of the wide interest in such a conversion problem, and because so many have sent in solutions, the editors present herewith the second best solution to the poser, which brings $3.00 to the sender, Reader Clinton Shorrock.

GENTLEMEN:

To solve Mr. Strong's difficulty with the CR tube conversion, I would like to suggest an easy and very efficient way to get better vertical scanning. I have found that by adding an extra stage of amplification to the vertical output, greater height in the picture is easily achieved.

Nearly any triode will work very well; in one case, I used a 6C4 miniature and hooked it in parallel with the vertical output stage. Mounting can be either under the chassis or on top, depending on which is more convenient. Changing certain values of resistors, such as the one found between B+ and the primary of the vertical output transformer, also helps somewhat.

—CLINTON D. SHORROCK.
Ridgewood, N. J.

LOCK-IN TROUBLE

GENTLEMEN:

I have a Model 255 Teletone 10-inch television receiver on which the picture runs horizontally almost constantly. It will not stay locked in for more than two or three minutes at a time.

The horizontal hold control is very critical—a slight movement either to right or left and the picture starts running.

I have done everything I can think of to the set except to realign it.

Can another reader of RTM suggest a remedy for this?

—BERNARD J. HELLMAN.
St. Louis, Mo.

PICTURE OUT OF FOCUS

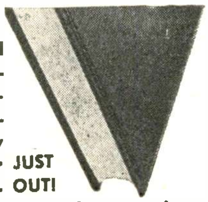
GENTLEMEN:

On an RCA Model T121 I'm working on, the picture is out of focus at the edges, even when the focus is perfect near the center of the screen.

In addition to fuzziness at the edges, I notice that there are some unusual faults, like ghosts, at the right of vertical lines on the picture. The extra lines are faint and evenly spaced, with three or four of them next to the desired verticals.

Is my trouble an open peaking coil, or something else? What is the correct procedure in locating the fault? Thanks for any help you can give me.

—IGNATIUS TIZZANO.
So. Ozone Park, N. Y.



Fix on the Facts

→ from page 22

trap adjustment much easier. The "Indicator Ion Trap," as the new arrangement is called, consists of a luminescent material applied to the rear of the limiting aperture disk. When the electron beam is not properly centered, it strikes this material and causes it to glow a bright green, which can be seen from the rear of the tube by looking in the gap between the anode and the second grid. The ion trap magnet is adjusted for minimum glow; then the brightness control is increased and the magnet again adjusted for the least luminescence. With the brightness control set at maximum, some glow will still be seen, for then the "beam-limiting aperture" will be fulfilling its name by permitting only the center of the swollen beam to pass through the opening. The adjustment of the magnet for minimum glow, of course, will still insure that the beam is properly centered.

In addition to affording a precise method of adjustment, this indicator ion trap also permits the whole adjustment to be made by a single operator, working at the rear of the set.

It is hoped that this little yarn on the how and why if ion-trapping has shown the importance of having the ion trap in proper adjustment at all times. Whenever a set is disturbed—say by servicing or being moved—the ion trap should be carefully readjusted before the brightness control is ever advanced. The performance and longevity of the most costly single item in the television set, the tube, are largely dependent upon this service procedure.

— RTM —

Servicing Flyback HV Supplies

→ from page 9

the high voltage kickback horizontal output transformer winding is open and should be replaced. This can be checked by measuring the resistance between the 6BG6 and 1B3 plate caps; the correct reading should be under 500 ohms. If you get an "infinite" reading, the transformer winding is definitely open. The transformer must then be replaced. If, in this test, the voltages of both tubes are the same, the trouble might lie in either the 6BG6, the damper (6W4, 5V4, etc.) or the horizontal oscillator tube (usually a 6SN7) and these tubes may be replaced or substituted in any convenient order.

After making the foregoing tests, you may still have no high voltage. In that case, remove the set from the cabinet and employ regular shop procedures. On the other hand, if there is no 6BG6 plate voltage, check the flyback transformer ¼ amp. fuse. This may be located in the high voltage cage or under the chassis, although some sets may not be fused at all. If the fuse is found to be OK, change the damper tube.

Bench Procedure

This method of servicing the high voltage circuit is the usual practice of "outside" servicemen, working in their customers' homes. In most cases, time and test equipment are both rather limited, so if these tests are completed without effecting a repair, the only thing to do is to pull the set and deliver it to the shop, where better equipment will insure that it can be fixed.

In the shop, the bench man usually repeats these procedures. Should he find the need for more detailed anaysis, the following procedure is recommended:

1. Check the voltage from grid to cathode of the horizontal output tube. This value should be between –15 and –50 volts.

2. If there is little or no bias, check the waveforms of the horizontal oscillator. Typical waveforms are indicated at check points on Fig. 1. If the waveforms are not correct, make a voltage

and R-C check of the horizontal oscillator. As a matter of fact, if there is no bias on the horizontal output grid tube, the trouble is most probably between the horizontal oscillator and the grid of the output tube.

3. Check screen voltage of the horizontal output tube.

4. Jump the screen bypass with another.

5. See that the DC voltage at the cathode of the damper tube is considerably higher (50 to 150 volts) than it is at the plate.

6. Check linearity circuit coil and condensers.

7. Check horizontal deflection coils by measurement or substitution.

8. Measure the resistance of the kickback transformer filament circuit at the high voltage rectifier heater pins with tube removed. The measured resistance should be low—on the order of two or three ohms.

9. Check the width control (by substitution if necessary).

10. Refer to the service data for any peculiarities of the particular set you are working on.

11. If all of this fails, and no arc can be drawn from the high voltage rectifier plate cap connector (removed from the tube), replace the horizontal output transformer. Even though the transformer apparently checks OK, one shorted turn (often caused by internal arcing) is enough to prevent operation. There are no outward indications of this condition.

—RTM—

TV Field Strength Meter

→ from page 8

greatest. Erection of the antenna at this point, with a lead-in running to the set, will complete the job. If ghosts are encountered, the antenna can be moved to another spot, again revealed by the meter. The installation man, by walking about the roof and observing the changing signal intensity, can form a mental image of how the signal strength varies from point to point. If ghosts appear in one section, the antenna can be moved to another spot where the signal level is still usable.

Comparison Tests

There are, in addition to the foregoing applications, such additional uses as comparison of various boosters, comparison of transmission lines to deter-

→ to following page

→ from preceding page

mine which introduce the least loss, determination of which antennas are better suited for a certain installation, etc. To the man who is daily concerned with antenna installation, a field strength meter soon becomes almost indispensable.

Circuit

The accompanying block diagram of the meter shows its operation. The front end of the unit contains a Standard Coil rotary turret tuner with a 12-channel switch. As in television receivers, there is a fine-tuning control to enable the operator to tune in each station for maximum meter indication. The incoming signal is amplified by an RF amplifier (6AG5) and then converted to 26 Mc (approx.) by mixing with a local oscillator signal.

Following the mixer is a 2-stage IF system peaked to 26 Mc. This is the equivalent of the video IF system in a television receiver, except that the stages are sharply peaked here, since we are primarily concerned with the carrier and not with the sidebands. The signal is detected by a 1N34 crystal and the peak value of the video signal—as established by the incoming sync pulses—is then indicated by the meter. A rotary switch underneath the meter permits the proper shunt to be brought in for an on-meter reading. In the last, or off, position of the rotary switch, a short is placed across the meter to prevent damage to the movement when the unit is not in operation.

A 6AU6 amplifier beyond the video second detector output receives whatever signal is developed by the detector and feeds this signal into a phone jack. The purpose of this stage is to permit identification of interference signals, when these are encountered. In the absence of interference, only the 60-cycle vertical sync buzz will be heard when earphones are plugged into the jack.

The sound carrier of any station except those on channels six and thirteen may be received by switching the channel selector to the next higher frequency channel and adjusting the fine tuning control ot the low frequency end of its range.

The instrument is powered by a full-wave voltage-regulated power supply. An OA2 voltage regulator tube maintains the B plus value at 150 volts over a range of line voltages from 105 to 130.

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