Howard W. Sams

PF REPORTER

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for the Electronic Service Industry

DECEMBER • 1955

25 CENTS

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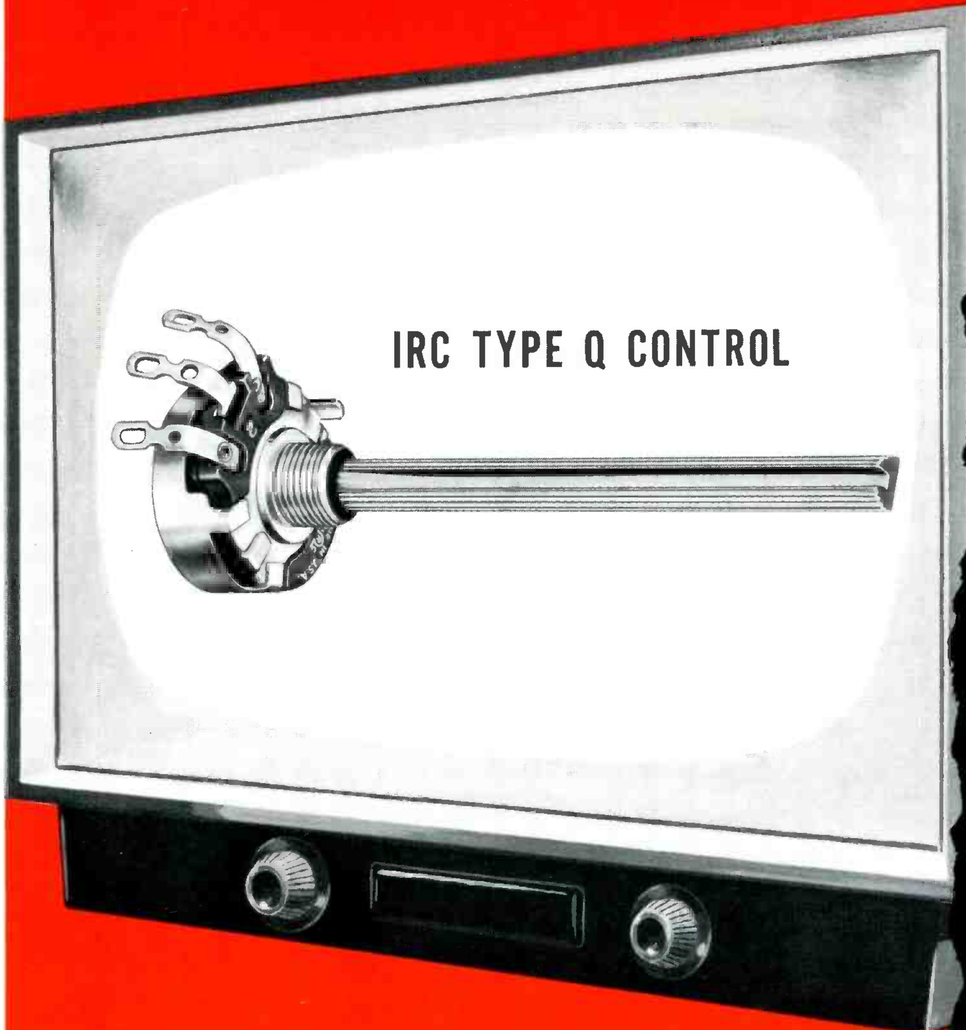

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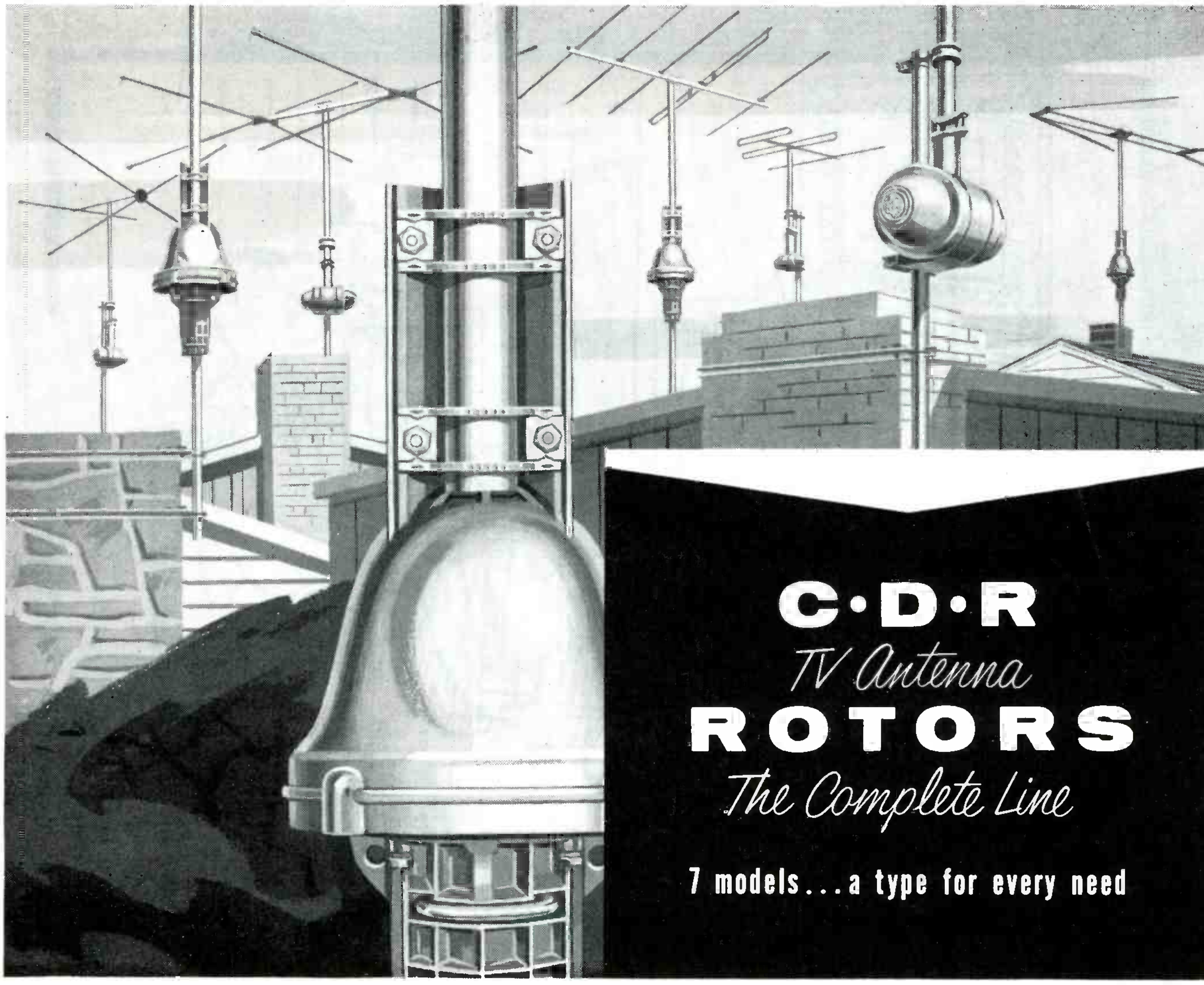

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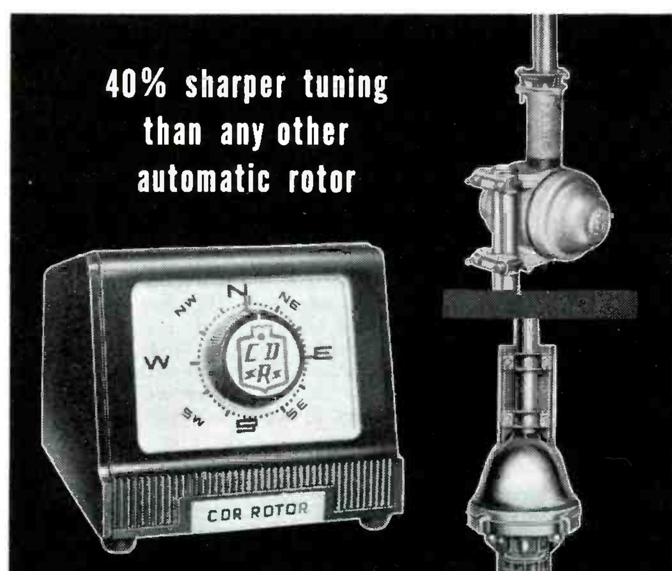

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THE **RADIART** CORP.
CLEVELAND 13, OHIO

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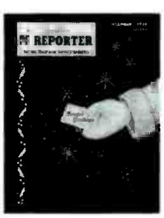
for the Electronic Service Industry

DECEMBER · 1955



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Cover Illustration by Glenn R. Smith.

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TURN ME AROUND

FIELD REPORT NO. 7

NORTH, SOUTH, EAST AND WEST... JFD IS VOTED *BEST*

SERVICEMEN *EVERYWHERE* AGREE ON JFD ANTENNAS

ON-THE-JOB PERFORMANCE IN TOWN AND COUNTRY PROVED IT TO THEM—NOT CLAIMS. JFD MAKES OVER 275 DIFFERENT ANTENNAS—ANOTHER ONE OF MANY REASONS WHY YOU, TOO, CAN DEPEND ON JFD ANTENNAS TO MEET ANY AREA OR PRICE REQUIREMENT. SEE YOUR JFD DISTRIBUTOR TODAY AND FIND OUT FOR YOURSELF.

RALPH H. NEWBY
NEWBY'S RADIO & T. V. SERVICE
PHILADELPHIA, PENNA.

IN THE NORTHEAST PHILA. AREA MOST TAP ROOM OWNERS ARE INTERESTED IN RECEIVING N.Y. CHANNELS #9, #11 FOR THE VARIOUS SPORTING EVENTS. AFTER TRYING MANY DIFFERENT BRANDS AND MODELS OF HI GAIN ANTENNAS, WE HAVE SELECTED THE STACKED STAR-HELIX FOR ITS REMARKABLE GAIN ON ALL DISTANT CHANNELS, AND FOR ITS SUPERIOR FRONT TO BACK RATIO. AFTER NUMEROUS INSTALLATIONS WE ARE VERY PLEASED WITH CUSTOMERS' COMPLIMENTS ON THE APPEARANCE AND PERFORMANCE OF THE STACKED STAR-HELIX.

BERNARD OSBALDESTON
BERNARD OSBALDESTON LTD.
HAMILTON, ONTARIO

THE JFD FIREBALL IS A "MUST" WITH ME WHEN I'M UP AGAINST "GHOSTS." IT GIVES ME HIGH GAIN TO BOOT. THE INLINE CONSTRUCTION CUTS DOWN WIND RESISTANCE WHICH REALLY COUNTS IN HURRICANE WEATHER. EVEN THE HOME-OWNERS LIKE ITS LOOKS.

LOUIS B. DEMPSEY
COLONIAL TELEVISION & APPLIANCE CO., INC.
WILMINGTON, DELAWARE

RECENTLY, OUR WILMINGTON DISTRIBUTOR FOR YOUR JFD PRODUCTS INFORMED US ABOUT THE "STAR-HELIX" ANTENNA, MODEL SX711. WE HAVE BEEN INSTALLING THEM IN SEVERAL CRITICAL AREAS WHERE RECEPTION IS VERY BAD. THE RESULTS ARE SO ASTOUNDING, WE ARE ACTUALLY RECEIVING CALLS FROM GREATLY SATISFIED CUSTOMERS. THIS ANTENNA ACTUALLY ELIMINATES THE GHOSTS FROM THE PICTURES.

CARMEN LASHEN
HUTTER RADIO INC.
BROOKLYN 25, NEW YORK

GHOSTS HAVE BEEN A BIG HEADACHE HERE BECAUSE OF ALL THE BIG BUILDINGS IN THE NEIGHBORHOOD. THERE WAS NOTHING WE COULD DO ABOUT GETTING RID OF THEM, BECAUSE NO MATTER WHAT ANTENNA WE PUT UP, WE GOT GHOSTS. THEN CAME THE FIREBALL. IT JUST WIPED OUT THE GHOSTS LIKE THEY WERE NEVER THERE. I RECOMMEND THE FIREBALL.

VASTINE L. JANDA
JANDA RADIO & T. V. SERVICE
LA GRANGE, TEXAS

LET'S FACE IT. SERVICEMEN LIKE ME CAN'T AFFORD TO BELIEVE ANTENNA CLAIMS ANY MORE. THE PICTURE IS WHAT COUNTS. I SEE WHAT THE JFD STAR-HELIX CAN DO IN LOCATIONS THAT USED TO BE AS BAD AS "DEATH VALLEY." IT'S ONE OF THE FEW THAT LIVES UP TO ITS CLAIMS.

ELLIS E. HARRIS
HARRIS RADIO AND T. V. SERVICE
MEMPHIS, TENNESSEE

I AM USING THE JFD SUPER 13 ANTENNA IN MY T.V. INSTALLATIONS. IT PERFORMS GREAT ON ALL THE FOLLOWING CHANNELS, ESPECIALLY ON THE HIGH BANDS. CHANNELS 5 & 13 IN MEMPHIS, 125 MI. AWAY. CHANNELS 6 & 13 IN BIRMINGHAM, 100 MI. AWAY. CHANNELS 3 & 12 IN JACKSON, MISS., 150 MI. AWAY. CHANNEL 12 IN MONTGOMERY, 180 MI. AWAY. I HAVE HAD COMPLETE CUSTOMER SATISFACTION WITH THIS ANTENNA.

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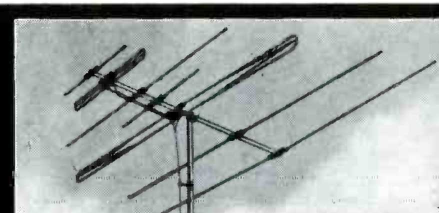

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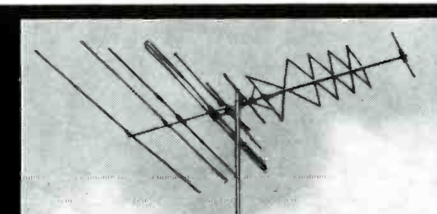
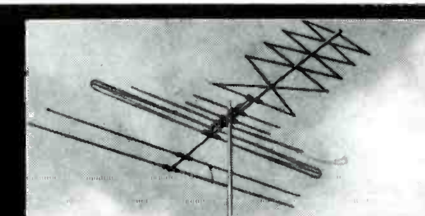
FB500	single	$17.35
FB500S	stacked	$36.65
FB500S-68†	68" wide stacked	$36.65
FB500S-96*	96" wide stacked	$38.60



JFD SUPER-STAR HELIX

SX13	single	$35.00
SX13S	stacked	$72.50



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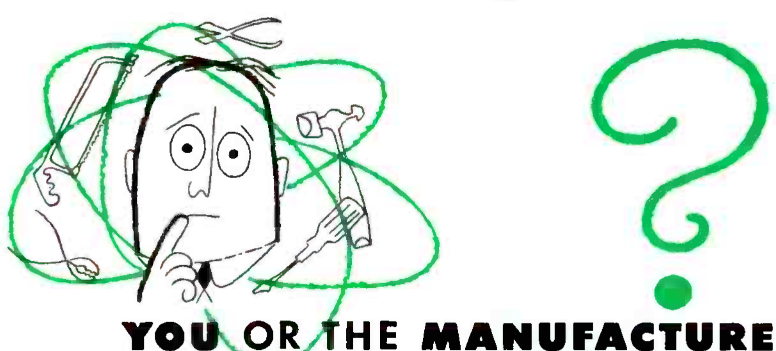
SX711	single	$25.50
SX711S	stacked	$52.50
SX711S-96*	96" stacked	$55.00

*for added ch. 2-6 gain

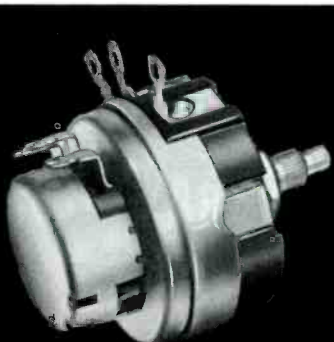
†for areas with co-channel and cross-channel interference

let's face the facts...

so who pays to put your TV replacement controls together...



YOU OR THE MANUFACTURER?



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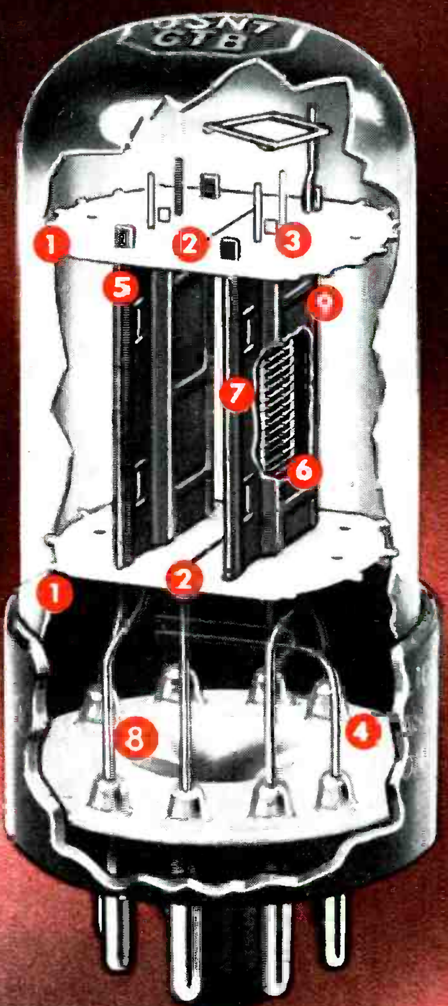
FOR TV SERVICE

RAYTHEON



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2. Slot in micas to reduce leakage between sections.
3. Cathode pinched above top mica for tighter mica cathode fit — lower microphonic level.
4. Short strong leads support mount at several points.
5. All plate tabs pinched or welded above top mica and below bottom mica to strengthen mount.
6. Improved grid design for sharper cut off.
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8. Short leads — direct to pins.
9. Strict control of plate diameters (Geometry) for uniform characteristics.
10. Shorter over all length to improve rigidity.

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Examining DESIGN Features

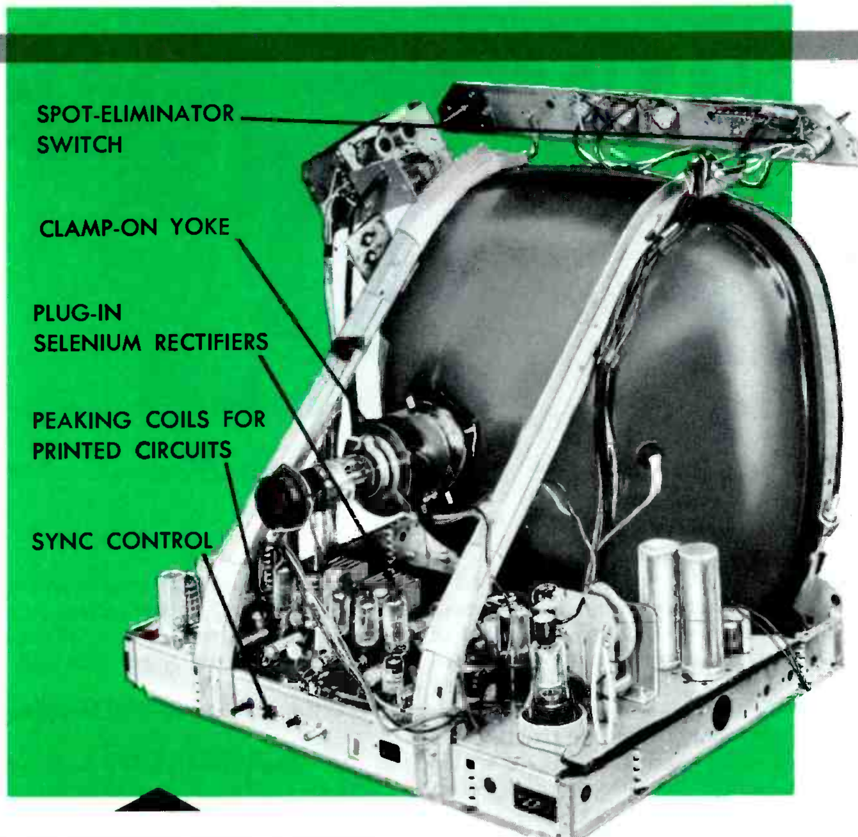


Fig. 1. The Westinghouse Chassis V-2342.

WESTINGHOUSE CHASSIS V-2342

In our over-all plan to describe new design features incorporated in the latest television receivers, we have selected the Westinghouse Chassis V-2342 for this month's discussion. This chassis is pictured in Fig. 1. It is felt that a complete circuit explanation is not needed; therefore, emphasis will be placed only upon the new developments adopted by this particular manufacturer. This chassis has been designed for VHF reception, and it utilizes 16 receiving tubes plus a 21AP4A picture tube.

One unusual feature that becomes readily apparent in the photograph is the use of metal rails extending from the rear of the chassis and over the top of the picture tube. These rails support the picture tube, tuner, and bracket for the front-panel controls. The 21-inch picture tube is secured by the two rails and a metal strap. The chassis and tube may be removed from the cabinet as a complete assembly.

The tuner is mounted on one of the top rails, as shown in the photograph, so that all the operating controls can be located at the top front of the receiver. If the tuning unit has been mounted on the main chassis, a complex coupling mechanism would have been required and would thus have increased production cost and would have increased the possibility of mechanical trouble.

Modern design is reflected in this chassis through the extensive use of printed-wiring circuitry and of the new 600-milliampere tubes. Two printed-wiring boards are employed in this chassis. The IF assembly board includes the IF amplifier circuits and the crystal-detector circuit. The other board includes the circuits of the video amplifier, sound detector, sync separator, vertical discharge and output, keyed AGC, and horizontal multivibrator. Both printed-wiring boards are physically attached to the main chassis by a number of snap-in trimounts which are small buttonlike snaps. The use of these snaps will facilitate the removal of the printed-wiring boards should it ever become necessary.

Stagger tuning with frequencies in the 40-mc range is employed in the IF strip. The intercarrier sound system is designed without a separate sound IF stage. A relatively strong 4.5-mc signal is taken from the plate circuit of the video amplifier and is coupled directly to a 3BN6 limiter-detector stage. This stage in turn drives the 12BK5 audio output tube.

Spot-Eliminator Switch

This chassis also incorporates a switch that operates in conjunction with and is part of the on-off switch. Its purpose is to eliminate the intense bright spot that would appear at the center of the picture-tube screen after the receiver has been turned off. In time, permanent damage to the screen coating may result if this spot were permitted to remain. A partial schematic diagram of the switch circuitry is given in Fig. 2. The switch is shown in an open position which indicates that the receiver is in operation. When the on-off switch is opened, the spot-eliminator switch automatically closes. A positive DC potential that is higher than normal is applied to the grid of the picture tube. The increased beam current will rapidly dissipate the energy stored in the high-voltage circuit, and the tube will be extinguished before the sweep has completely collapsed.

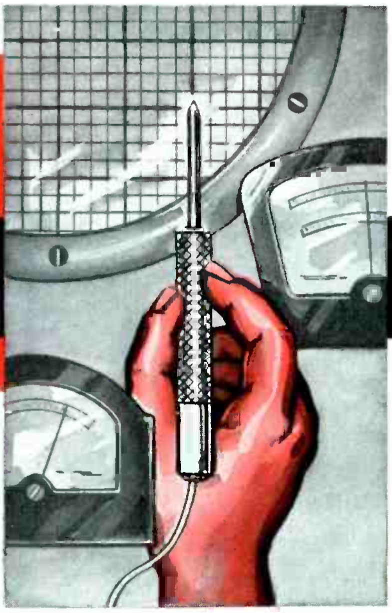
Clamp-on Yoke

Another new feature adopted by Westinghouse for use in this chassis is a clamp-on type of deflection yoke which is pictured in Fig. 3. The rear yoke cover has two flanges which extend back on the neck of the picture tube. An adjustable metal band is placed around these extended pieces, and it clamps the entire assembly to the neck of the picture tube. Adjustments of the deflection yoke may be made by loosening the adjustment screw which is indicated in the figure. When the yoke assembly is clamped in place, make sure that it is tight against the bell of the tube in order to prevent any neck shadow.

Should it become necessary to obtain a replacement yoke from the

* * Please turn to page 61 * *

Notes On
TEST EQUIPMENT



Presenting Information on Application, Maintenance, and Adaptability of Service Instruments

by Paul C. Smith

How Fast Is Fast?

The service technician has a healthy interest in getting a job done quickly. It means more jobs completed in a working day and therefore more money in his pocket. The customer is not likely to complain, either, if his receiver is returned in good working condition after a minimum period of waiting.

So, the technician is always interested in any equipment which he believes will save time. Sometimes he may form an opinion as to the relative ease and speed of operation of a piece of equipment when compared with a similar one made by a different manufacturer. Closer examination of both units may show him that his opinion is based upon personal reasons rather than upon any marked superiority of one instrument over the other.

A recent inquiry from a reader led us to conduct an investigation of three well-known makes of tube testers in our laboratories. As the investigation progressed, it became evident that we had been guilty of a little wrong thinking ourselves in rating (subconsciously at least) one of the testers over the others in the matter of speed.

The test was made in order to determine the relative number of operations necessary in a routine check of a receiving tube and thereby to get some idea of the ease and speed of operation of each tester.

A twin triode was selected as a good type for the test because more operations would be required than if a single-section tube were used; therefore, any definite advantage of one particular tester over the others would have a better chance of being noticed. Only shorts and merit tests were performed. The instructions in the manuals and roll charts which accompanied the instruments were followed carefully, and each step in the testing procedure was numbered as it was performed.

At times, there was some question as to what might be called a separate operation or step. For example, the chart might indicate that all lever switches are to be set at one position. If the levers are all grouped together and are to be set in the same manner, they could all be set simultaneously; and this could therefore be listed as one operation.

The final results showed that substantially the same number of operations (about 19) were required to test this particular twin-triode tube on any one of the testers; and therefore, one particular tester could hardly be considered to have an advantage over the other two in speed or ease of operation. Our original preference for one was probably based upon the fact that we started our service career with a tester of that particular make and consequently were more accustomed to operating it.

In the light of the foregoing results, the matter of speed is not so important a consideration as whether the tester used will give a true indication of the condition of the tube being tested; but no attempt was made to compare the testers in that respect. The worth of a tester would be determined by the extent to which its indication would be verified when the tube is actually put into use.

Precision Model ES-550 Oscilloscope

The Model ES-550 oscilloscope shown in Fig. 1 is manufactured by the Precision Apparatus Company, Inc., Glendale, L.I., N.Y. It is a wide-band, high-sensitivity oscilloscope suitable for monochrome and color TV service and alignment. The instrument uses a 5CP1/A cathode-ray tube.

Fig. 1. Precision Model ES-550 Five-Inch Oscilloscope.

Both the vertical and the horizontal amplifiers are of the push-pull design, both amplifiers have compensated attenuators of the step type, and both have cathode-follower input stages for minimum loading on circuits. In addition to the step attenuators mentioned, the oscilloscope has vernier attenuators in the vertical and horizontal amplifiers. The sensitivity of the vertical amplifier is 10 millivolts rms per inch. The frequency response is within one decibel from 10 cycles to 3.5 megacycles per second and is within three decibels from 10 cycles to 5 megacycles per second. The horizontal amplifier has a sensitivity of 100 millivolts rms per inch, and its frequency response is within one decibel from 10 cycles to 1 megacycle per second and is within three decibels from 10 cycles to 2 megacycles per second.

Controls for two types of phasing are provided — the LINE PHASE and the BLANKING PHASE controls. The LINE PHASE control is for the purpose of superimposing the sweep trace upon the return trace when a response curve is being viewed. The SWEEP SELECTOR switch must be in the LINE position so that the LINE PHASE control will function in this manner. The BLANKING PHASE control has two functions: (1) at the first part of its rotation, a switch is actuated to provide for blanking of the return trace of the oscilloscope sweep; and (2) during the remainder of the rotation of the control, the phase of the blanking can be adjusted. External blanking signals can be introduced at the Z-axis input terminal labeled BEAM MOD.

A switch labeled V. POLARITY allows for inversion of any waveform if the operator so desires.

The oscilloscope can be calibrated directly by means of the built-in calibration circuit. A choice of three peak-to-peak ranges is offered, the maximum peak-to-peak voltages on the individual ranges being .05, .5, and 5 volts. The voltages can be varied continuously from zero to maximum in each range through use of the P-P CAL. VOLTAGE control. The calibrating voltages are applied by means of a push button on the front panel.

A multivibrator circuit is used to develop the internal sweep of the oscilloscope, and the sweep range is from 10 cycles to 100 kilocycles per second. This range is covered by five positions of the SWEEP SELECTOR switch. Two additional positions of the switch provide sweep frequencies of 30 and 7,875 cycles per second for viewing vertical- and horizontal-sweep signals in TV receivers.

A feature which deserves special mention is the automatic control of the sync amplitude. It is provided on all internal-sweep ranges. A great many general-purpose oscilloscopes have a manual control for adjusting the amplitude of the sync signal. This manual control is eliminated in the Precision Model ES-550 oscilloscope, and the proper amplitude of sync signal is applied automatically. Synchronization is obtained merely by adjusting the step and vernier controls of the sweep frequency. A sync signal of either positive or negative polarity can be selected by the sync-selector switch. A panel jack is provided for an external sync signal.

By making tests, we found that very stable synchronization could be obtained because of this automatic feature. An audio-signal generator was connected to the vertical input of the oscilloscope and was adjusted to its maximum frequency of 200 kilocycles, and the oscilloscope sweep was set at its maximum rate. Synchronization was obtained easily and was maintained even when the signal input was reduced until the response curve was only 1/8 inch high. With many oscilloscopes, synchronization becomes increasingly difficult when sweep rates near the maximum frequency limit are used.

It should also be pointed out that the maximum sweep rate of 100 kilocycles for the Precision Model ES-550 oscilloscope is higher than that found in a number of general-purpose oscilloscopes.

This instrument is housed in a steel case having a blue-gray ripple finish. Over-all dimensions of the case are 8 1/4 by 14 1/2 by 18 1/2 inches.

Simpson Model 383 In-Circuit Capacitor Leakage Tester

A service technician may suspect that a trouble is being caused by capacitor leakage, and he may be unable to locate the offending capacitor by conventional methods. He may slave over a particular section of a receiver, a section which he is sure is the seat of the trouble, and wind up with a wholesale replacement of capacitors in the hope that the offending one will be eliminated.

Such a procedure is often successful, but it is time consuming and involves the replacement of good parts. The Simpson Model 383 in-circuit capacitor leakage tester shown in Fig. 2 is designed to locate leakage in paper, mica, and ceramic capacitors and, moreover, to do so while the capacitor is still connected in the receiver circuit. The instrument is not designed to test electrolytic capacitors.

Fig. 2. Simpson Model 383 In-Circuit Capacitor Leakage Tester.

In Fig. 3, the leakage resistance R_L is pictured as being in parallel with the capacitor C and also in parallel with the circuit resistance R_C. The total resistance R_t will be indicated by an ohmmeter placed across this network, and it will always be less than the value of the smaller of the two resistances R_L and R_C. In the majority of cases, the circuit resistance will be much less than the leakage resistance of the capacitor, therefore, an ohmmeter check will not disclose the leakage resistance of such a capacitor unless the capacitor is disconnected from the rest of the circuit.

Even when the capacitor is not connected in a circuit, an ohmmeter test may not be conclusive except in cases in which the value of the leakage resistance is very low. If the leakage resistance is comparatively high, it will approach the value of the resistance of many new capacitors; and a bad capacitor in this leakage range cannot be distinguished from a good one by means of an ohmmeter check. Yet there are many critical circuits in which such leakage will cause trouble.

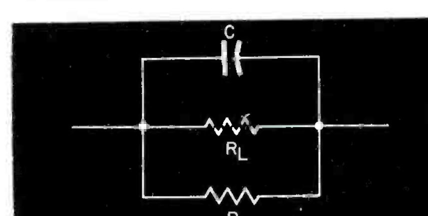


Fig. 3. Equivalent Circuit Diagram of Leaky Capacitor in Parallel with Circuit Resistance.

The design of the Simpson Model 383 tester is based upon a new discovery concerning leakage resistance. It has been found that leakage resistance differs from ordinary circuit resistance in that it is quite often of a nonlinear and unstable nature, particularly when tested with a pulsed voltage like that developed by the Model 383. When a leakage resistance is subjected to a pulse voltage, several things may happen.

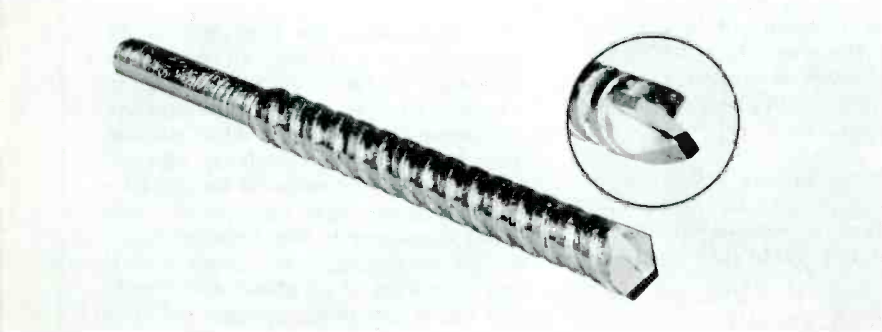
* * Please turn to page 75 * *

CARBIDE-TIPPED BITS for MASONRY DRILLING

Making an efficient and neat antenna installation in many homes requires drilling through some form of masonry material. Sometimes this task involves the major part of the time and labor used in installing a television antenna. This does not need to be the case, however. Drilling into most masonry materials can be done within seconds or minutes if an electric power drill with a carbide-tipped bit is used. Recent advances in the fabrication and the application of carbide-tipped masonry bits make it possible to set anchors and to drill entrance holes for lead-in wires in nearly all masonry materials with a minimum of time and effort.

Carbide-tipped masonry bits should be given consideration, by every antenna technician, as important additions to the tool kit. The savings in time and labor plus the customer satisfaction gained from a neat installation will more than compensate for the cost of the bits.

The rotary cutting of a material requires that the cutting edge of the bit must be moving across the surface of the material being cut. Pressure must also be applied to the bit to force the cutting edge into the material. The cutting edge at the center of a pointed bit is not moving across the surface of the material; and therefore, the point must be forced into the material before the moving portion of the cutting edge will contact and cut the material. If the cutting edges are away from the center of the bit, as in the core designs, the applied pressure will be distributed to active cutting edges without the necessity of first forcing



Pointed Bit

The pointed type of masonry bit is composed of a tungsten carbide tip, a fluted body, and a steel shank. The carbide tip is brazed into a slot that is cut into the end of the body. Spiral fluting about the body of the drill removes the powder from the drill hole and prevents the bit from becoming jammed.

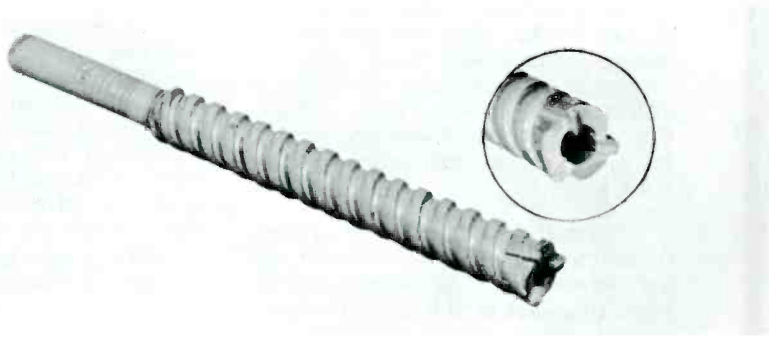
This type of masonry bit is the least expensive of the carbide-tipped bits and also the most widely used. It is generally used for drilling holes of small diameter in the softer masonry materials such as common brick, limestone, cement block, and soft concrete.

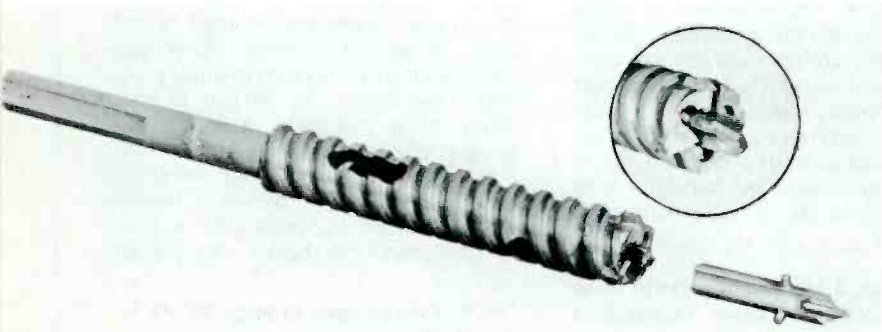
Photographs: Robert W. Reed

Coreless Bit

The coreless type of masonry bit is a multitipped bit which has several carbide tips arranged radially about its end. The coreless bit contains a bore, but the diameter of the bit is not large enough to cut out a solid core of masonry material.

The placement of the carbide tips around the center of the bit creates higher rates of penetration into the softer masonry materials than is possible with the pointed bit. The design of this bit also permits rotary drilling of hard masonry materials such as tapestry brick, structural tile, and hard concrete.

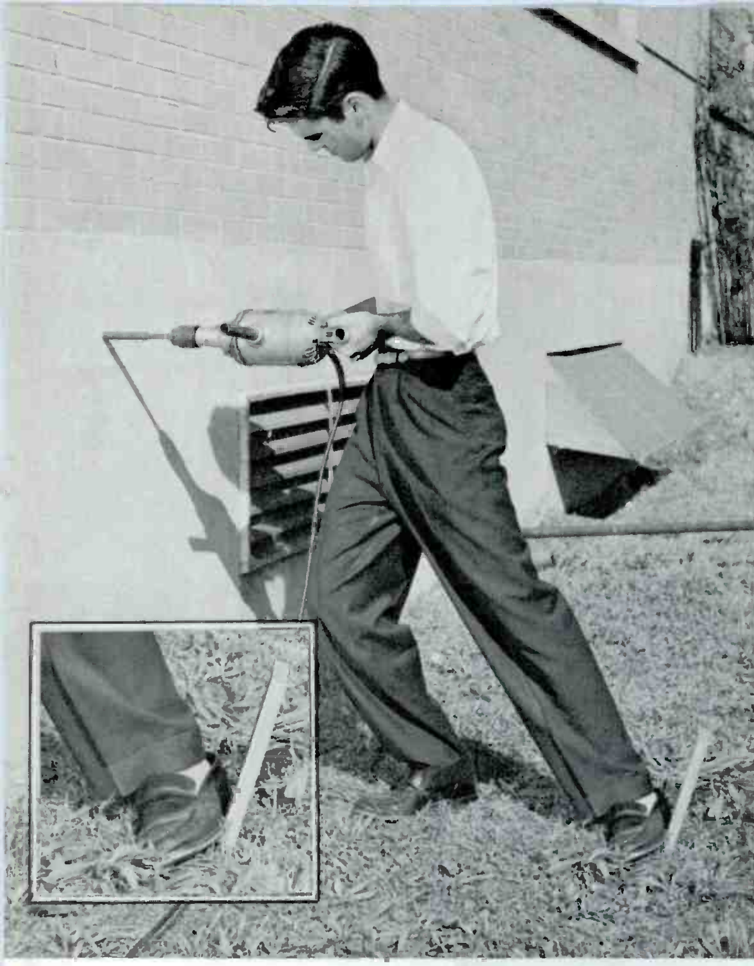




Core Bit With Removable Starting Center

The core type of masonry bit is similar to the coreless type except that it has a larger diameter and it cuts out a solid core of material. The carbide tips are placed on the rim of the bit around the opening of the bore.

This type of masonry bit can be used with a removable starting center which is an accessory item and which aids in starting and centering the bit. The drilling is started with the center inserted into the bore of the bit. When the core bit has started cutting into the material, the starting center is removed and the drilling is completed with the core bit alone.



One Man Using a ½-Inch Power Drill

One man using a ½-inch power drill can apply an average of 50 pounds of pressure to a drill bit. Greater pressure can be obtained by using a foot support such as a stake driven into the ground so that the operator can brace himself against it. Using this brace, one man can apply an average force of 80 pounds over an extended period of time.

Two Men Using a ½-Inch Drill

Drilling into hard masonry with drill bits of large diameter requires considerable drilling pressure. Two men can apply as much as 170 pounds of pressure by bracing themselves against some solid object. Most ½-inch power drills are provided with three hand grips which make it possible for two men to operate the same drill.

the bit into the material. Placement of the cutting edges away from the center of the bit produces higher rates of penetration than are possible with the pointed bit under the same pressure.

Drilling Pressure

The pressure on a carbide-tipped bit is one of the most important factors involved in drilling any type of masonry material. Much of the dulling or breaking of masonry bits is caused by improper pressure being applied to the bit.

When a tool bit is placed against a material and the pressure is gradually increased, a pressure level is reached at which the tool bit begins to cut into the material. Increasing the pressure above this level results in faster penetration of the material and reduced wear on the cutting edges. A masonry drill operating below the pressure level at which effective cutting takes place is rubbing instead of cutting. This rubbing creates overheating and dulling of the cutting edges and therefore reduces the usable life of the masonry bit.

The rotary type of masonry bit should always be operated at pressures slightly above the level at which effective cutting takes place. Never operate a rotary masonry bit below this level. If the pressure stalls the power drill, use a heavier power drill. Do not reduce the drilling pressure.

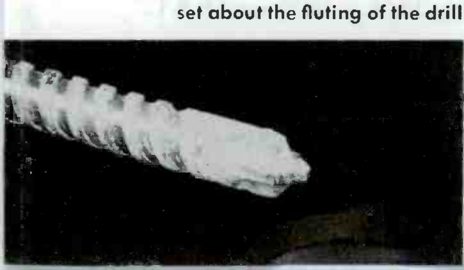
The pressure necessary to produce cutting of a masonry material must be increased when a bit that has a larger diameter is used or when a harder masonry material is being cut. The range of pressures can extend from 20 or 30 pounds when bits of small diameter are used in soft materials to approximately 200 pounds when a 3/4-inch bit is used in hard materials.

The recommendations given by the manufacturer of a masonry bit should be followed for pressures and drilling speeds to be used. Practice in the use of masonry bits is necessary; and excessive wear and breakage of tool bits will be prevented if a few easy rules are followed:

1. Operate drill bits at proper speeds.
   a. Approximately 1,000 rpm for bits with diameters of 3/8 inch or less.
   b. Approximately 550 rpm for bits with diameter between 3/8 inch and 1 inch.
2. Maintain enough pressure to produce cutting.
3. Use a heavier power tool if the proper cutting pressure stalls the drill.
4. Keep the drill running when removing it from the hole.
5. Resharpen the tool bit when it becomes dull. Bits that are dull overheat and break easily.
6. Do not drill into wet or damp masonry.

CAUTION: Do Not Drill Into Damp Masonry

This pointed bit was used to drill a section of damp masonry. The powder formed during cutting has become packed and has become set about the fluting of the drill. This caused jamming of the drill bit. To continue drilling of the masonry by increasing the pressure will result in the generation of excessive heat which can dull the bit and cause possible splitting of the masonry.



PRESSURES THAT CAN BE DEVELOPED IN VARIOUS DRILLING POSITIONS		DRILLING HORIZONTALLY IN A WALL				DRILLING VERTICALLY	
		SHOULDER LEVEL (POUNDS)	WAIST LEVEL (POUNDS)	KNEE LEVEL (POUNDS)	GROUND LEVEL (POUNDS)	IN CEILING (POUNDS)	IN FLOOR (POUNDS)
ONE MAN STANDING ON A LEVEL SURFACE USING A 1/2-INCH ELEC. POWER DRILL	NO FOOT BRACE	45 TO 60	50 TO 70	40 TO 60	35 TO 50	60 TO 110	100 TO 125
	FEET BRACED	60 TO 80	85 TO 100	70 TO 85	75 TO 90		
TWO MEN STANDING ON A LEVEL SURFACE USING A 1/2-INCH ELEC. POWER DRILL	NO FOOT BRACE	90 TO 110	100 TO 120	75 TO 90	75 TO 90	120 TO 170	150 TO 180
	FEET BRACED	130 TO 150	140 TO 160	140 TO 160	130 TO 150		

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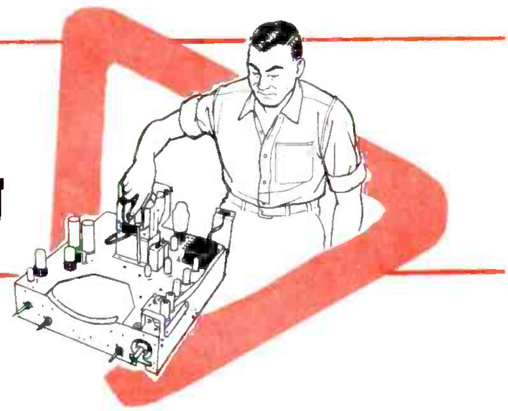

by **Calvin C. Young, Jr.**

DIRTY CONTROLS CAN BE CLEANED IN THE HOME

New devices and cleaners for cleaning controls while in the customer's home have been introduced by the R-Columbia Products Co., Inc., Highwood, Illinois, and by the General Cement Mfg. Co., Rockford, Illinois. These devices make it possible to clean contrast, volume, brightness, and other controls which have become dirty and to do this without the necessity of removing the TV chassis from its cabinet. One of the new cleaning devices is shown in use in Fig. 1. It is a plunger type of injector which screws onto the threaded bushings of standard controls in TV and radio receivers. An adapter also makes it possible to clean the volume controls of auto radios.

A special solvent that cleans and relubricates controls is available from each manufacturer and should be used in the injector which is supplied by each one. This will ensure long life for the plunger elements in the injector.

Use of the Injector

To use the injector, it is first necessary to fill it with the solvent. This is done in much the same manner that a fountain pen would be filled. You simply insert the nozzle into the container of solvent, and slowly pull out the plunger. Allow the nozzle to remain immersed in the solution for several seconds to ensure a full load. Extract the nozzle from the solution, and allow the excess fluid to drain back into the container. Since these solutions do contain a small percentage of a lubricating substance, be careful to put down a good drop cloth in the work area. Several layers of newspapers can be used instead of a drop cloth. Hold a rag under the nozzle when transporting the loaded injector up to the control of the TV receiver. See Fig. 1.

The barrel of the injector should be placed over the shaft of the control which is to be cleaned, and the injector should be tightly screwed onto the bushing of the control shaft. This will cause the cleaning solution to be forced into the dirty control when the plunger is pushed forward.

NOTE: Be sure to place several layers of newspapers under a console TV or between the TV and the table when you are working on table models. This should be done because excess cleaning solution may run out of the control and possibly out through the bottom of the TV cabinet.

After the solution has been injected into the dirty control, draw out the plunger handle quickly. This will draw any fluid that might be left in the injector barrel back into the injector itself. Remove the injector from the control shaft, and rotate the control shaft vigorously. This will help clean the contact surfaces on the resistive element.

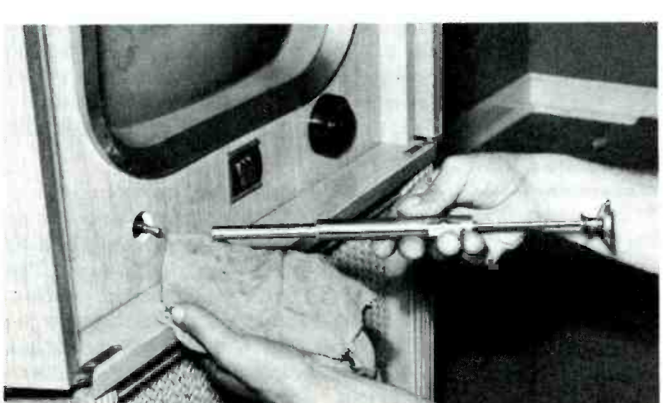

Fig. 1. TROLMASTER Injector Made by the R-Columbia Products Co., Inc.

Allow the excess solvent a few minutes to drain away and evaporate. The control has been cleaned and relubricated as a result of the foregoing procedure and is ready for normal usage.

NOTE: Be very careful not to get any of the cleaning solution on the customer's rugs, floors, or furniture. Do not put any of the used solvent back into the container of fresh solvent. Disposal of the residue solvent left in the injector can best be made after leaving the customer's home.

HANDLING PHONE CALLS FOR SERVICE

One of the more difficult problems which faces the owner of a small service shop is that of answering the telephone. It is obvious that, in the case of a one-man shop, the technician-owner cannot be out making service calls and also be present in the shop to answer the telephone. If the telephone is not answered, it can mean the loss of potential customers.

A possible solution is to hire a person to keep the shop open and to answer the telephone. This solution has considerable merit and should be used if possible. We are all aware, however, that it is costly to hire and maintain an office employee. It usually means a direct expense of $40 or $50 per week in addition to the overhead involved. There are a number of things which can be done to help compensate for this additional outlay.

If the service shop is suitably located, small appliances and radios can be sold. These items can often be obtained from the local distributors on a consignment basis. With these items attractively displayed in the store window, the resulting sales should help to counteract the additional cost of the employee.

* * Please turn to page 56 * *

MAINTENANCE of
TAPE SPEED

by
Robert B. Dunham

LUBRICATION AND CLEANING

Every six months:

1. Oil the drive motor with 10 dro 20 motor oil.
2. Clean the front capstan bearin sene and lightly oil with SAE All cap
3. Oil SA
4. Cle

The Ninth in a Series of Articles Devoted to the Principles of Magnetic Recording

As is true with most any piece of equipment which makes use of moving mechanical parts and more or less involved electronic circuits, best results will be obtained with a magnetic tape recorder if the recorder is adjusted properly and maintained in proper operating condition.

Many owners of less expensive models of the home type of tape recorders would be surprised to see the space allotted to maintenance in the instruction manual supplied with a professional type of recorder. No doubt, many amateur and occasional operators think that professional recorders are so well designed and constructed that they should operate indefinitely with no special attention or adjustments being required. This is certainly an erroneous conclusion because good equipment requires good care and proper handling.

In broadcasting and recording studios or in any places in which recording or playback must meet rigid standards, extensive maintenance routines are performed at regular intervals in order to ensure results that fulfill these requirements. Of course, professional equipment is operated for many hours (perhaps continuously) each day, but a home type of recorder may be operated only occasionally. Nevertheless, a home machine must receive some attention and must be maintained in correct operating condition if satisfactory recording and reproduction are to be obtained.

The last statement is particularly true if tapes recorded on other recorders are played back on some particular machine or if the tapes are recorded on this certain machine and then played back on other recorders. Any discrepancy in operation between the recorders can spoil the quality of the recording. Variations in design of different recorders must be taken into consideration when playing tape on a machine other than the one on which it was recorded, but each machine (although identical in design) must be adjusted properly if faithful recordings are to be obtained.

The mechanical portion of a tape recorder should be checked, cleaned, lubricated, and adjusted at appropriate intervals the frequency of which depends upon the use given the recorder. The electronic section should also be checked and adjusted because every section of a recorder must operate satisfactorily. No weak links can be tolerated.

The recommendations of the manufacturer should be followed when adjustments are made on a unit, but the information available in the usual service manual is sometimes limited and inadequate. So, some general and some detailed information on adjustment and maintenance of a tape recorder should prove helpful.

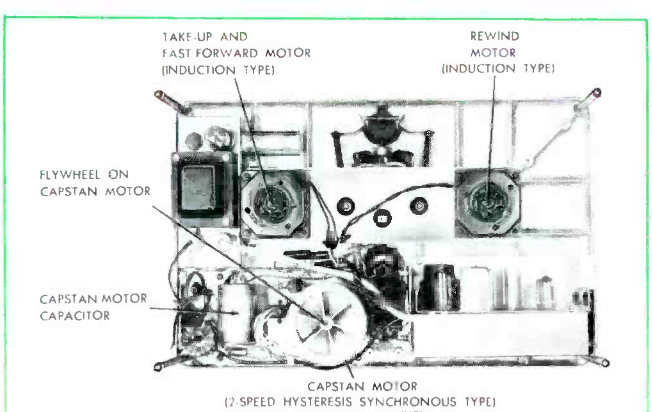

Fig. 1. Bottom View of Concertone Model 1502 Showing Motors.

Many of the requirements to be met by the tape-transport mechanism in handling tape properly have been mentioned in previous articles of this series on magnetic tape recording. These requirements and those concerned with the electronic section of a recorder will now be reviewed with respect to the maintenance and adjustments required to provide consistent and satisfactory recording and playback. Tape recorders vary in form and design, but information which will aid in understanding what should be done with a certain machine can be gained from discussing some typical examples because of the basic principles involved.

Speed of Tape-Transport Mechanism

The tape-transport mechanism must move the tape across the face of the erase, record, and playback heads at a certain constant speed. If the speed is not correct nor constant, satisfactory recordings cannot be made; therefore, speed is a very critical consideration.

The most common tape speeds are 30, 15, 7 1/2, 3 3/4, and 1 7/8 inches per second. The two higher speeds are used for wide-range recordings. Speeds of 15 and 7 1/2 inches per second are used on many home types of machines for recording and reproduction of music. Speeds of 3 3/4 and 1 7/8 inches per second do not afford a really wide frequency range and find their most suitable application in recording the speaking voice.

Probably the most logical method for testing tape speed is to use one of the test tapes supplied by one of the many manufacturers. The playing time is checked against measured intervals on the tape as the tape is played back on the recorder which is being checked. The intervals of playing time are usually indicated by tones and spoken announcements.

Some users may be puzzled if the tapes they have recorded do not sound right when played back on another recorder. This can easily be due to the speed of the recorder. A tape speed, which is slower or faster than normal but is maintained constant during recording and playback, will produce normal results when the tape is played back on the machine on which it was recorded. In other words, the tape is recorded and played back at the same speed, and the discrepancy in speed is not noticeable.

When a tape which was recorded on a recorder operating at a normal tape speed is played back on a machine which is moving the tape at a speed slower or faster than normal, the pitch and the quality of the recorded signal will be altered. The quality and pitch will be changed for the same reason if the tape is recorded on a machine which is not operating at a normal speed and is then played back on a machine which is operating at the correct speed.

Incorrect speed can be caused by a defective motor, by a worn or defective pulley, idler wheel or drive belt, or by any condition that places an excessive amount of drag or loading on the drive system. Excessive drag or loading usually causes erratic speed and produces a signal variation which is usually called "wow." These conditions will be discussed in more detail as we continue.

Motors

Drive motors are critical items because they must turn the capstan at a constant speed; therefore, they are powerful and smooth-running motors. The hysteresis synchronous motors used in professional recorders account for a substantial portion of the purchase price of the complete recorder. This type of motor features constant speed and smooth operation which explains why they are so universally used in high quality machines. Some of these motors have windings that make it possible to change the motor speed by throwing a switch. Figs. 1 and 2 show transport mechanisms that use hysteresis synchronous drive motors.

Definite instructions are usually given with professional recorders on how and when to lubricate the drive motor. The instructions with the Ampex 600 (Fig. 3) are typical -- 5 drops of oil on the motor bearing every 500 hours of operating time. Some motors might use 10 drops of oil in the same length of time. SAE 10 or SAE 20 motor oil is usually

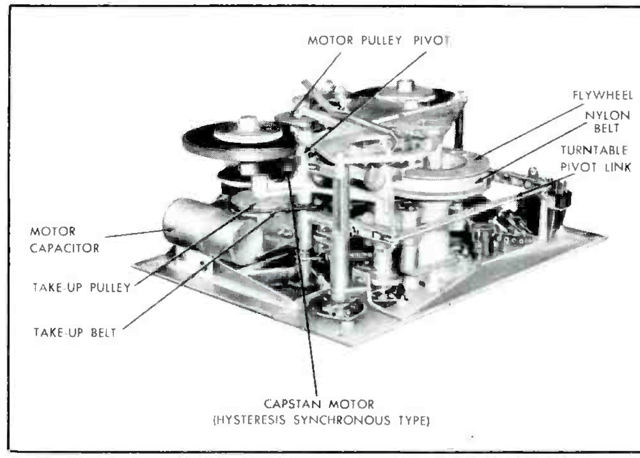

Fig. 2. Tape-Transport Mechanism of Ampex Model 600 Which Employs One Motor. The Belts, Pulleys, and Pivots Can Be Seen.

specified for this purpose. Long and satisfactory use can be expected from these motors if they are cleaned and lubricated properly and if they are not overloaded.

Induction motors (Fig. 1) are usually used for take-up and rewind motors and for drive motors in home types of recorders. These are supplied in a variety of styles and sizes, but all of them feature high power and smooth operation. When a motor of this type is used as a drive motor, one or more idler wheels or drive belts are usually employed to transmit power to the capstan. Since these are single-speed motors, a change in tape speed is accomplished by a mechanical arrangement which permits a change in the drive ratio between the driving and driven shafts. More will be said later about idlers and belts.

As a general rule, this type of motor is fitted with bearings that are saturated or impregnated with oil; and therefore, they should never require lubrication during the lifetime of the motor. Some of these bearings are fitted with felt washers which are saturated with oil.

If, by chance, a bearing should become too dry or become fouled with an accumulation of dirt or some foreign material to such an extent that the operation of the motor is affected, no doubt the situation could be corrected if the affected bearing were cleaned and lubricated. No more than a sufficient amount of oil should be applied to the felt washer or to a bearing because an excessive amount of oil can cause a lot of trouble when it flows or is thrown to adjacent surfaces. The precaution about using too much oil should always be heeded when an electric motor is being lubricated because the motor can become soaked with oil and contaminated. The precaution is especially important in the case of equipment such as a recorder in which the presence of oil on critical surfaces can cause trouble.

Procedures recommended by the manufacturer should be followed if it is necessary to clean and lubricate any of the motors mentioned. Any disassembling and reassembling must be done with care. Some manufacturers do not recommend the use of carbon tetrachloride for cleaning because too much oil is thereby removed from the bearings. Excessive amounts of cleaning fluids should not be used. After the bearings have been cleaned, they should be oiled carefully according to the recommendations mentioned previously.

Drive, take-up, and rewind motors are usually very rugged and dependable units that provide satisfactory service if given reasonable

* * Please turn to page 39 * *

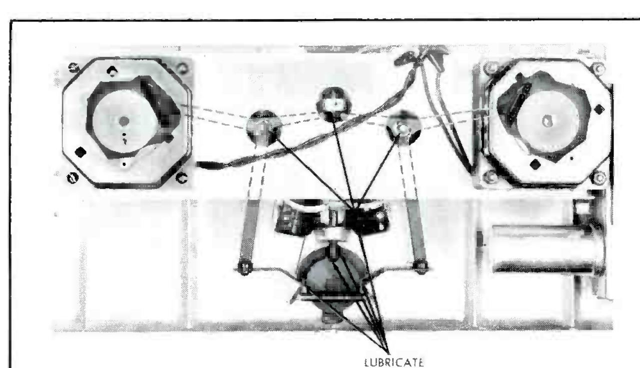

Fig. 3. Close-up of Some Points That Require Lubrication in the Concertone Model 1502.

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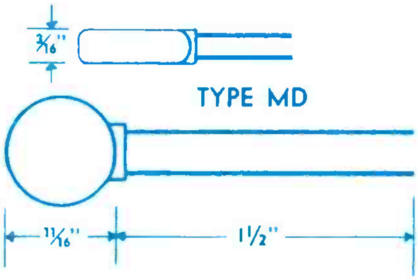

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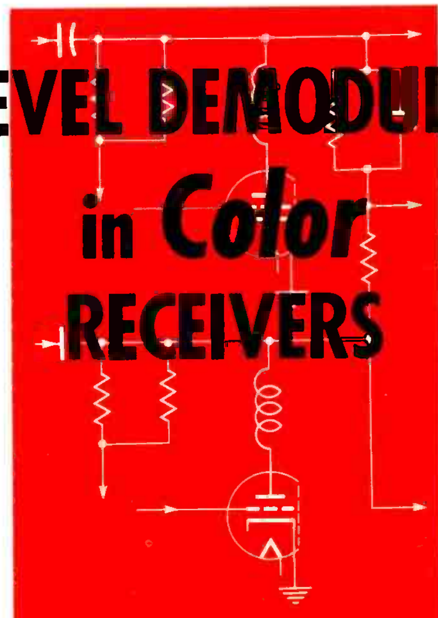
HIGH-LEVEL DEMODULATION in Color RECEIVERS



AN EXPLANATION OF A NEW CIRCUIT DESIGN

by C. P. Oliphant

Until recently, the demodulation stages in a color receiver have been of the low-level type in which the color signals after demodulation have to be amplified by the proper amount before being applied to the picture tube; therefore, the stages of amplification between the demodulators and the picture tube are necessary. The color signals are mixed with the luminance signal, are passed through amplifiers, and then are applied to the picture tube. In other receivers, the color signals are amplified and then mixed with the luminance signal in the picture tube. In either case, additional stages of amplification for the color signals are necessary.

In receivers which employ circuits for high-level demodulation, the chrominance signal is amplified to the desired level before being applied to the demodulators. High-level demodulators are much more efficient than low-level demodulators. The signals at the output of the demodulators are of sufficient amplitude and can be directly coupled to the picture tube. Because of the high level of signal obtained, additional stages of amplification are not needed. This type of demodulation eliminates the need for three to nine stages in the color receiver.

Because of the frequencies involved, it is easier from a design standpoint to provide for amplification of the chrominance signal before demodulation than it is to provide for amplification of the color signals after demodulation. The frequencies of the chrominance signal fall within the range of 2 to 4.2 megacycles, and the frequencies of the color signals after demodulation are in the range of 30 cycles to 1 megacycle per second.

In the following discussion, the basic operation of high-level demodulators will be explained, and then two circuits that are produced commercially will be covered.

BASIC CIRCUITS OF HIGH-LEVEL DEMODULATORS

A basic circuit of a high-level demodualtor is shown in Fig. 1. A locally generated reference signal is applied to the grid of the triode, and the chrominance signal which is to be demodulated is applied to the plate. The reference signal causes the triode to conduct heavily each time the signal goes through a positive peak of voltage. These regular bursts of current endure for only a small portion of each cycle because the triode operates essentially as a class-C amplifier. Each time the tube conducts, the plate voltage with respect to ground assumes a fixed value of about 25 volts. At these times, the chrominance signal which is effectively in series with the plate voltage will be going through a specific point in its cycle. The location of this point in the cycle will be dependent upon the phase relationship between the CW reference signal and the chrominance signal.

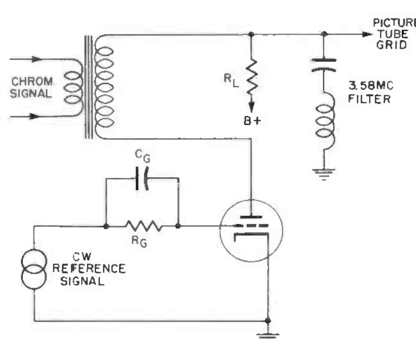


Fig. 1. Basic Circuit of a High-Level Demodulator.

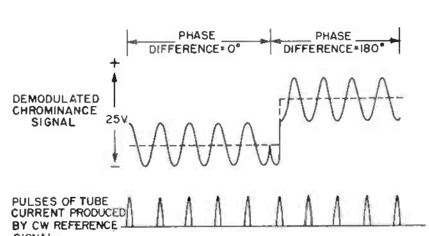


Fig. 2. Waveforms Illustrating High-Level Demodulation Action.

In Fig. 2, the pulses of current produced in the tube by the CW reference signal on the grid are shown at the bottom of the drawing. A chrominance signal that is in phase with the CW reference signal will have its positive peaks clamped at 25 volts. A chrominance signal that is 180 degrees out of phase with the CW reference signal will have its negative peaks clamped at 25 volts. The dotted line in the drawing represents the signal waveform which is obtained after the 3.58-mc portion of the signal is filtered out. This is the waveform of the demodulated color signal.

Only the phase variations of the chrominance signal are shown in Fig. 2; the amplitude of the chrominance signal is shown as remaining constant. A change in amplitude would also be detected by the demodulator.

The amplitude of the demodulated output signal is directly proportional to the amplitude of the chrominance input signal; therefore, if a demodulated signal of 90 or 100 volts peak to peak is needed, a chrominance input signal of the same value will produce the desired results, This can be noted from an examination of Fig. 2.

Obtaining G-Y Signal From Common Cathode Circuit

The basic circuit that was shown in Fig. 1 represents only one triode section of a high-level demodulator stage. At least two triode sections are needed for complete demodulation of the chrominance signal. A basic circuit of a two-triode demodulator is shown in Fig. 3. These triodes function as R - Y and B - Y demodulators. It is not necessary to employ three triodes because the third color-difference signal can be obtained by the mixture of the other two color-difference signals. As

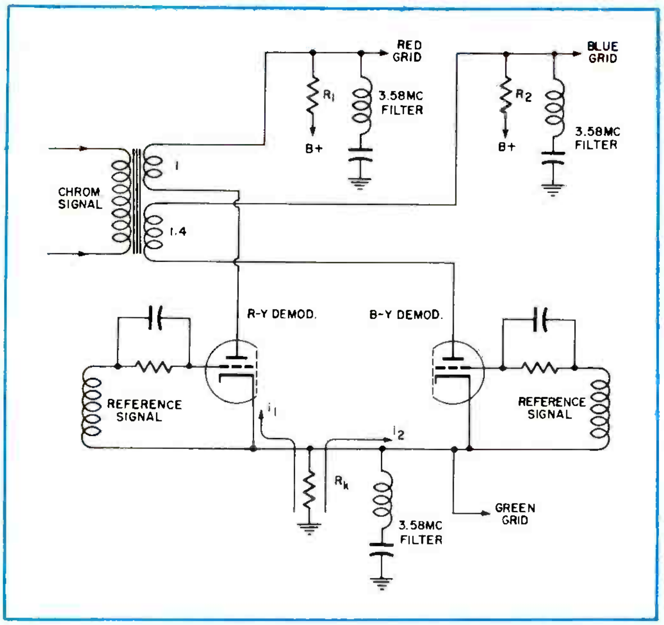


Fig. 3. Basic Circuit of a Two-Triode Demodulator Which Employs a Common Cathode Impedance.

shown in Fig. 3, the G - Y color-difference signal is obtained from the common cathode circuit of the demodulators. This design takes advantage of the fact that a G - Y signal is made up of -.51(R - Y) and -.19 (B - Y).

The correct operation of the demodulator circuit of Fig. 3 depends upon three factors: (1) the amplitude of the chrominance signal applied to each plate of the two triodes, (2) the ratios between the plate-load resistors and the common cathode resistor, and (3) the phase relationship between the two reference signals which are applied to the grids of the triodes.

The color-difference signals are attenuated by unequal amounts before transmission in order that the amplitude of the video signal may be kept below that of the sync signal. In order for the correct amplitudes of the color-difference signals to be restored, the amplitudes of the chrominance signals applied to the demodulators must be of the correct ratio. This is accomplished by using a coupling transformer which has the windings of its two secondaries in the proper turns ratio. As shown in Fig. 3, a turns ratio of 1.4 to 1 is used if the receiver has B - Y and R - Y demodulators. With this specified turns ratio, the chrominance signal applied to the B - Y demodulator will be 1.4 times as great as that applied to the R - Y demodulator.

Selecting Values for Load Resistors

The correct ratio between the color-difference signals will be present if the load resistors are of the proper values. The ratio between one plate-load resistor R1 and the common cathode resistor R_k has been found to be 1.96 to 1. The ratio between the other plate-load resistor R2 and R_k is 5.26 to 1. These ratios have been found by the following reasoning.

We know that the G - Y signal is obtained from the voltage across the common cathode resistor R_k and that it is made up of -.51(R - Y) and -.19(B - Y). We also know the path of current flow through both demodulators. As shown in Fig. 3, i_1 is the R - Y demodulator current which flows from ground through R_k and through the R - Y triode, and i_2 is the B - Y demodulator current which flows through R_k and through the B - Y triode. From these known facts, the ratio between each of the plate-load resistors R1 and R2 to the common cathode resistor R_k can be determined as follows:

$$R1 \times i_1 = (R - Y), \qquad (1)$$

$$R_k \times i_1 = .51(R - Y). \qquad (2)$$

Then by dividing equation 1 by equation 2, we obtain:

$$\frac{R1}{R_k} = \frac{1}{.51}$$

$$R1 = \frac{R_k}{.51}.$$

Then by substituting 1,000 ohms for R_k, we obtain:

$$R1 = 1960 \text{ ohms.}$$

This is a ratio of 1.96 to 1 between R1 and R_k. The value of R2 can be determined by the same reasoning:

$$R2 \times i_2 = (B - Y), \qquad (3)$$

$$R_k \times i_2 = .19 (G - Y), \qquad (4)$$

$$\frac{R2}{R_k} = \frac{1}{.19}$$

$$R2 = 5260 \text{ ohms.}$$

This is a ratio of 5.26 to 1 between R2 and R_k.

Phase Relationship Between Reference Signals

In order for the circuit of Fig. 3 to produce the proper color-difference signals to be fed directly to the picture-tube grids, the phases of the reference signals applied to the control grids of the demodulators must be taken into consideration. In other types of demodulator circuits, the reference signals are applied in quadrature (90 degrees apart in phase). In the circuit of this figure, however, this is no longer true. The reference signals have a phase difference of 63.58 degrees. If this phase difference were left at 90 degrees, a B - Y signal produced by the current i_2 flowing through R_k would appear across the load resistor R1 and an R - Y signal produced by current i_1 flowing through R_k would appear across R2. Incorrect color-difference signals would therefore be produced and would improperly control the conduction of the guns in the picture tube.

Color-difference signals of the correct amplitudes must be added to the luminance signal in order to reproduce the desired color. For instance, when only red is to be reproduced, the R - Y color-difference signal must have a relative value of .7. This amount of R - Y signal, when added to the luminance signal (which has a value of .3 when only red is being transmitted), will allow full conduction of the red gun. Since the luminance signal is applied equally to all three guns, the B - Y and G - Y signals must each equal a -.3 in order to cancel the +.3 furnished to each gun by the luminance signal. The green and blue guns should be nonconducting during the reproduction of red.

If the common cathode resistor were not present and if the reference signals were applied in quadrature to the grids of the triodes, the chrominance signal would be demodulated into R - Y and B - Y portions which are shown by the vector representation in Fig. 4. The R - Y portion of the chrominance signal would be developed between the plate side of R1 and the cathode of the R - Y demodulator, and the B - Y portion would be developed between the plate side of R2 and the cathode of the B - Y demodulator.

With the cathode resistor in the circuit, the vector representation of the demodulation action will be altered. See Fig. 5. Because of the small voltage drop E_{rk} across R_k, the phase of the voltage across the load resistor of each tube will be changed. A small negative vector E_{rk} is shown added to the R - Y vector to form the resultant vector E_1. This is the new voltage from the plate side of R1 to the cathode of the R - Y demodulator. The small negative vector E_{rk} is also added to the B - Y vector to form the resultant vector E_2. This is the new voltage from the plate side of R2 to the cathode of the B - Y demodulator. The voltages from the plate sides of the load resistors to the cathodes of the demodulators are no longer R - Y and B - Y but are the two voltages E_1 and E_2; therefore, for correct demodulation of the chrominance signal, the reference signals applied to the grids must correspond to the phase angles of the vectors E_1 and E_2. When this is done, a pure R - Y signal is formed across the plate-load resistor R1, a pure B - Y signal is formed across the plate-load resistor R2, and a pure G - Y signal is formed across the cathode resistor R_k.

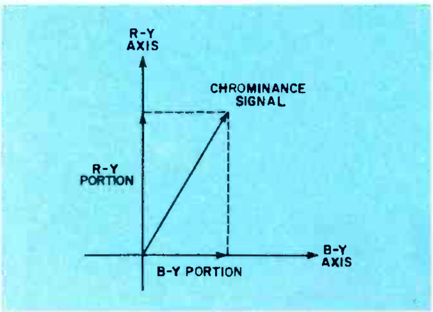


Fig. 4. Demodulated Portions of a Chrominance Signal During Quadrature Demodulation.

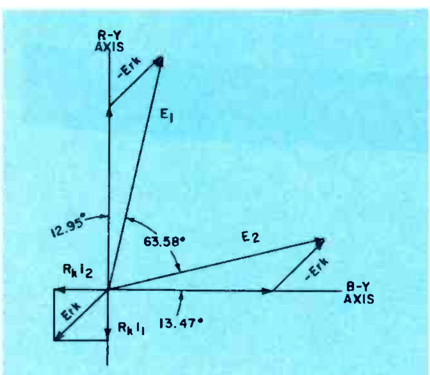


Fig. 5. Alteration of the Demodulation Action When the Common Cathode Impedance Is Employed.

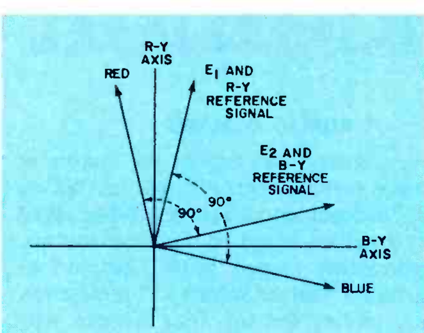


Fig. 6. Relationship Between the New Phase Angles of the CW Signals and the Red and Blue Vectors.

The vector drawing of Fig. 6 shows that the new phase angle of the R - Y reference signal is in quadrature with the vector that represents the blue chrominance signal and that the phase angle of the B - Y reference signal is in quadrature with the vector that represents the red chrominance signal. With this arrangement and with a chrominance signal representative of the color red being received, an output from only the R - Y demodulator will be produced. There will be no output from the B - Y demodulator. The reverse is true when a chrominance signal representative of the color blue is being received. Demodulation will be performed solely by the B - Y demodulator.

Correct Signals at Guns of Picture Tube

Let us see how the correct signals are applied to the guns of the picture tube under specific conditions. Assume that a red bar is being transmitted and that the incoming signal is such that a signal level of one volt is being produced at the red grid of the picture tube. Under these conditions, we know that the following relative values of signals must be present:

Y = .3
R - Y = .7
B - Y = -.3
G - Y = -.3
B = 0
G = 0
R = 1

From the standard expression for the luminance signal, Y = .3R + .59G + .11B, we know that the luminance signal will equal .3 when only red is being transmitted because the values for blue and green are equal to zero. This .3 value of luminance is applied to all three guns of the picture tube; therefore, for full conduction of the red gun, an R - Y color-difference signal with a value of .7 must be supplied from the R - Y demodulator. At the same time, a B - Y color-difference signal with a value of -.3 must be supplied to the blue gun and a G - Y color-difference signal with a value of -.3 must be supplied to the green gun so that the luminance signal will be cancelled.

There will be an R - Y color-difference signal of .7 produced across R1 in Fig. 3 because (1) the load resistors are in the correct ratio, (2) the chrominance signals driving the demodulators are in the correct ratio, and (3) the reference signals applied to the grids have the correct phase relationship.

The next area of investigation concerns the way in which the circuit

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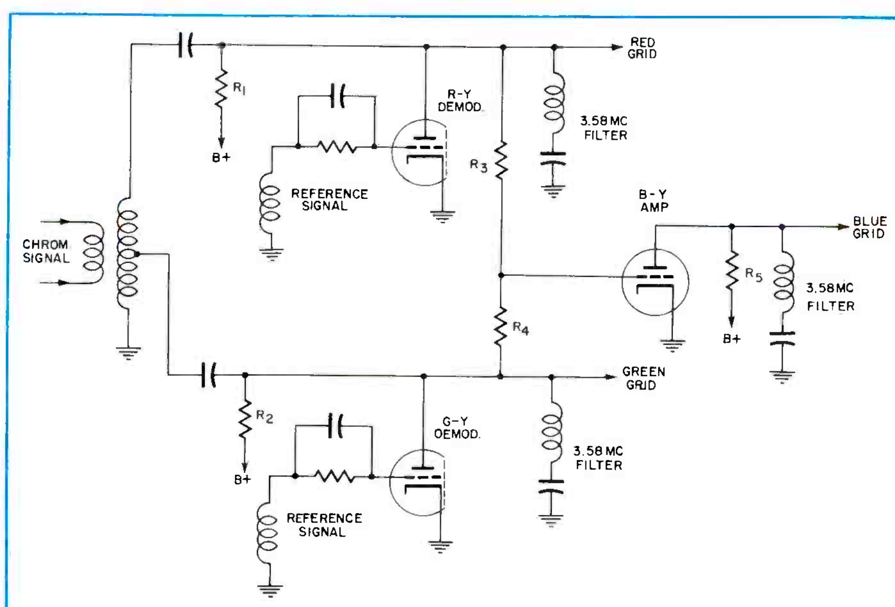

Fig. 7. Basic Circuit of a Two-Triode Demodulator Which Does Not Employ a Common Cathode Impedance.

No. 1 in independent survey among servicemen

"Fewer returns" votes for "Silver Screen 85" were more than twice that of No. 2 and No. 3 brands combined

Best quality and consumer demand important reasons why servicemen make "Silver Screen 85" their No. 1 choice.

Servicemen gave "Silver Screen 85" the highest vote of confidence paid any picture tube in a national survey recently conducted by an independent research corporation. "Silver Screen 85" took top honors in answer to the key question, "what picture tube do you consider *best regardless of price?*"

FEWER RETURNS

"Fewer returns" were experienced with "Silver Screen 85" than with the No. 2 and No. 3 brands combined. "Best quality" and "better picture" were highest among reasons servicemen gave for voting "Silver Screen 85" No. 1.

PUBLIC DEMAND

Consumer demand was one of the factors of importance servicemen credited to "Silver Screen 85" according to the survey. When asked why they specified brand to their distributors, more servicemen named public demand as their reason for "Silver Screen 85" preference.

In fact, among the top four reasons why servicemen specified brand, "Silver Screen 85" again took 1st place.

You, like the servicemen who offer its high praise, can profit from "Silver Screen 85's" success story. Make "Silver Screen 85" your good-will leader. Feature it; promote it; you'll develop strong customer relations and high word-of-mouth recommendations. Your business will flourish and so will profits.

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Shop Talk

MILTON S. KIVER
President, Television Communications Institute

New Trends Revealed at Electronics Conventions

Every service technician should find time every year or two to visit an engineering electronics convention. A number of these are held throughout the country each year. The two principal conferences are the Institute of Radio Engineers' (I.R.E.) convention held each March in New York City and the WESCON convention held somewhere on the West Coast in August of each year. The latter was held in San Franciso this year; and since this afforded an excellent opportunity to combine a vacation with a little business, a trip was laid out so that we would be in San Francisco at the time of this convention.

An engineering electronics convention is, as its name suggests, devoted to the engineering and theoretical aspects of electronic circuitry and electronic devices. A number of technical papers are given by engineers on a wide variety of subjects all of which relate to some facet of this extraordinary electronics field. Very few of these papers, if any, actually deal with an aspect of servicing; and so, the reader might be led to wonder why he is urged to attend one of the conventions. The suggestion to attend is made not because of the talks which are given but because of the exhibits which to many engineers really form the heart of a convention. The technician will also find these exhibits interesting because he will find clues in them to the forthcoming "new look" in electronics. For example, the present surge toward transistor radios was quite plainly indicated in the WESCON convention of 1954 and in the I.R.E. convention held earlier this year in New York.

Till now, only portable receivers have been transistorized because this has been the most obvious application; however, there is no reason why a conventional home radio should not be transistorized, too. Indeed, one such unit was shown at the last WESCON show. Power is supplied by batteries, and it is estimated that the yearly cost of battery replacement would only be approximately 60 cents as against an estimated $2.50 in power costs that the average set user pays per year for his AC (or AC-DC) receiver. In addition, a transistorized receiver would not be hampered by cords or power outlets. It could be placed anywhere in a house and moved easily when the notion strikes. And last but not least, it makes a small contribution to the relief of overburdened power lines, a problem which is particularly acute in homes that are 15 or more years old.

The mention of this transistorized home receiver should not be taken to mean that all you have to do is attend one of these conventions in order to see next year's models. Such is not the case. Actually, what you glean from the various exhibits is not so much the actual shape of things to come but rather the direction or trend in which electronics engineers are moving in their various investigations. For example, in this year's WESCON show, the dominant impression that this writer took away with him was that there is a gradual veering toward simplification in electronic circuitry, in electronic devices, and in electronics practices.

In the field of electronic devices, computers offer an excellent illustration of growing simplification. These machines are ordinarily thought of as consisting of hundreds of complex circuits which will perform astronomical feats of calculation in microscopic intervals of time; however, at the convention, a definite trend toward the development of small, compact instruments which will perform only a limited set of operations could be definitely discerned. It has been found that such computers are not only easier to operate but that they open up all businesses, large and small, to the benefits of automation. As Robert T. Keller, Vice President of the Chrysler Corporation said on this subject, "We want small, fast, more simply constructed units that can be tied together by mechanical production aids into flexible automation units. The devices do not look as ingenious as the large complex machines, but they are more spectacular in their production records."

If this trend toward small computers continues and their use becomes widespread enough, service technicians may be called upon to maintain and repair them. After all, why not? To some extent we service industrial equipment now (or could, if we wanted to), and a computer is just another piece of industrial gear.

Before you shrug this off as far-fetched nonsense, consider the automatic vacuum-tube voltmeter that was introduced recently. See Fig. 1. This is an "automated" instrument in which appropriate voltage or resistance ranges are selected automatically by the range-selector switch when the probe tip of the instrument is brought in contact with an unknown voltage or resistance. The manufacturer of this unit is the Bergen Laboratories of Fair Lawn, N. J.

The Volt-Ohmatic meter (as this device is called) achieves this automatic range switching by an extension of the circuit operation of conventional vacuum-tube voltmeters to include a feedback path. To get somewhat technical for a moment, conventional vacuum-tube voltmeters can be said to be of the open-loop type. As long as the range-selector

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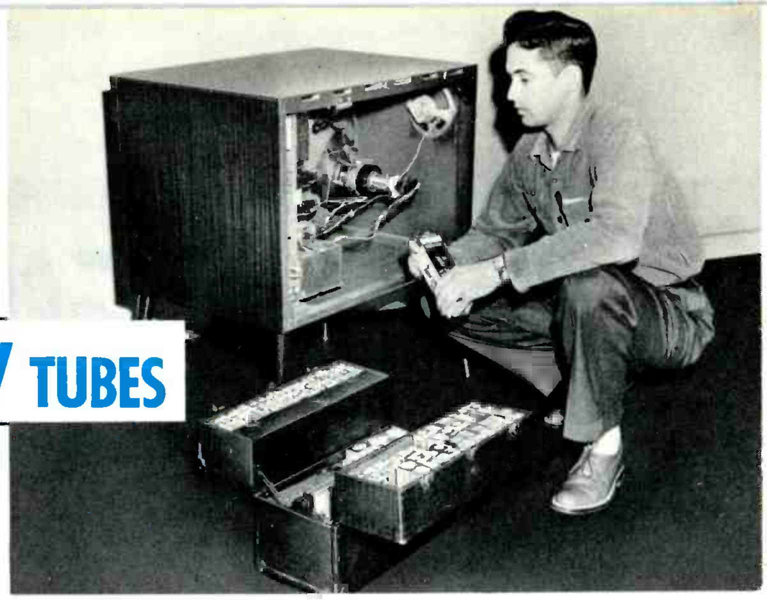

A STOCK GUIDE for TV TUBES

The following chart has been compiled to serve as a guide in establishing proper tube stocks for servicing TV receivers. The figures have been derived by combining (1) a production factor (the number of models and an estimate of the total number of receivers produced by all manufacturers) and (2) a depreciation factor (based on an average life of six years for each receiver, and the figures are reduced accordingly each two months).

1. The figures shown are based on a total of 1,000 units. This was done in order to eliminate percentage figures and decimals. The figure shown for any tube type then represents a percentage of all tubes now in use. For example, a figure of 100 would imply that that particular tube type constitutes 10 per cent of all tube applications.

2. Some consideration should be given to the frequency of failure of a particular type of tube. A tube used in the horizontal-output stage will fail much more frequently than a tube used as a video detector. Thus, even though the same figure may be given for both tubes, more of the horizontal-output type should be stocked.

3. The column headed '46 to '55 is intended for use in those areas where television broadcasting was initiated prior to the freeze. Entries in this column include all tubes used since 1946 except those having a value of less than one, which is the value of the minimum entry in this chart. The '52 to '55 column applies to the TV areas which have been opened since the freeze. Since the majority of receivers in these areas will be of the later models, only the tubes used in these newer sets are considered in this column. The minimum value of one also applies to this column.

4. The listing of a large figure for a particular tube type is not necessarily a recommendation for stocking that number of tubes. The large figure does indicate that this tube is used in many circuits and emphasizes the necessity for maintaining a stock sufficient to fill requirements between regular tube orders.

	46-55 Models	52-55 Models
c0A2	-	-
c1AX2	-	-
c1B3GT	41	44
1X2	4	1
1X2A	3	4
c1X2B	2	2
#*2AF4	-	-
c*3A2	-	-
c3A3GT	-	-
*3AL5	-	-
*3AU6	-	-
*3AV6	-	-
3CB6	3	3
*3CF6	-	-
*3CS6	-	-
*4BQ7A	-	-
*5AM8	-	-
*5AN8	-	-
*5AQ5	-	-
*5AT8	-	-
*5AV8	-	-
*5BK7A	-	-
*5T8	-	-
c5U4G	45	47
*5U4GA	-	-
*5U4GB	-	-
5V4G	6	-
*5V6GT	-	-
5Y3GT	3	2
6AB4	2	2

	46-55 Models	52-55 Models
6AC7	6	6
c#6AF4	3	3
#*6AF4A	-	-
6AG5	26	8
6AG7	2	2
c6AH4GT	3	4
c6AH6	6	8
6AK5	3	3
c6AL5	72	72
6AL7GT	4	-
c6AM8	1	1
#6AN4	-	-
c6AN8	3	3
c6AQ5	13	14
6AQ7GT	2	2
6AS5	3	3
c6AS6	-	-
6AT6	4	3
c6AU4GT	1	1
6AU5GT	3	3
c6AU6	120	112
6AV5GT	2	3
c6AV6	16	18
c6AX4GT	12	11
6AX5GT	1	2
*6AX8	-	-
c6BA6	12	9
6BC5	9	7
c6BC7	-	-
c6BD4A	-	-

A stock of these tubes should be maintained in UHF areas.

* New tubes recently introduced.

c These tubes have been used in color television receivers.

	46-55 Models	52-55 Models
6BE6	6	7
c6BG6G	11	5
6BH6	6	-
6BJ6	1	-
c6BJ7	-	-
c6BK5	3	3
6BK7	3	5
c6BK7A	2	2
c6BL7GT	5	7
c6BN6	5	5
6BQ6GA	1	1
6BQ6GT	18	24
*6BQ6GTA	-	-
*6BQ6GTB	-	-
6BQ7	5	11
c6BQ7A	7	9
c6BY6	-	-
*6BZ6	-	-
c6BZ7	7	2
c6C4	10	9
c6CB6	110	136
c6CD6G	9	10
6CF6	1	1
c6CL6	1	2
c6CS6	2	2
c6CU6	-	-
c6DC6	-	-
6J5	3	3
6J5GT	1	-
6J6	30	28
6K6GT	14	9
c6S4	8	10
*6S4A	-	-
6SH7GT	1	-
6SL7GT	3	2
c6SN7GT	65	71

	46-55 Models	52-55 Models
c6SN7GTA	7	7
*6SN7GTB	-	-
6SQ7	2	2
6SQ7GT	2	2
c#6T4	-	-
c6T8	13	13
c6U8	10	12
6V3	2	3
c6V6GT	19	17
6W4GT	25	27
6W6GT	7	11
c6X8	6	8
6Y6G	2	1
*7AU7	-	-
7N7	2	-
c12AT7	13	13
c12AU7	45	34
c12AV7	3	3
12AX4GT	2	4
*12AX4GTA	-	-
12AX7	4	5
12AZ7	-	2
c12BH7	10	13
*12BH7A	-	-
*12BQ6GTB	-	-
c12BY7	7	8
12BZ7	2	-
*12CU6	-	-
12SN7GT	5	4
*25BQ6GA	-	-
25BQ6GT	3	4
*25BQ6GTB	-	-
25L6GT	5	5
25W4GT	1	1
5642	1	1
c*6505	-	-

POLAR GRAPHS

EVALUATING THE DIRECTIVITY OF TV ANTENNAS

by George B. Mann

The purpose of a graph is to portray by means of a diagram the interrelation of two or more sets of values. When the horizontal directivity of a television antenna is being considered, for example, two sets of data are of primary interest. These are the relative strengths of a signal received by the antenna and the relative positions of the antenna when these signal strengths are recorded. The signal strength which is used as the reference is the maximum that is received during rotation of the antenna, and the reference position is the position at which this maximum signal is received. Other positions are given in terms of degrees of rotation away from the reference position, which is called the "true heading" or the "zero-degree position" of the antenna.

When displayed on a graph, an antenna field pattern should convey a maximum amount of information to the reader. In order to fulfill this consideration, the graph should be designed so that a minimum amount of effort will be required by the reader to interpret the information.

Rectangular and Polar Co-ordinates

The graphs in Figs. 1 and 2 are shown to illustrate the difference between two systems of plotting an antenna field pattern. In Fig. 1, a pattern has been plotted by the use of rectangular co-ordinates. The percentage of maximum signal received by the antenna is plotted in a vertical direction. The rotation of the antenna in degrees from true heading is plotted on the graph in a horizontal direction.

In Fig. 2, the same field pattern has been plotted by the use of polar co-ordinates. This kind of graph is particularly descriptive when one set of values stands for rotational movement or position and could be used in the case of antenna directivity. The percentage of maximum signal received by the antenna is plotted in Fig. 2 as a radius vector or, in other words, as a distance from the pole (or center) of the graph. Each antenna position is plotted in degrees from the zero-degree position. The degrees are customarily marked off as shown in Fig. 2. The information provided by point A in Fig. 2 is that a signal strength which is 80 per cent of maximum is received when the antenna position is 20 degrees from a true heading. Point A would usually be designated as "radius, 80 per cent; and angle, 20 degrees."

Recording Field Patterns

The usefulness of a field pattern plotted in polar co-ordinates can best be explained by a review of the system which is used in recording a field pattern. The recording must be carried out under almost ideal conditions. The receiving antenna and the transmitting antenna are generally mounted in such a way that they are out of the way of all obstructions. One arrangement commonly used is that of mounting the antennas on high towers. This reduces signal reflections and the effects of ground; moreover, the towers used to support the antennas are constructed of wood so that the reflected signals will be reduced to a minimum.

In making field-pattern recordings, it is convenient to have as few variables as possible; therefore, the transmitting antenna used as a radiating source is chosen for complete coverage of the television and FM frequencies. Usually, this broad-band radiator is secured permanently to the transmitting tower and is positioned to direct a signal toward the receiving antenna. A broad-band transmitting radiator permits tests to be made at various frequencies without the necessity for changes at the transmitting site.

The receiving antenna is installed on a rotor-driven mast atop the receiving tower so that the antenna can be rotated through a 360-degree arc. The signal received by the antenna is detected, and the signal level is read on a field-strength meter. Since the signal from the transmitting source is maintained at a constant level, any change in the strength of the received signal will have a definite relationship to the position of the receiving antenna. If this change is recorded on a polar graph, the resultant curve will show the directional characteristics of the antenna.

Plotting Polar Graphs

Point-to-Point Recording

One system of plotting a polar graph of antenna directivity is to measure the signal received by the antenna at regular intervals of rotation. The antenna is first rotated to the position at which a maximum signal is indicated on the field-strength meter. This is the zero-degree position.

Assume that a maximum signal of 500 microvolts is indicated on the meter. This is the first plot point and is recorded on the graph as point No. 1 at a radius of 100 per cent and at an angle of zero degrees. See Fig. 3. The antenna is then rotated 10 degrees, and a signal of 475 microvolts is read on the meter. This reading is 95 per cent of the maximum receivable signal; and therefore, the second plot point will be at

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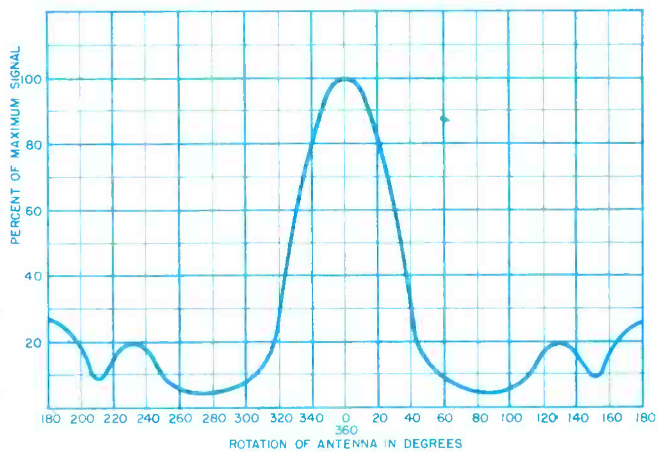

Fig. 1. Antenna Field Pattern Recorded in Rectangular Co-ordinates.


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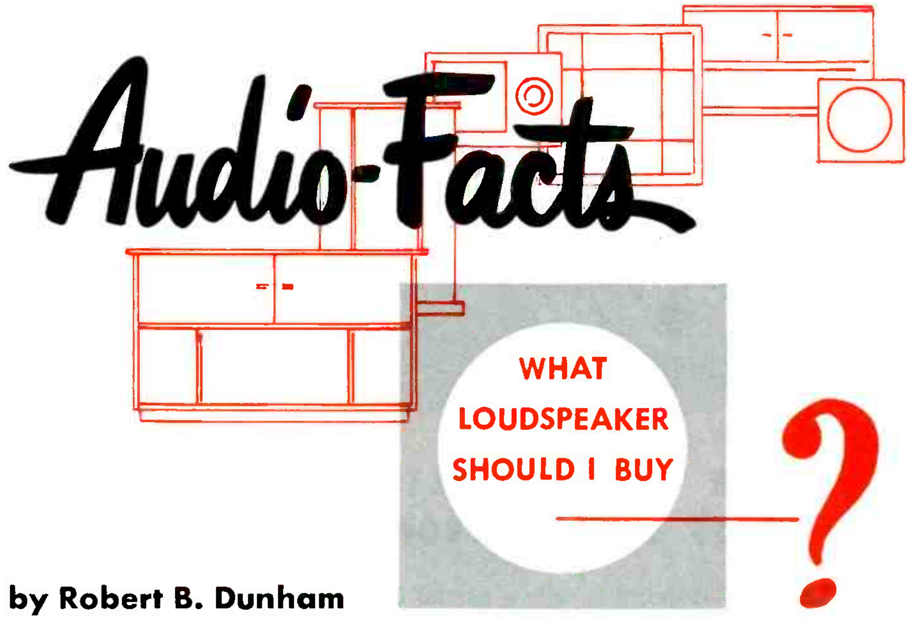
Imp
Burton Browne / New York



Audio-Facts

What Loudspeaker Should I Buy?

by Robert B. Dunham

What can any of us who are active in audio work (and who should consequently know something about the subject) answer when some one asks, "What loudspeaker should I buy?"

The author has heard this question more often than any other from individuals who already own an audio system and from those who are in the process of acquiring a home music system. The desire for information about loudspeakers was probably one of the chief reasons why many of the thousands of visitors attended the audio shows of last fall. It was observed that after these visitors and prospective buyers had looked and listened and had asked innumerable questions, most of them still seemed to be confused and undecided about loudspeakers.

Loudspeakers have been discussed several times in these columns; but since they are such controversial pieces of equipment, we should be able to consider some important points regarding the selection of a suitable unit without overworking the subject. It would certainly be worth while if some suitable answers could be given to the problems which are encountered by most people when they select a loudspeaker.

Besides the characteristics of the loudspeaker itself, some other factors must be considered in the selection of a loudspeaker. When we mention loudspeaker in these paragraphs, we are speaking of a unit complete with drivers, enclosure, networks, and any other necessary accessories. These factors include among others; the tastes and ideas of the individual or individuals who will listen to the loudspeaker, the place where it will be used, the manner in which it will be used, and the cost.

A look at the small Karlson "8" enclosure (which contains an 8-inch driver and which measures 17 1/4 by 11 3/4 by 10 inches) and at the large Electro-Voice Patrician (which has a four-way system, stands 62 inches high, and weighs over 300 pounds) would be enough to indicate that each has its place. Each unit is capable of excellent reproduction when used for the purposes and under the conditions for which it was designed. One unit might be chosen instead of another because of physical size, power rating, or price; but many other things must be considered in addition. If each one of the significant factors that influence the choice of a loudspeaker were to be thoroughly investigated, it would be found that some factors would overlap and depend to a great extent upon the presence of others.

Consider this example. A certain tired businessman, who likes to close the door and listen in privacy to nothing but harpsichord recordings, wants a suitable driver mounted in a small enclosure which will fit on a bookshelf in his "library" (that is what he likes to call the converted broom closet). A loudspeaker is selected to give very good results in this situation, and the man is very happy with his music system. A few weeks later, however, he decides to fill his house with friends and neighbors to listen to his collection of spectacular demonstration records. He moves his entire music system into the parlor so that his guests can hear such things as the way a double-header New York Central train would sound if it should come in through the front door and blast its way out of the house via the breakfast-room window. In this new situation, he finds that he is disappointed in the performance of his music system.

All of this may sound facetious, but it is typical of the situations so often encountered when dealing with audio enthusiasts. It also serves to illustrate that a change from low-level reproduction in a small room to high-level reproduction in a large room will change the demands made upon a loudspeaker.

The individual who wants to listen to music can derive a lot of enjoyment from listening to a home music system that provides balanced and undistorted reproduction. The system can be large or small high-powered or low-powered; but as long as it is operating properly, it will sound all right. If another loudspeaker is installed alongside the original one and if some AB tests (comparison checks of loudspeaker A versus loudspeaker B) are made by switching from one to the other, the listener will undoubtedly detect a noticeable difference. The peculiar thing is that the listener usually cannot explain what the difference is. In all probability, he will be unable to decide which speaker he thinks is better than the other. Sometimes, he can decide that one is better than the other; and then after a short time, he will find that he has changed his mind and that he thinks the other one is better.

Actually, any one of a great number of loudspeakers is suitable for use with a good audio system. Some loudspeakers are deficient in certain respects when they are compared with others; and those that are really inferior can be detected very easily when compared with a good one. In actual practice, when a home music system is in operation, the controls are usually adjusted so that the music will sound the best. In this way, if a loudspeaker is deficient in some respect, the deficiency is compensated for by the adjustment of the controls. Some deficiencies cannot be completely eliminated or masked; but if they are not too noticeable, they will not detract from the enjoyment gained from listening to the music.

We have developed a conviction that the person who listens to his home music system because he likes to listen to music can use almost any one of the great number of medium-sized loudspeakers that are supplied by so many well-known manufacturers. If the rest of his audio system is good, he will be very happy with the

reproduction of music obtained from it. Perhaps he had to select the loudspeaker because of its cabinet or because it sold for a price that he could afford. Even so, if it was produced by a reputable manufacturer, he made no mistake in choosing it.

If the owner of an audio system becomes dissatisfied with his loudspeaker and decides that it is not good or if he is one of the enthusiasts who is more interested in the sounds or effects that a loudspeaker can produce and is less interested in music, then it is a different story. In these cases, problems of selection are encountered.

Maybe the dissatisfied owner who is unable to decide what loudspeaker he should buy has been present at too many demonstrations and sales talks given by salesmen who have stressed that one particular unit is the only one that is good and that all of the others are inferior. There are a number of really confused individuals who arrived at that state after visiting two or three audio salesrooms and after listening there to the pro-and-con arguments about certain loudspeakers.

If a listener who likes music does not hear live music occasionally, he may lose some of his ability to judge the performance of a loudspeaker. He may actually forget how live music sounds. The person who likes effects and spectacular sounds may not care whether the music sounds like live music or not. He will be listening for sounds.

At a recent audio show, the author was standing near two men as they listened intently to a demonstration of one of the largest and most highly regarded loudspeaker systems. During the reproduction from tape of some kettle drums (which sounded very real to the writer), one of the men turned to the other and said critically, "You know — that sounds sort of hollow to me." Surely, this listener missed some of the value of this demonstration because he did not realize that kettle drums actually do sound hollow in a live performance.

Perhaps the person who is selecting a loudspeaker wants to buy the "best one made," and he is willing to pay whatever is necessary. Then we have a situation similar to that of deciding which is the best automobile. We find that we have experts who say this one is best and experts that claim another one is the best. They can explain the reasons why. How are we going to prove which one is right? Of course, these experts do agree on most major points; but it is still necessary for the individual to make the decision. If he can make up his mind that a certain one is best, he knows he will be buying the best one and can be happy.

Audio enthusiasts can become so delighted with the technical aspects of the equipment in their audio systems that they derive their greatest pleasure from experimenting, from trying for spectacular effects, and from lots of just plain arguing on the subject. This is the audio fan who so often becomes dissatisfied with his loudspeaker. He finally finds another one which he decides is the one for him; and after acquiring it, he uses it until he becomes dissatisfied again. This can go on and on, but it does serve a purpose — greater experience and knowledge are gained.

In addition to being difficult to select, the loudspeaker of an audio system seems to be the part that receives the most criticism, undergoes the most experimentation, and is most often replaced with a "better" one. These reactions by owners are apparently due in part to the fundamental principles upon which a loudspeaker operates. These principles include considerations that are electrical, mechanical, acoustical, and psychological — and those make quite a combination.

Loudspeakers are different from other pieces of audio equipment such as amplifiers. An amplifier can be designed to produce certain definite results; and when the unit has been completed, precise measurements can be made to verify the results. Different manufacturers can produce amplifiers which differ in design but produce the same desired results. A good amplifier can amplify a signal without otherwise changing it to any great degree.

A loudspeaker performs the important function of changing the electrical signal into an acoustical signal. This action and the results it produces cannot be measured with ease or with the precision associated with scientific measurements; therefore, the human element enters into any evaluation of a loudspeaker.

No loudspeaker can do a perfect job of reproducing every sound in the range of audible frequencies. The usual loudspeaker produces many peaks and leaves many holes in its response throughout its frequency range. Even though the loudspeaker (woofer, midrange, or tweeter) is used for reproducing only a limited range of frequencies, it still cannot reproduce sound perfectly. Every loudspeaker has certain characteristics that tend to color the sound it produces. Every driver unit and every enclosure has these characteristics; therefore, a certain driver unit when installed in one enclosure can sound very different when installed in another enclosure. The same thing can happen if different driver units are tried in a certain enclosure.

These characteristics are the ones that are taken into consideration when a driver unit is matched with an enclosure. By making a careful choice of driver and enclosure, the user can eliminate or reduce the undesirable characteristics of one or both units and can retain or emphasize the desirable characteristics. This could be a source of many ideas to anyone interested in improving his loudspeaker, and the ideas could develop along many different lines.

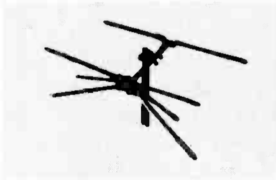
Driver units now in general use have all been developed on certain basic principles, and most enclosures are of a few basic types. Much of the similarity ends there because each designer and manufacturer developed his units according to his ideas of how a loudspeaker should be made and how it should operate. The ideas of one designer may be practically the opposite to those of another, but the loudspeakers produced by each one can provide excellent reproduction even though the loudspeakers differ in design.

Studying the philosophy behind the deisgn of different loudspeakers is very interesting, but the many different types of loudspeakers produced from these designs can certainly present a confusing problem to a prospective purchaser.

Most people know that loudspeakers are produced in a wide variety of physical sizes as well as in a wide range of power ratings. This problem of choosing a loudspeaker is further complicated by the fact that a small low-powered loudspeaker is not necessarily the best one to use with a small low-powered audio system. Some of the largest loudspeaker systems (in fact most of them) are so efficient that they provide adequate levels of volume even though the amplifiers connected to them may be operating at very moderate levels. By virtue of this efficiency, a good low-powered amplifier can operate well within its limits of capabilities and provide high quality reproduction at high levels of volume.

Some small loudspeakers, particularly if small inefficient drivers are used, are very inefficient and consequently cause a low-powered amplifier to be driven beyond its

* * Please turn to page 52 * *



TELCO SCOUT 3 ANTENNA
Eight elements; for low channels.
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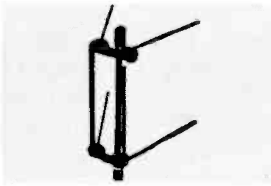
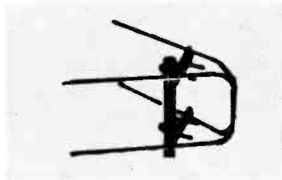
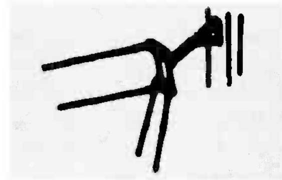


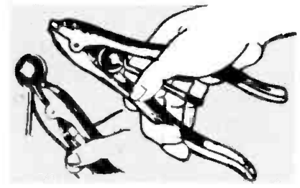
TELCO DOUBLE V ANTENNA
Adjustable UHF & VHF...Channels 2-83.
No. A-9010 NET $3.75



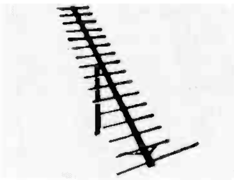
TELCO U-TYPE DOUBLE V ANTENNA
Adjusts to any V angle; VHF-UHF.
No. A-9017 NET $3.57



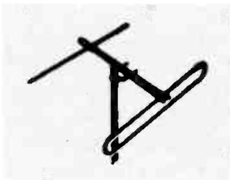
TELCO DOUBLE V WINDOW-TENNA
UHF-VHF; mounts on window frame.
No. A-9057 NET $5.37



TELCO STAND-OFF "EYE-OPENER"
Handy tool for faster installing.
No. 8450 NET $0.75

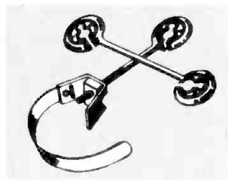


TELCO UHF GOLDEN YAGI
16-element style, cut to channel.
No. A-325 NET $4.92

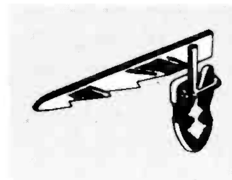


TELCO HI-LOW DIPOLE ANTENNA
Pre-assembled; VHF chs. 2-13.
No. A-250 NET $5.22

TELCO E-Z STAND-OFF
UHF-VHF; 3½" machine screw.
EZ-8031 NET $4.80/C



TELCO E-Z KANT-STRIP STAND-OFF
7½" 3-way; 9" stainless strap.
EZ-8396 NET $0.33



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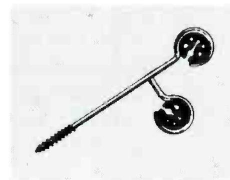
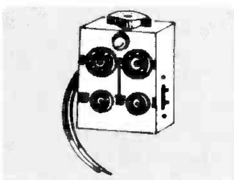
EZ-8751 NET $0.15



TELCO DUPLEX STAND-OFF
7½" in-line duplex wood screw.
No. 8225 NET $0.15



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Series fil. and continuity tester.
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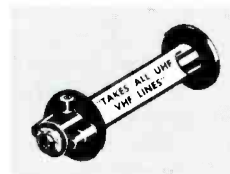
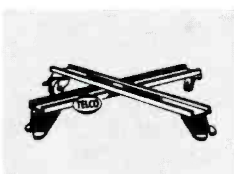
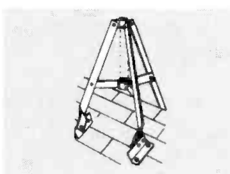


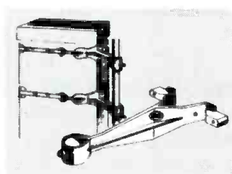
TELCO UNIVERSAL LEAD-IN TUBE
Fits ¾" hole, 14" wall; brown.
No. 8958 NET $1.17



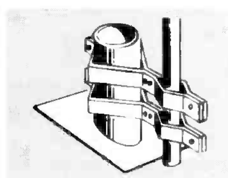
TELCO TV SET ROLL-AROUND
Fits all sets, easy to install.
No. 8957 NET $5.97



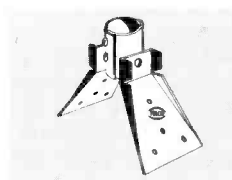
TELCO TRIPOD TOWER BASE
Supports 10' masts without guys.
No. 9063 NET $4.17



TELCO CHIMNEY MOUNT BRACKETS
Cast alum. pair for 1¼" masts.
No. 8001 NET $4.05



TELCO VENT MOUNT
Holds mast to 2" to 4" vents.
No. 8802 NET $1.35



TELCO UNIVERSAL RIDGE MOUNT
Adjustable to peaks, flat roofs.
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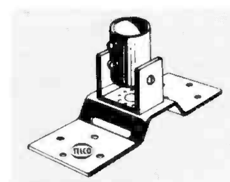
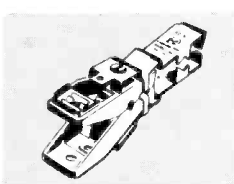
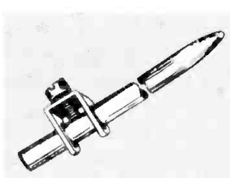


TELCO FITZ-ALL MOUNT
Use anywhere; masts to 2".
No. 8804 NET $1.77



TELCO 3-WAY TV LINE KLIP
For straight, side, plug-in (RCA).
No. 9015 NET $0.13



TELCO GROUND ROD
4 ft. long; ⅜" diameter.
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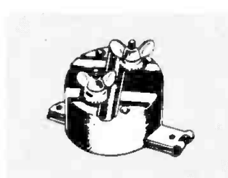

TELCO UNIVERSAL LIGHT. ARRESTOR
UL approved; UHF and VHF.
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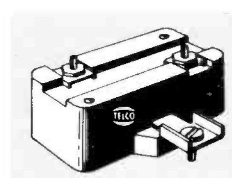
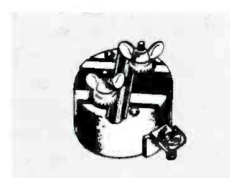
TELCO ACRYLIC SPRAY-KOAT
Fast-drying outdoor-indoor use.
No. 8665 NET $1.19

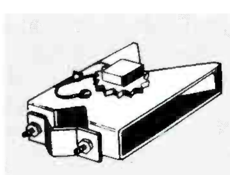


TELCO SPECIAL LIGHT. ARRESTOR
For 300-450-ohm open line; UL.
No. 8640 NET $0.60

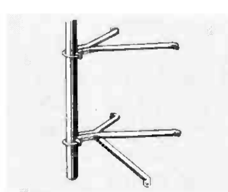


TELCO DELUXE LIGHT. ARRESTOR
For all types TV lines, VHF & UHF.
No. 8642 NET $0.75

TELCO RIGID-TYPE TV BASE
Smart wrought black finish.
No. 9082 NET $3.57



TELCO RATCHET CHIMNEY MOUNT
Galvanized straps; masts to 1¾".
No. 9218 NET $2.37



TELCO TUBULAR WALL MOUNT
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SERVICING RECEIVERS of UNKNOWN ORIGIN

BY VERNE M. RAY

How many times have you been requested to service a television receiver having a brand name you never heard of and for which you cannot locate any related service literature? Sooner or later this problem confronts every service technician in the television field. Our motive in publishing this article is to explain why this problem exists and to aid the technician in locating the service information which will help him to complete the repair of such receivers.

Basic Types of Brand Names

Brand names can be classified into three basic groups. First, there are brand names of receivers which are advertised and distributed nationally. These usually carry a registered trademark or a name associated with the manufacturer. Obtaining service information about receivers with these brand names is no problem because the service literature is widely distributed by both the manufacturer and the companies that publish such literature.

Brand names in the second category are for receivers distributed and sold by large retail organizations which belong to a co-operative purchasing group. This group may consist of chain stores, mail-order houses, department stores, and the like. Receivers sold by these organizations are usually purchased in large quantities from a manufacturer and are widely distributed under brand names which are well-known in the industry. As a result, service literature covering receivers bearing these names is also readily available.

It is estimated that at least ninety per cent of the television receivers in use today fall into these first two categories. This leaves ten per cent in the third category which involves approximately three and a half million receivers with little-known brand names. When it is considered that there are only a few dozen to several thousand receivers of each brand and that there may be design variations between receivers which carry the same brand name, it can be seen that the procurement of applicable service literature for a specific chassis may present somewhat of a problem.

There are various sources of receivers with brand names that are not well-known. A manufacturer may wish to dispose of chassis at the end of a production run, and therefore he may be willing to allow a merchandiser to sell them under another name. Some manufacturers may sell small quantities of chassis from their regular production run and allow them to be distributed under another name. A few manufacturers have gone bankrupt and have salvaged inventories by assembling receivers to be sold under another name. At least one company is in the business of manufacturing small quantities of receivers to be sold under various brand names chosen by the retail merchants.

The net result is the existence of receivers bearing names which are unfamiliar to many service technicians. In most cases, the distribution of such receivers carrying a specific brand name will not be nationwide but will be concentrated in a specific area. Sometimes a manufacturer will not maintain proper records showing the chassis which were built for each brand name, nor will he produce enough sets of a given brand to warrant the expense of printing and distributing service literature for each brand. The manufacturer may feel that the expense of printing manuals to cover the circuits incorporated in only a few hundred receivers cannot be justified.

From what has been stated up to this point, the reader may have correctly surmised that many of the receivers in the last category are very similar to some of those for which service literature has been published and distributed. As a result, the technician who already has a fairly complete file of service data will find that some of it will aid him in the servicing of unfamiliar brands. For instance, it is possible that the chassis used in one brand of receiver may be exactly the same as that used in another and that both chassis were manufactured by the same company. It is not possible for the manufacturer of the chassis nor a publisher of service data to state such facts unless it is mutually agreeable with the manufacturer and the brand-name organization. For obvious reasons, such an agreement is seldom reached.

In cases in which two receivers are alike in every respect except for the name, service literature may be distributed on both receivers in the form of two different pieces of literature. If the production of one of the receivers were very limited, manuals which specifically cover these receivers may not have been printed; however, a service-literature index may list the name of the receiver and

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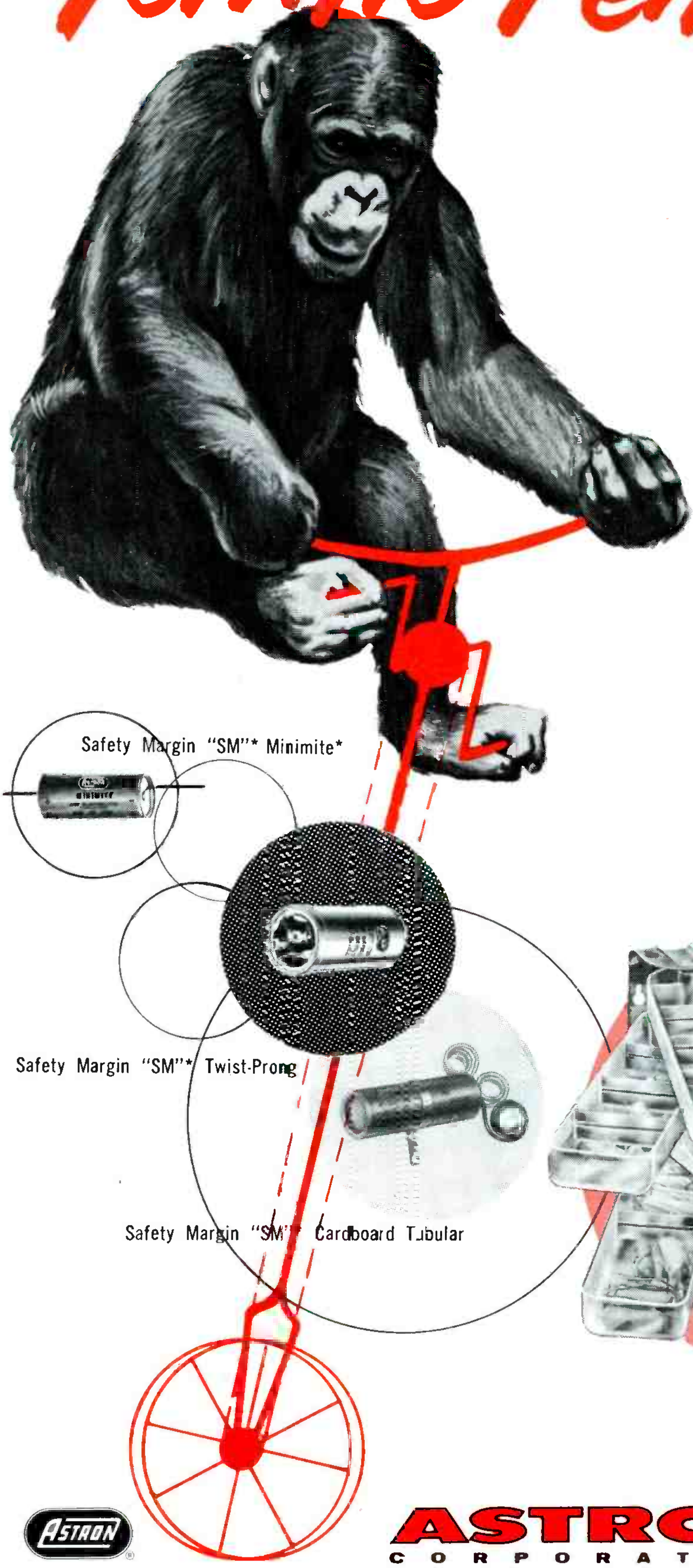
Terrific Performance



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Dollar and Sense Servicing

by *John Markus*

Editor-in-Chief, McGraw-Hill Radio Servicing Library

TRAFFIC-STOPPER. A wooden Indian with an electronic brain stands out on the sidewalk in front of T. L. Kidd's radio and TV repair department in Kingsburg, Calif., advertising the business and providing a lot of fun besides. When Old Kaligah twinkles his electronic eyes and puts out his shaking hand as his quavering jaws grunt out a greeting, nervous women take one look, scream, and take off. When Kaligah calls old people by name and carries on a conversation, they go away talking to themselves. Kids love him, though, and ask all kinds of questions for which his hidden master just doesn't know the answers. But everybody in town knows where that shop is, which is the chief purpose of the advertising.

"I thought him up while at the Lions Club one night. It took me three months of hard work to build him, but the fun and advertising we have received have more than repaid us for the hard work and expense of building him," writes National Radio Institute graduate Kidd in National Radio-TV News.

Old Kaligah's head is carved out of redwood and contains a sensitive relay which operates the hinged lower jaw in perfect synchronism with the voice. The 6AF6 eyes also are voice-operated. In the feathers atop the head is a hearing-aid microphone so that the operator at the remote-control panel can hear all that goes on. The head is turned by the motor of an Erector set to face the person to whom he is talking.

Another Erector-set motor extends the right arm for a handshake. A stiff spring in the motor drive permits a vigorous shake without stripping gears. An insufficient number of motors in the Indian keeps the left arm hanging idle.

Inside the chest are two amplifiers. One feeds the loudspeaker in his chest to provide his voice, either from the remote microphone or a tape recorder. The output of a phono turntable can be mixed in when Old Kaligah is requested to sing or yodel.

The other amplifier is a 2-tube DC amplifier that operates at cutoff until a sound builds up a positive charge on the grid capacitor. This then allows the output tube to draw current through the sensitive relay that moves the hinged lower jaw. The slight slap each time the jaw closes gives Kaligah's words a decided snap of authority.

Thus did an advertising discussion at a Lions Club meeting pay off. Give a thought to applying for membership in your own local club or a similar businessmen's organization dedicated to helping others. You benefit in proportion to your own participation, and oftentimes these benefits are quite unexpected. Give, and ye shall receive.

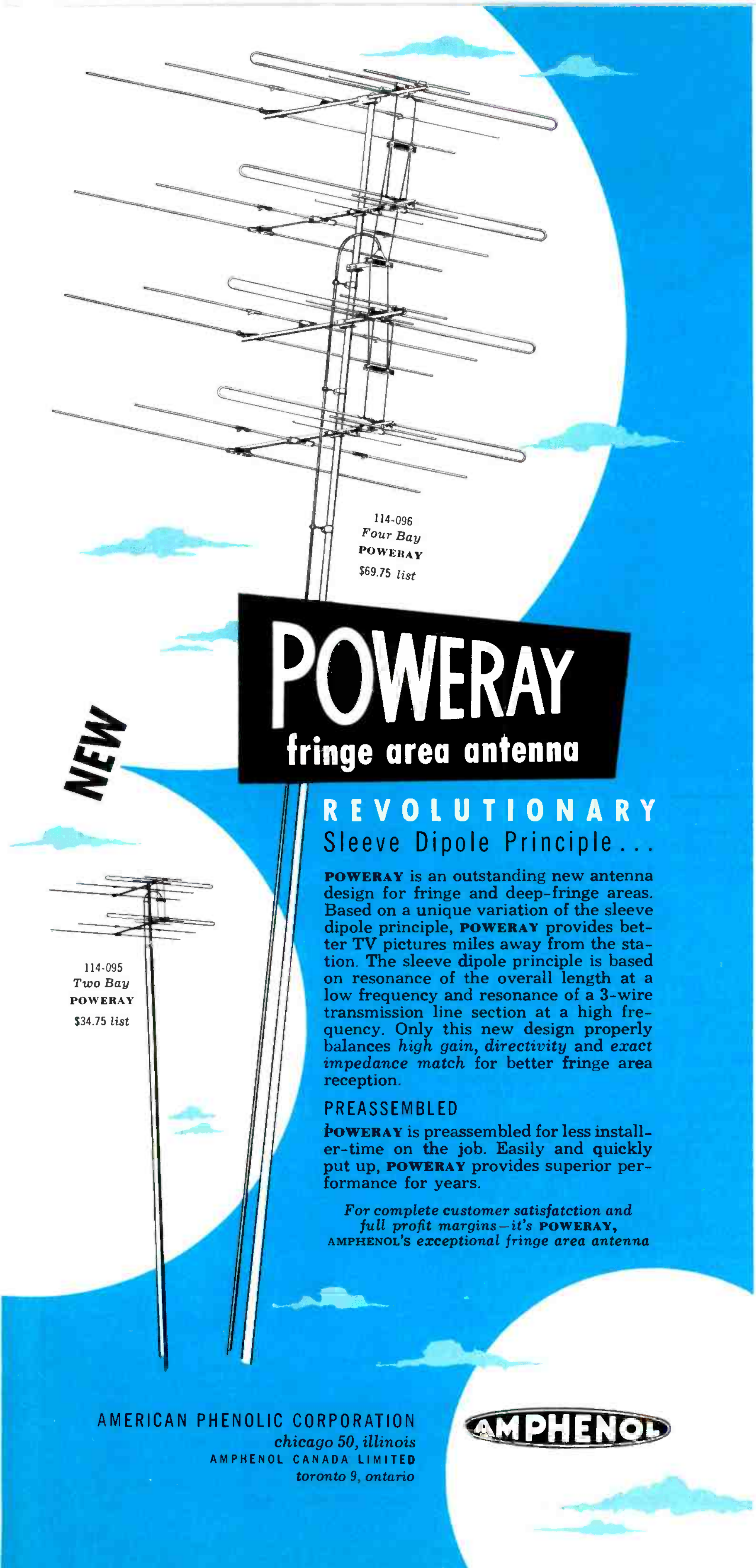
SUPERMARKETS. The new simple-to-use tube testers are starting to show up along with stocks of new tubes in supermarkets, drug stores, and hardware stores. The first reaction of many service technicians to this sight is resentment, but there is really nothing new about the practice. We had it back in the early days of radio when even the dime stores and auto-supply stores had testers and sold tubes. It has come back as part of the current nationwide do-it-yourself fad. People want to have a try at replacing tubes in an ailing set before calling in a service technician; so, the stores are meeting the demand for tubes and testers. The fact that these tube testers cannot show up all of the troubles in TV tubes is unknown or ignored by the home handyman.

Actually, the supermarkets may be helping the servicing business. When the customer can't fix the set by putting in new tubes, he's ready to acknowledge that an expert is needed and he's in the right frame of mind to pay for professional know-how. If you encounter a customer who tells you that he has fixed his own set on a previous occasion, do not ridicule him. Instead, compliment him for having successfully repaired such a complicated electronic device. Then proceed to fix his set in a professional way.

DRINKING. Pubs in Norfolk, England, petitioned for later closing hours on the grounds that TV was keeping home until 9 p.m. the customers who used to show up regularly at 7. In sympathy, local authorities approved the flow of beer for an extra half-hour.

CLIPPING. To keep used TV sets moving steadily off the floor, Minneapolis shop owner Don Gabbert clips corners. When the dust starts to collect on the set, he clips one corner of the price tag; this means that the commission has been boosted to 5 per cent. When two corners are clipped, the man who sells the set gets 8 per cent. This technique stimulates the interest of salesmen because it boosts their income; whereas, cutting the price of the set means less income when commission is fixed.

SAGE. Still pretty much top secret is SAGE, the code name of a vast semi-automatic radar air-defence network under construction for the Arctic outposts of North America. The letters stand for Semi-Automatic Ground Environment, in case any of your customers ask.



SCATTERCASTING. You'll be hearing a lot from now on about a brute-force broadcasting technique that just shoots the works at the sky in a specific direction. The transmitting equipment consists of up to 50-kw transmitters with 23-db-gain antennas that give an effective radiated power up to 10 million watts in the VHF band. This is the most powerful ever achieved in radio communication. A highly sensitive receiver can be hooked up to a high-gain antenna that is focused on the signals scattered in the E-layer of the ionosphere and will give reliable reception day and night for distances as great as 1,300 miles — way beyond the line of sight. There is no fading and none of the other drawbacks of older point-to-point long-distance radio communication; the equipment itself is now the limiting factor on reliability.

Pickup of the scattered signal from an ionospheric layer that heretofore was believed to pass all VHF signals has been compared to seeing in the clouds at night the lights of a distant city over the horizon.

TILT-OUT. To aid in servicing series-filament vertical-chassis TV sets, CBS has put hinges at the bottom of the chassis on sets in their 1956 line. When the back cover is removed, the chassis can be swung out and down to an angle of 45 degrees, where it is held by brackets. This permits access to both top and bottom at the same time so that open heaters can be located and repairs or adjustments can be made. Tubes can now be replaced in less than half the time formerly required.

If you like this thoughtful consideration of servicing problems, say so loud and clear after you've worked on a few of these sets. Say it to CBS so they'll continue the practice, and say it to other set manufacturers so they'll follow suit or come up with something better.

HIGHWAY HI-FI. Optional in the 1956 Chrysler line is a 16 2/3-rpm phono that fits under the dashboard and plugs into the car radio. The phono motor operates off the car's storage battery. Special 7-inch Columbia records having up to 35 minutes of playing time will be available for this new CBS-Columbia development.

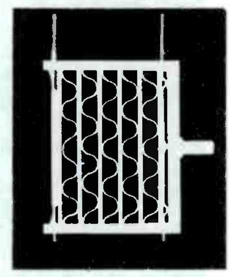
* * Please turn to page 53 * *

RCA SELENIUM RECTIFIERS

-one comprehensive line for virtually all replacement requirements!

Now, RCA offers you a top-grade line of selenium rectifiers for general replacement use in TV, radio receivers, and phonographs. Advanced design, select raw materials, and superior workmanship give you a *dependable line* of selenium rectifiers *for virtually all* service jobs.

Advanced Design for Dependable Performance and Long Life



Note the wide-open plate spacing for elimination of solid center "hot spot." Design utilizes corrugated spacers for *excellent heat dissipation and rigid construction for rugged service.*

NEW—smaller size . . . for any given current, they are smaller than other types.

NEW—quicker installation . . . integral mounting stud.

NEW—wide-open design . . . insures maximum heat dissipation, cooler operation . . . no center "hot spots."

NEW—rigid construction . . . for rugged service.

RCA SELENIUM RECTIFIERS—*a comprehensive line*—for consistently good performance, easier installation, longer life and customer satisfaction. ORDER FROM YOUR RCA DISTRIBUTOR TODAY!

WIDE SELECTION OF 12 TYPES

Max. Output ma	Max. Input volts	RCA Type
65	130	205G1
75	130	200G1
100	130	206G1
150	130	201G1
200	130	207G1
250	130	208G1
300	130	202G1
350	130	209G1
400	130	203G1
500	130	204G1
400*	130	210G1
500*	130	211G1

*Special thin types for use where available space will not permit the use of type 203G1 or 204G1.

RADIO CORPORATION of AMERICA
ELECTRONIC COMPONENTS HARRISON, N. J.

Ungar

SOLDERING IRONS
ESPECIALLY DESIGNED

FOR PRINTED CIRCUITS

- *It's compact — takes up little room in kit.*
- *Draws only 23½ watts.*
- *Series of interchangeable tips makes this an all purpose iron. From 23½ to 47½ watts.*
- *New Super Hi-Heat (4000 series tips) will solder ground connection to chassis. Actual tip temperature up to 1000°F delivering as much heat as a 150 watt iron.*
- *New iron plated tiplets . . . last 10 times as long.*
- *Low cost.*

Don't botch up a costly printed circuit by using any conventional iron or gun. Use an UNGAR. It's *especially* designed to service printed circuits. The proper tool will save you costly trouble. Otherwise, it's like catching a rat in a bear trap — it might work but in all probability it won't. Don't take unnecessary chances. Ask your jobber for the UNGAR Heavy Duty handle No. 776 and threaded heating unit No. 535 with ⅛″ tiplets. Available through jobbers everywhere.

Write for free printed circuit folder

Ungar ELECTRIC TOOLS, INC.

P.O. Box 312, Venice, Calif.

Maintenance of Tape Speed

(Continued from page 17)

care and if not overloaded by some abnormal condition.

Conditions Causing Wow and Flutter

Wow, which is a term for comparatively slow variations in the recorded signal, is due to variations in tape speed. Signal variations that occur at a high rate of speed are called "flutter." Both are very appropriate terms because they give accurate descriptions of the effects heard when the tape is played.

The tape-speed variations that are responsible for wow and flutter can be caused by one or more of a number of conditions which place a varying load or drag on the mechanism moving the tape. These conditions are usually caused by damage, wear, or misadjustment of some moving parts; by lack of lubrication; or by contamination with some foreign substance.

As mentioned previously, the lack of proper lubrication of an idler wheel, pulley, or pivot point can cause wow. If the surface (that makes contact with the driving parts or the parts being driven) of an idler wheel or pulley becomes contaminated with grease, oil, or some foreign substance, wow can result from slipping or other irregular action. If the working surface of an idler wheel, pulley, or drive belt is damaged or worn, the irregular action will certainly be heard as wow. The obvious cure for worn or damaged parts is to replace them, but replacing parts will probably not be required as often as lubrication and adjustment of the mechanism.

As in the case of induction motors, many of the idler wheels and pulleys are fitted with bearings that should require no lubrication. Others should be oiled at regular intervals, as specified by the manufacturer. SAE 10 or SAE 20 motor oil is often specified for fast-turning pulleys or wheels. The precaution of not oiling to excess must be observed because no oil or grease can be tolerated on the working surfaces of idler wheels, pulleys, belts, or any parts that contact the tape. Contamination of these surfaces is probably the most common source of erratic operation.

Pivots or slides (Figs. 2 and 3) that are slow moving or restricted in movement are usually lubricated with some form of grease such as Lubriplate. Some of these points in some recorders require no lubrication because of the type of material used; consequently, once more the recommendations of the manufacturer should be followed.

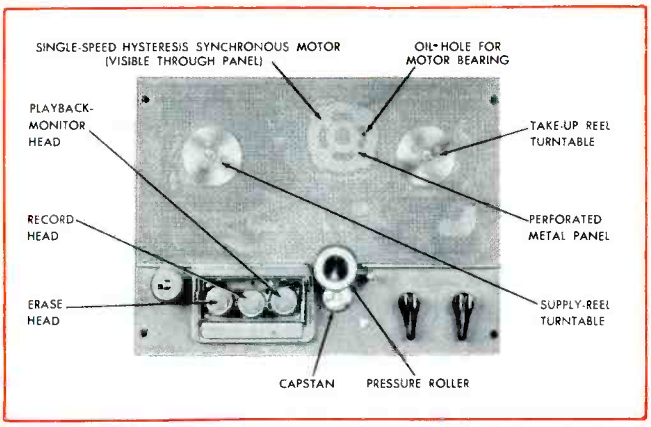


Fig. 4. Tape-Transport Section of Ampex Model 600.

The surfaces of idler wheels, pressure rollers, and capstans should be cleaned with carbon tetrachloride or alcohol. The choice depends upon which is specified by the manufacturer. When either one of these cleaners is used, the surfaces should be cleaned carefully. A clean cloth should be used and just enough of the fluid to clean the surfaces that should be cleaned without touching or disturbing other parts.

When cleaning the pressure rollers and capstans shown in Figs. 4 and 5, the faces of the heads should be cleaned also. Carbon tetrachloride or alcohol can be used with the aid of a clean cloth or a pipe cleaner. As before, use care and apply just enough fluid.

This cleaning of the heads, capstan, and pressure roller is required because in addition to contamination from the sources mentioned, the tape itself usually leaves a deposit on their surfaces. After a period of use, the deposit (most of which comes from the magnetic coating and the lubricant now used on most tapes) can be seen on the capstan and pressure roller. The deposit cannot be allowed to build up too heavily because the tape must make constant and clean contact with these surfaces. Otherwise, the sound quality will suffer, and flutter may be produced.

While discussing the lubricating and cleaning of the capstan and capstan pressure roller, we should mention the importance of adjusting the pressure roller for correct pressure. Flutter and all manner of variations in the signal can result if the pressure is too light to maintain correct tension and tape movement. On the other hand, if too much tension is applied, a very heavy strain (load) is placed upon the motor and the bearings involved.

The pressure roller of the Concertone Model 1502 can be adjusted by turning the adjustment screw which is indicated in Fig. 5. While the recorder is operating normally (in either the record or playback mode), the adjustment is turned until the pressure exerted on the tape and capstan is increased from too light an amount to an amount which is sufficient to reduce to a minimum any flutter or variations heard in the monitored output. The screw is then locked in position by a lock nut.

In the next article of this series, we will continue the discussion of the adjustment and maintenance of tape recorders. It may seem that motors were given a lot of space, but they certainly are important. Other things such as brakes, tape tension, and equalization are also important and will be considered.

ROBERT B. DUNHAM

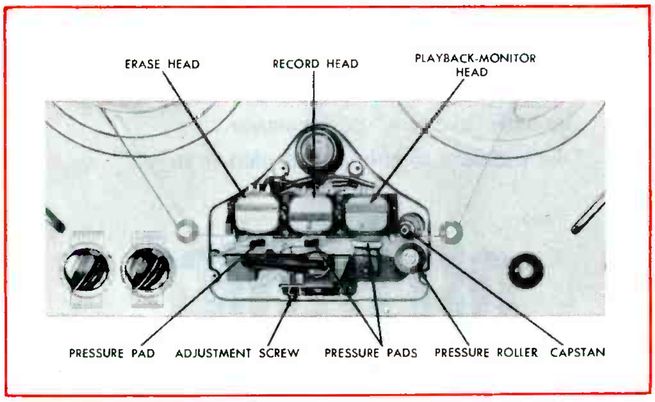
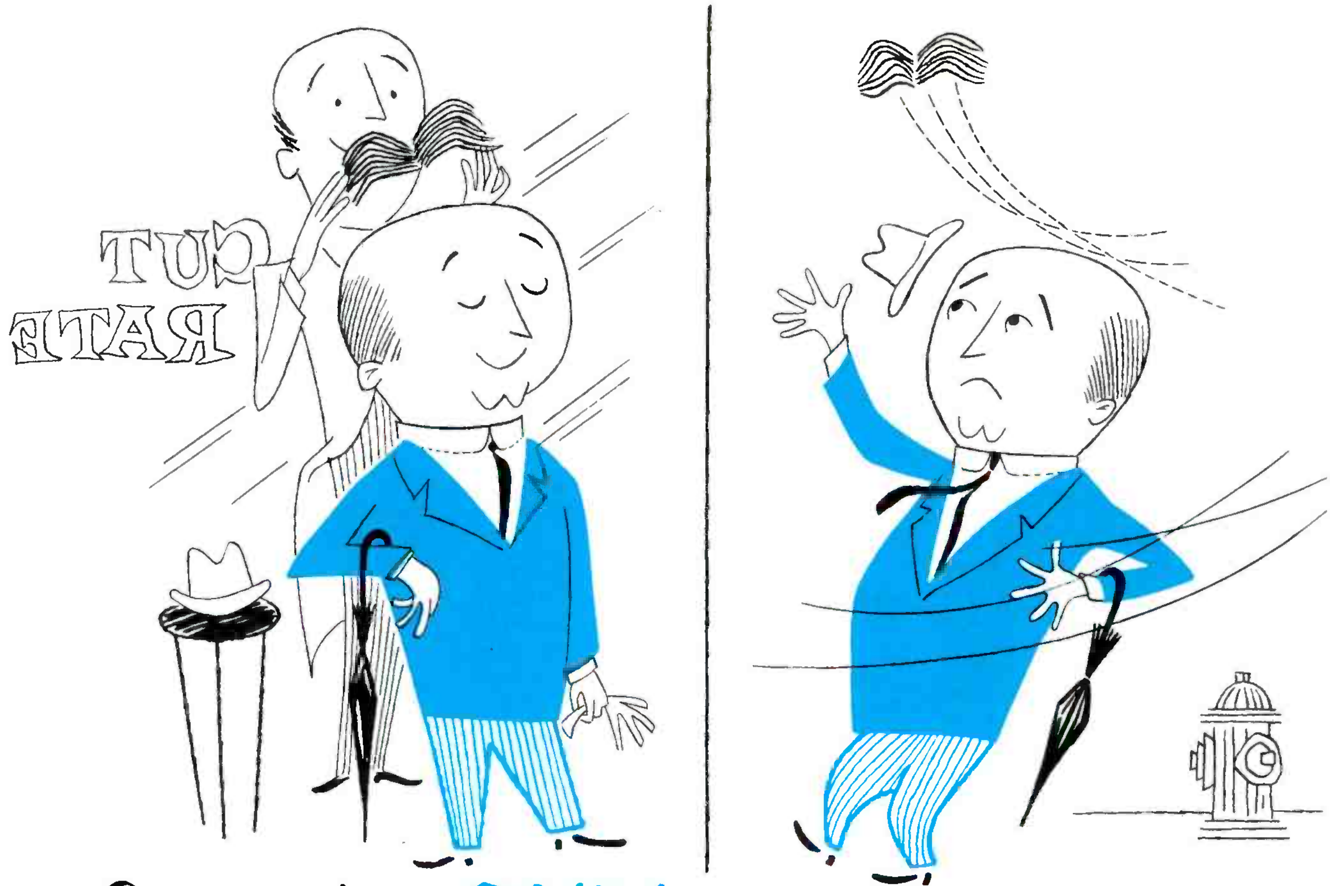


Fig. 5. Head Assembly on Concertone Model 1502.


CUT
RATE


TWIN-SCREEN
HI-LITE
Picture Tubes

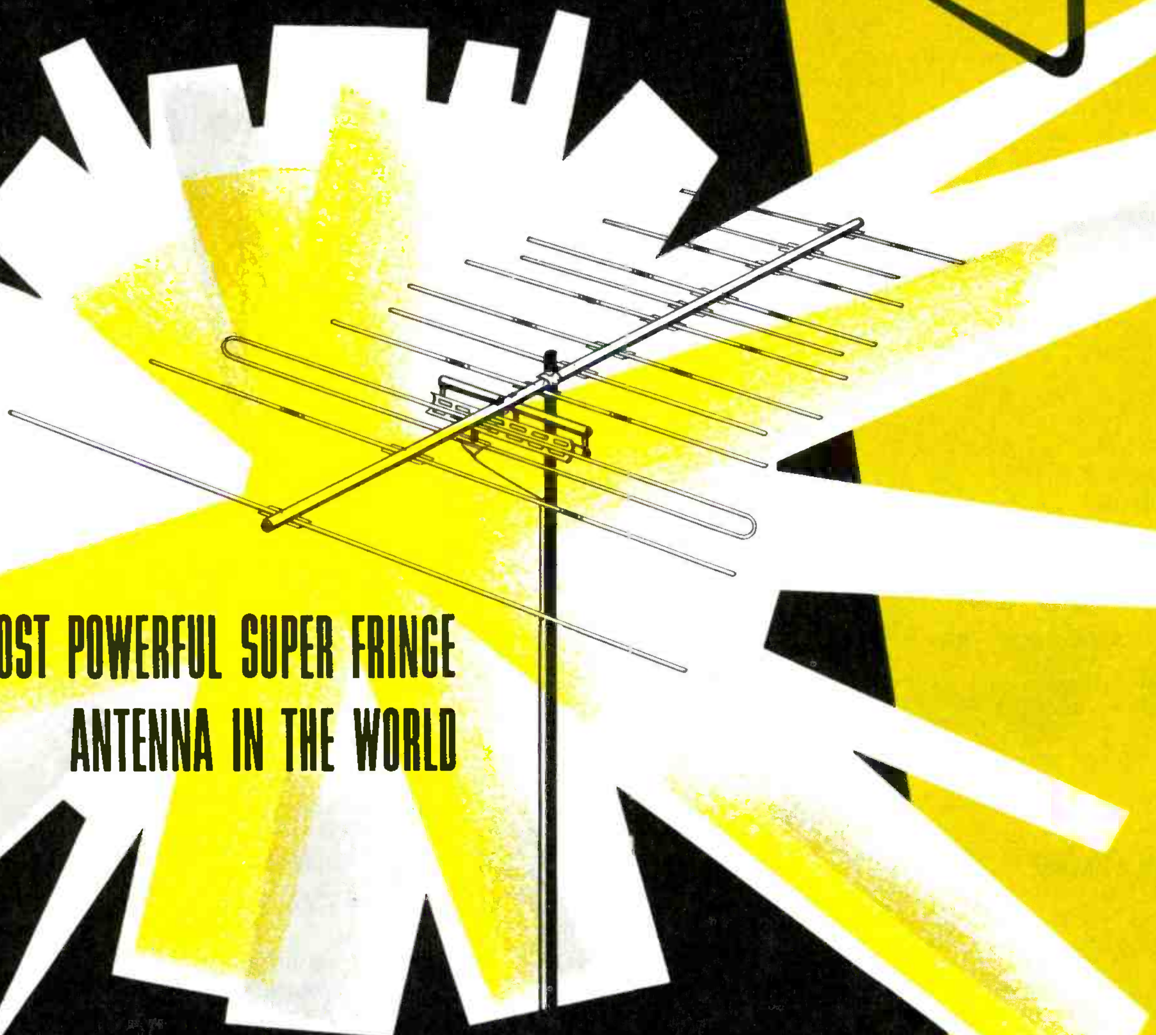
PF REPORTER Subject Reference Table

The following Subject Reference Table for the PF REPORTER is intended to provide a ready reference to subjects in the various articles that have appeared in the 1955 issues.

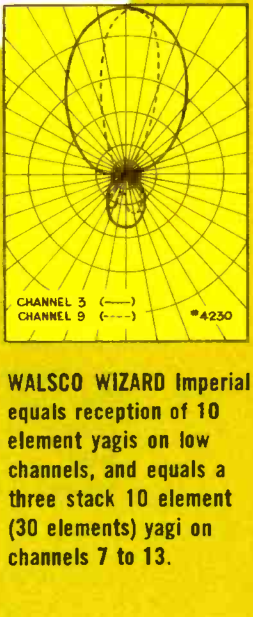
The table has been divided into major-subject headings in common usage in the electronics field. These are listed in alphabetical order, and a descriptive breakdown of the material is then given under these classifications. Under the subject listing, the name of the article appears in italics and is followed by the issue of the PF REPORTER in which it was published.

All subjects which are treated extensively enough in the text to be helpful in servicing or in understanding the operation of a circuit are listed in this Subject Reference Table. For subjects treated in the issues of previous years, consult the Subject Reference Tables in the December 1953 and 1954 issues.

FIRST TO BREAK THE TV RECEPTION BARRIER...



MOST POWERFUL SUPER FRINGE ANTENNA IN THE WORLD



WALSCO WIZARD Imperial equals reception of 10 element yagis on low channels, and equals a three stack 10 element (30 elements) yagi on channels 7 to 13.

NEW WALSCO WIZARD

with exclusive **PHASE REVERSER**

Distance is no barrier to the amazing new WALSCO WIZARD. Exclusive "Phase Reverser" delivers the sharpest, crystal-clear picture ever seen in the most difficult reception areas. No other antenna like it!

New WIZARD offers highest gain and sharpest directivity possible on all VHF channels. Installation in a jiffy . . . without complicated harnesses, phasing stubs, or extra dipoles. Guaranteed for 3 years!

Actual comparison of fringe antenna performance

Channels	Gain (db) Single Bay 2	4	6	7	9	11	13
Walsco Wizard Imperial	6.1	6.9	8.2	11.9	11.6	10.8	12.6
Antenna "A" With 3 Phase Reversing Dipoles	6.3	6.6	8.1	10.5	10.2	10.6	12.4
Antenna "B"—Yagi Type with Phasing Loops	5.1	5.5	6.8	7.5	9.6	8.8	11.2
Antenna "C"—Yagi Type with Loading Coils	5.9	6.9	8.6	9.1	8.6	9.6	7.8

Model	Price
Wizardette #4210	$14.90 list
Wizard #4220	19.50 list
Wizard Imperial #4230	34.90 list

Walsco
ELECTRONICS CORPORATION
A SUBSIDIARY OF Telautograph CORPORATION
3602 Crenshaw Blvd.,
Los Angeles 16, California

High-Level Demodulation in Color Receivers

(Continued from page 23)

of Fig. 3 can produce B - Y and G - Y signals with values of -.3. From Fig. 6, we can see that the value of voltage E_2 is zero during the transmission of a red bar. This means that there is no difference in signal potential between the plate side of load resistor R2 and the cathode of the B - Y demodulator; therefore, the signal voltage developed across R_k must be equal to the signal voltage developed across R2. In other words, the value of the G - Y signal must equal that of the B - Y signal.

Referring to the relationship:

$$G - Y = -.51(R - Y) - .19(B - Y), \quad (5)$$

we can show that G - Y is equal to -.3. By substituting G - Y for B - Y and the value of .7 for R - Y in this equation just mentioned, we obtain:

$$G - Y = -.51(.7) - .19(G - Y)$$

$$1.19(G - Y) = 1.357$$

$$G - Y = \frac{-.357}{1.19} = -.3.$$

B - Y, being equal to G - Y, will also be equal to -.3 during the transmission of a red bar.

If a blue were being transmitted, the reverse would be true. Demodulation would be restricted to the B - Y demodulator. The same procedure as the foregoing could be followed to prove that the correct signals are applied to the guns of the picture tube during the transmission of a blue bar.

Obtaining B-Y Signal From Plate Circuits

A variation in the design of a high-level demodulator circuit is the basic circuit shown in Fig. 7. Demodulation of the chrominance signal is performed in the same manner as it is by the basic circuit that was shown in Fig. 3. The main differences between the two circuits are in the method by which the chrominance signal is shunt fed to the demodulators and in the method by which the third color-difference signal is obtained. In the circuit of Fig. 3, the G - Y signal is obtained from the common cathode circuit of the demodulator stages. In the circuit of Fig. 7, the two triode circuits are designed as R - Y and G - Y demodulators. The B - Y signal is obtained by mixing in the correct proportion, the R - Y and G - Y signals at the output of the

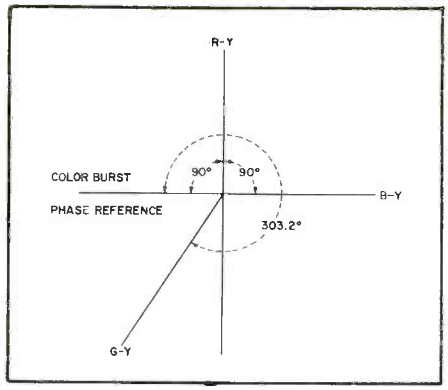


Fig. 8. Relationship of the G-Y Axis to the R-Y and B-Y Axes.

demodulators. Then the signal is passed through a stage of amplification.

The R - Y signal is applied to the grid of the B - Y amplifier through resistor R3. The G - Y signal is applied through R4. The values of these resistors are such that the correct amounts of the R - Y and G - Y signals are mixed together to produce the B - Y signal. The ratio between R3 and R4 is governed by the expression:

$$B - Y = -2.73(R - Y) - 5.36(G - Y). \quad (6)$$

With R3 and R4 in the ratio of approximately 1 to 2, the R - Y signal

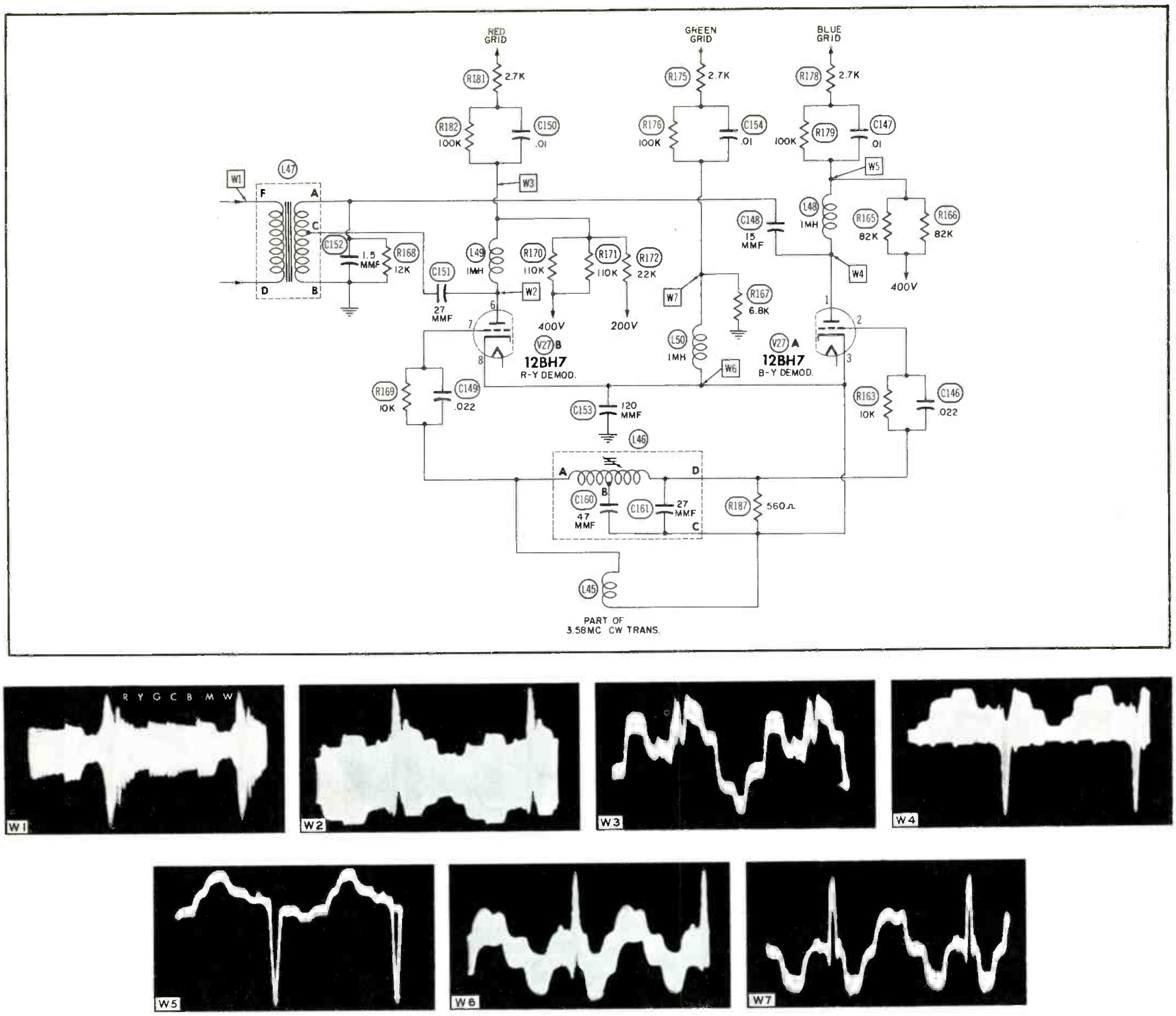


Fig. 9. Circuit and Associated Waveforms of the High-Level Demodulators Employed in the Hoffman Model 21M1100A Color Receiver.

and the G - Y signal will be mixed (in the correct proportion) to produce the B - Y signal.

The demodualtors in the circuit of Fig. 7 demodulate along the R - Y and G - Y axes. The relationship of the G - Y axis to the R - Y and B - Y axes is shown by the vector diagram in Fig. 8.

HOFFMAN MODEL 21M1100A COLOR RECEIVER

The circuit of the high-level demodulators employed in the Hoffman Model 21M1100A color receiver is shown in Fig. 9. Waveforms of the signals at various points in the circuit are shown below the figure. This circuit employs R - Y and B - Y demodulators and obtains the G - Y signal from a common cathode circuit. A single 12BH7 tube is used for the demodulator stages. V27B is the R - Y demodulator, and V27A is the B - Y demodulator. The chrominance signal is applied to the plates of the demodulators through L47. The chrominance signal that is applied to L47 appears as waveform W1. This signal is coupled to the plate of V27B by capacitor C151 and to the plate of V27A by capacitor C148.

The signal at the plate of the R - Y demodulator V27B is illustrated by waveform W2. This is the R - Y color-difference signal that has been detected from the chrominance signal by the R - Y demodulator. The 3.58-mc signal which is present in waveform W2 is removed by coil L49. After removal of the 3.58-mc signal, the R - Y signal appears like waveform W3. The R - Y signal is then applied to the red grid of the picture tube.

Waveform W4 represents the signal at the plate of the B - Y demodulator V27A. This is the signal that has been detected from the chrominance signal by the B - Y demodulator. The 3.58-mc signal which is present in waveform W4 is removed by coil L48. After removal of the 3.58-mc signal, the B - Y signal becomes waveform W5. This is the appearance of the B - Y signal that is coupled to the blue grid of the picture tube.

The unfiltered G - Y signal that is present at the common cathode connection is waveform W6. After removal of the 3.58-mc signal by coil L47, the G - Y color-difference signal becomes waveform W7. This signal is then coupled to the green grid of the picture tube.

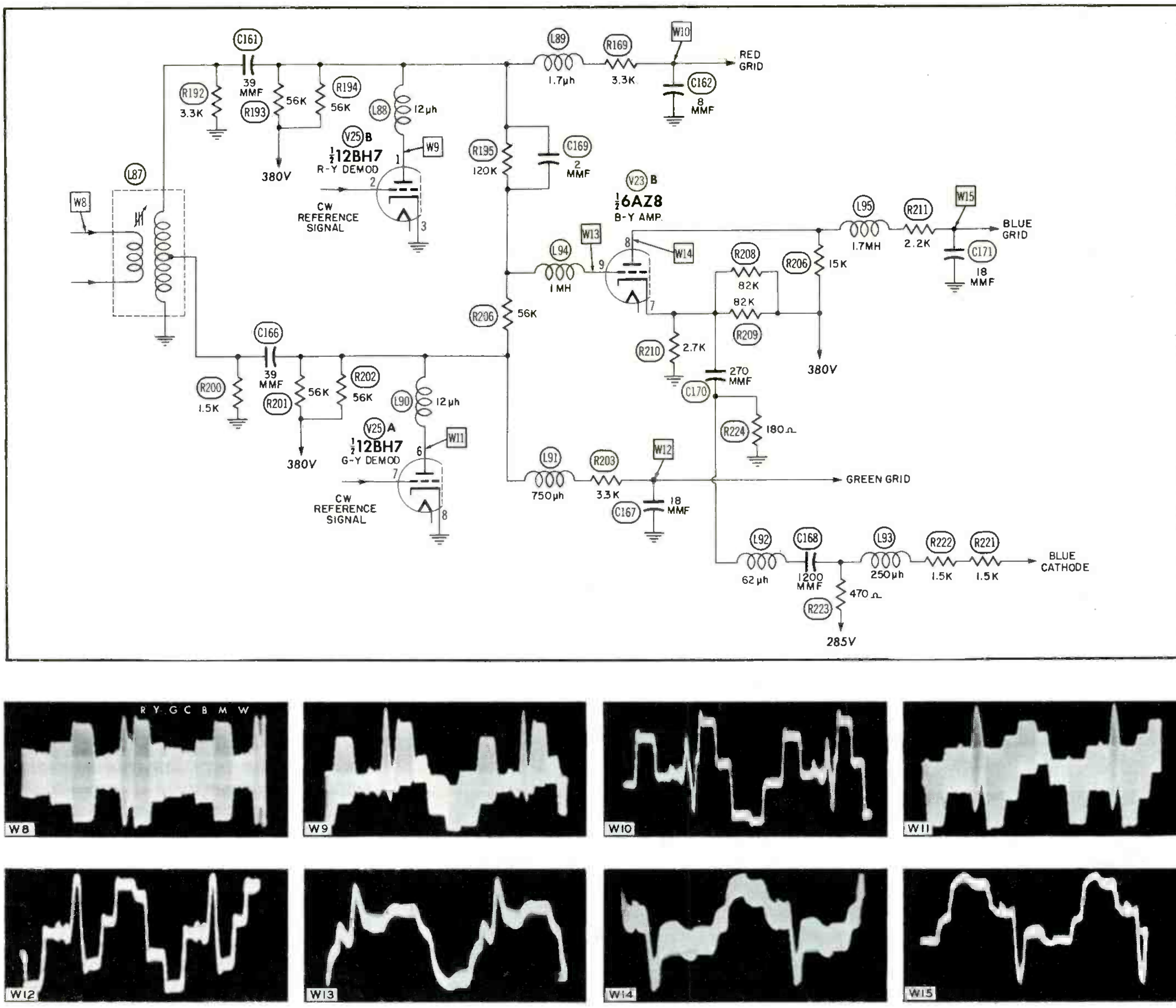


Fig. 10. Circuit and Associated Waveforms of the High-Level Demodulators Employed in the RCA Victor Model 21-CT-662 Color Receiver.

The reference signals applied to the grids of the demodulators are obtained from L45 which is at the output of the color-synchronization section. The phase difference of 63.58 degrees between the two reference signals is obtained by the tuning of coil L46.

RCA VICTOR MODEL 21-CT-662 COLOR RECEIVER

The demodulator circuit shown in Fig. 10 is employed in the RCA Victor Model 21-CT-662 color receiver. Waveforms of the signals at various points in the circuit are shown below the figure. This circuit uses a single 12BH7 tube for the R - Y and G - Y demodulators. V25B is the R - Y demodulator and V25A is the G - Y demodulator. The R - Y and G - Y signals are mixed to form the B - Y signal, and then the B - Y signal is amplified by the B - Y amplifier V23B.

The chrominance signal is applied to the plate circuits of the demodulators through transformer L87. It is shown as waveform W8. The signal is coupled to the plate of the R - Y demodulator by capacitor C161 and to the plate of the G - Y demodulator by capacitor C166.

The demodulated plate signal of the R - Y demodulator is waveform W9. After the 3.58-mc signal is removed by coil L89 and capacitor C162, the R - Y video signal appears as shown by waveform W10. This is the signal that is applied to the red grid of the picture tube.

The signal at the plate of the G - Y demodulator is represented by waveform W11. The 3.58-mc signal is removed by coil L91 and capacitor C167. Waveform W12 is the G - Y signal which is applied to the green grid of the picture tube.

The R - Y signal is applied to the B - Y amplifier through resistor R195. The G - Y signal is applied through resistor R206. A signal which is a combination of the R - Y and the G - Y signals is at the junction of these two resistors. The signal that appears at the grid of the B - Y amplifier is shown by waveform W13. The B - Y signal is amplified by V23B and appears at the plate as waveform W14. The 3.58-mc signal is removed by coil L95 and capacitor C171. The result is the B - Y signal that is shown by waveform W15. This is the signal that is applied to the blue grid of the picture tube.

C. P. OLIPHANT

Audio Facts

(Continued from page 31)

maximum limits in an effort to produce adequate sound levels from the loudspeaker. The distortion resulting from overdriving can be heard as various kinds of disturbances that destroy the quality of reproduction.

Notice that we said "some" loudspeakers because not all of the small ones are inefficient nor are all of the large ones efficient. Some small units do a remarkable job even when compared to the largest systems. Basically though, it is a fact that a small driver has to work harder than a large one in order to move the large volume of air required for developing high sounds levels.

At the present time, it seems that a large enclosure must be used if the best reproduction of the extreme low frequencies is to be obtained from a loudspeaker; however, some small enclosures and loudspeaker systems which have recently been developed will reproduce the low fundamental tones to a very satisfactory and remarkable degree.

Although the satisfactory reproduction of the very low frequencies is important, sometimes it is not absolutely necessary. Some musical selections do not make use of the really low bass tones; moreover, music can be enjoyed even though it is reproduced with a range that is restricted to some extent in the extreme bass and treble frequencies. A smooth and balanced response with no extreme peaks or holes is probably one of the most important things to check when selecting a loudspeaker.

If anything is to be gained from the preceding paragraphs, it should be the fact that all loudspeakers seem to possess both advantages and disadvantages. A large loudspeaker may provide more bass among other things, but it also might be so large that it cannot be fitted into the room where it is to be used. Besides that, a large unit costs 5 to 10 times as much as a small one.

Actually, the person buying a new loudspeaker cannot go too far wrong in selecting one that sounds good to him. It would be best if he could give it a trial in the location where he will use it. He should select one that has a cabinet of a size, style, and appearance which will fit in with the other furnishings. If the loudspeaker of his choice has been produced by a reputable manufacturer, he can feel assured that he has a unit which will give him continued satisfaction and pleasure.

ROBERT B. DUNHAM

Dollar and Sense Servicing

(Continued from page 36)

VOICE-POWERED. A single-transistor radio transmitter that operates without batteries has been developed by the Army Signal Corps. Range now is only about 600 feet, but a new model under development is expected to be good for a full mile.

The present unit is hardly larger than a walnut, bringing to realization a true batteryless wrist radio transmitter like those popularized in the comics. Enough power for the transistor is generated by the microphone which picks up the sound.

Next comes an associated receiver that operates from surplus energy stored up while transmitting. This transmitter and receiver combination should be no bigger than a matchbox and should sell for around $20 if and when it gets into mass production.

Another new item is being made by Bell Laboratories. This is a silicon disc that converts solar energy into electricity with high efficiency, for operating telephone amplifiers directly. In an experimental installation on a rural telephone line in Georgia, enough extra energy was produced during hours of sunlight to charge a storage battery for taking over in dark weather or at night.

Truly there is something new under the sun almost every day in this era of electronics.

GHOST PAINS. Excruciating pain in limbs that aren't there is being helped by UHF diathermy treatments. These radiations are being used in much the same way as the old-fashioned sugar pills that doctors of yesteryear passed out for imaginary ailments. The amputee believes in the effectiveness of the impressive electronic apparatus; therefore, good results are being achieved by Veterans' Administration doctors.

A good technical show can likewise ease the agony of a customer confronted with a bill for replacement of a picture tube. Clean uniform, neat tool box, professional manner, impressive methodical sequence of readjusting all the controls — these are the little things that can take the customer's mind off the mental pain of paying.

SECOND SETS. Only 3.7 per cent of all TV homes have two or more TV sets, according to the latest American Research Bureau survey. This means that with some 38,000,000 TV sets in use today, there are about 1,400,000 multiple-set homes. The percentage is climbing steadily because of the increasing variety of programs on TV and the widely varying interests of different members of a family. Even the kids are fighting with each other now about which program to watch.

But here's an unfathomable figure from the same survey: The average age of the TV sets replaced this year is only 2 1/2 years, even though the life expectancy is up to 8 years. Is good business the simple explanation, or are there more complex reasons why people are starting to turn in their sets for new models in much the same way as they turn in automobiles? Upping the screen size no longer appears to be a valid explanation, because over 80 per cent of the sets in use are already 16-inch or bigger.

SERIES IN COLOR. Nature's reluctance to acknowledge the arrival of the color TV era during the World Series this year didn't do much promotionwise for color. Lighting conditions that were constantly changing as the sun played peekaboo behind the clouds one afternoon were more than color cameras could handle. Lengthening shadows gave trouble, too, as action and cameras moved in and out of the shadow zone.

Columnists in New York papers were pretty much unanimous in expressing their opinion that today's color TV is not quite ready yet for outdoor sports. Maybe they just need automatic electronic exposure control right on the camera lenses. Hope our own set arrives in time for at least one of the football games so that we will have a standard of comparison for next year's outdoor programs.

TV COSTS. A penny isn't good for much more than paying a sales tax these days, but RETMA statisticians just figured out that 3 cents gets you a solid hour of entertainment on television. With three persons watching, the cost comes down to a penny an hour, which isn't bad even for the bad programs.

Here's how all this is reckoned: The average cost of a TV set is around $200. It lasts about 7 years and then rates a $30 to $40 trade-in allowance on a new set. Servicing cost averages $14 a year. Average viewing time is around 4 hours a day and consumes around 1 kilowatt of electric power costing 3 to 4 cents. Put all these figures into a computer and you come out with the 3¢-per-hour figure.

After so many years, service costs start going up on an old set; and the cost per hour of TV entertainment goes up accordingly. This is another selling point when you're trying to talk someone into trading in his 10-incher on a new set.

WHITE BAR. When Britishers in Norwich see a white bar appearing on their TV screens regularly every 3 minutes and lasting for 2 seconds, they know that the trouble isn't in their own set. The local station puts on this signal whenever its transmission is below satisfactory quality because of transmitter trouble.

JOHN MARKUS

Quicker Servicing

(Continued from page 15)

In addition to the sale of items or services, the new employee can be taught and delegated the job of keeping the company bookkeeping up to date. This alone will save you time and therefore money. The employee could also purchase parts from the local supply houses while you are working in the shop. In addition to this, he could keep a running inventory of the stock of tubes and standard replacement items.

Evening Phone Service

Since a sizable percentage of TV viewing takes place during the evening hours, a large percentage of troubles will occur during those hours. When a trouble occurs, many customers will immediately call for service. This creates additional problems for the service shop. The cost of maintaining a night telephone-answering service in addition to a daytime employee may be too expensive; yet, to avoid having the customer call another shop when he gets no answer from your telephone, some sort of service for answering the telephone should be maintained.

AUTOMATIC TELEPHONE-ANSWERING SERVICE

The automatic answering service, which is offered by the Bell System, makes use of a recording machine which will give a message to the customer and will also take a message from him. One of these automatic answering machines is shown in Fig. 2.

The installation of this answering machine makes it possible for the technician-owner of a small shop to be in the field making service calls without missing incoming telephone calls at the shop. The message which is repeated to each caller may be changed as frequently as desired. This means that when you leave the shop for just a few moments, the message can be worded to convey this fact to any caller.

The periods of time when the shop is closed for the night, weekends, or holidays, is the time when the automatic answering service comes into its own. The average person will call during these hours as soon as his set fails so that he can make arrangements to get service as early as possible the next day, and he would be more than willing to give a message to the recorder if that would ensure his getting service the next day.

At this point in the discussion, it would be well to mention that you can overdo the use of a service of this kind; and as a result, you might lose some business. For example, when a customer calls in for service: (1) he will want to know when to expect such service, (2) he may want to tell the technician what the trouble is, and (3) he may prefer to discuss some angle of his problem. It is obvious that the automatic machine cannot discuss these things with the customer. For this reason, the use of the device during the usual working hours should be held to a minimum. The machine should not be used just so that you can work on receivers without being interrupted by calls; but at any time when it becomes necessary to leave the shop, then by all means the machine should be turned on.

If you should contemplate the installation of this service, then direct-mail advertising to your customers to let them know that you are installing it will prepare them for this type of

Fig. 2. Bell System Automatic Telephone-Answering Machine.

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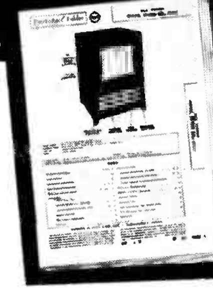

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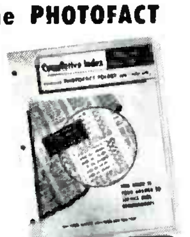

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14. Top and bottom views are shown. Top view is positioned as chassis would be viewed from back of cabinet.
15. Blank pin or locating key on each tube is shown on placement chart.
16. Tube charts include fuse location for quick service reference.

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.

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response when they call your shop. A little preliminary advertising in this manner will pay off in the long run.

Availability and Cost

The automatic telephone-answering service furnished by the machine in Fig. 2 is a feature of the Bell System and is available in all their service areas. Here in Indianapolis, Indiana, the cost of such service is about $12 per month and is probably about the same in other areas. This cost per month will in many cases make automatic answering service somewhat less expensive than the conventional answering service provided by an independent organization.

Operation of the Automatic Answering Machine

So that flexibility and usefulness of this machine for automatic telephone answering may be fully understood, it is necessary to know how it operates. It can answer the phone, convey a message to the caller, and then in turn record any message the caller may wish to leave. Or, it can be used to answer the phone and convey a message without recording any message from the caller. The unit can also be turned off so that the phone will operate normally.

You will notice in Fig. 2 that there are four sets of knobs, and two of these are dual. In addition, there are two keys. All of these knobs and keys are operating controls for the machine. The knob at the far upper left is the function-selector switch, and it has four positions which are (starting from the extreme counterclockwise position): DICTATE, CHECK, MESSAGE PLAYBACK, and AUTOMATIC ANSWER. Directly below the function selector are the START and STOP keys. Next, and in line with the START and STOP keys, is the ON-OFF switch which has its off position at the left. Then there is a dual control which serves as the service selector and the PLAYBACK VOLUME control. The service-selector knob is on the outer shaft, and it has two positions. One is for ANSWER & RECORD, and the other is for ANSWER ONLY. The PLAYBACK VOLUME knob is on the inner shaft.

Last in line and at the right side is the other dual control which serves as the message-use indicator and the message-selector control.

To put this automatic answering machine into operation, the first step is to record the message which you wish repeated to each caller. This is done in the following steps. Turn the ON-OFF knob to the ON position; turn the function selector to the DICTATE position; lift the telephone handset from its cradle; press the START key; when the red light located at the DICTATE position of the function selector comes on, dictate the desired message into the mouthpiece; and when the message has been dictated, immediately press the STOP key. This completes the operation necessary for recording the message.

The next step would be to check the message. This is done by placing the function-selector knob in the CHECK position and by pressing the START key. The message you dictated will be repeated through the receiver in the telephone handset which you must place to your ear. If the check proves that the message is satisfactory, then turn the function selector to the AUTOMATIC ANSWER position.

The service selector is then turned to the ANSWER & RECORD position, if it is desired that the caller leave a message. The message-use indicator and the message-selector knob should be reset to the zero positions so that the maximum number of messages can be accepted and recorded. When both are at zero, the dot on one knob and the zero on the other will both be directly below the dot on the panel. To reset the message selector to zero, a slight inward pressure must be applied before turning the knob.

When this procedure has been completed, the unit is ready to accept calls. It will repeat to the caller the message you have dictated and will record his message if he leaves one.

Playback of Recorded Messages

To play back all previous incoming messages, push on the message-selector knob and turn it to its extreme clockwise position. Lift the telephone receiver, press the START key, and listen to the messages. If you wish to listen to only part of the incoming messages, lift the telephone receiver; press the START key; then turn the message-selector knob slowly counterclockwise and release the knob at intervals to listen until the required place is reached. If released, the message-selector knob will continue to turn and the machine will continue to read back the messages by itself. This process of playing back may be repeated as many times as desired. Press the STOP key when the playback is completed.

Messages Must Be Clear

Since the machine cannot answer questions, the message it conveys to the caller must be clear. This message or announcement should contain the following information: (1) a statement that the call is being answered mechanically, (2) instructions for leaving a message if the service is used for ANSWER & RECORD, and (3) advice to the caller as to when his message will receive attention.

The following is a sample announcement that might be used by a television service company.

"Good evening! This is the --- TV Service Company. Your call is being answered mechanically by automatic equipment. Our technician is available for home service calls until 9:30 this evening. If you will leave your name, address, and phone number, he will call you at approximately 8:00 p. m. to confirm your call. You may start speaking at the sound of the tone. Please speak distinctly. Thank you."

This sample message takes about 25 seconds to repeat; and as you can see, the message is rather long. The maximum length of such an announcement message can be as much as 30 seconds. In actual practice, the length of the announcement should be kept as short as possible and still convey the desired information to the caller.

The automatic answering machine can accept as many as 20 messages of 30 seconds in length. If the messages are shorter than 30 seconds, more than 20 messages can then be accepted. The total length of the recording time is 10 minutes. If the recorder drum becomes filled with messages, then no further calls will be accepted. Additional calls will not be answered until the owner comes back to the shop, takes off the messages, and resets the machine.

Answer Only

The automatic answering machine can be set up to answer the phone, repeat the announcement message, and then hang up. This is done by simply turning the service-selector knob to the ANSWER ONLY position. An application of this type of service would be when you were closed for a holiday or a vacation trip. The announcement should be appropriate for the occasion. A sample is shown in the following:

"This is the --- TV Service Company. Your call is being answered mechanically by automatic equipment. We will be closed the 3rd, 4th, and 5th of July for vacation. You may call our shop on July 6th for service. We appreciate your patronage, and thanks for calling."

It becomes apparent that to solve this problem of telephone answering, some monetary outlay must be made. If you feel that your shop needs an answering service, determine which type would be best to meet your particular requirements; and then take steps to obtain the service. Business is lost through unanswered telephones.

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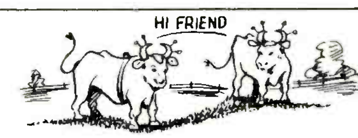

BULLTAMER. To discourage belligerent bulls from butting each other, farmers are putting electric shockers on the heads of troublemakers. One such unit, manufactured by Hot-Shot Products Company of Minneapolis to sell for around $30, is plastic harness having 11 buttonlike contact points connected to a small shocker. Six flashlight cells fitting into pockets of the harness provide the power. When a shock-mounted bull butts another, both get a shock; a couple of these shocks serve to convince both that there are better things to do than fight.

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Examining Design Features

(Continued from page 9)

manufacturer, the original rear cover and centering rings must be used because the replacement yoke will not include these items. This type of yoke mounting conserves space by eliminating the need for bulky support brackets which are usually employed with a chassis of conventional design.

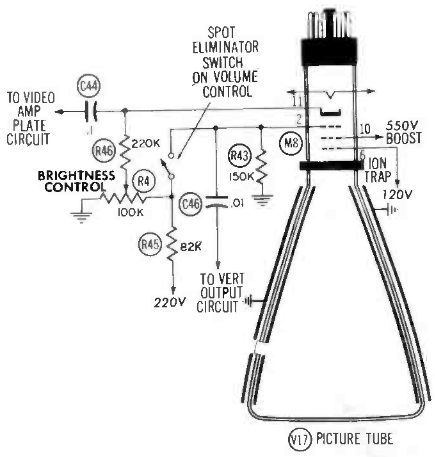


Fig. 2. Schematic Diagram Illustrating the Spot-Eliminator Circuitry.

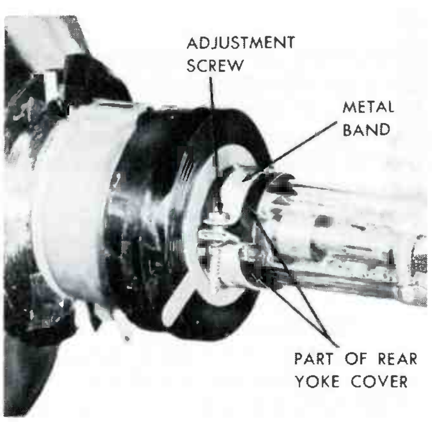


Fig. 3. Clamp-on Type of Deflection Yoke Employed in Westinghouse Chassis V-2342.

Plug-in Selenium Rectifiers

The popularity of the plug-in type of selenium rectifier continues to increase. Two of these units are employed in the low-voltage power supply of this receiver. The terminals of the rectifiers serve as connectors or plugs which fit into sockets mounted on the chassis. One of the two sockets for each rectifier is mounted in a slotted opening so that it can be moved and that the spacing between the two sockets will match the spacing between the terminals of the different sizes of replacement units. Each rectifier has one terminal twisted at right angles to the other terminal, and the chassis sockets are mounted so that the rectifier will always have the correct polarity when it is inserted.

In order to replace the older types of selenium rectifiers, it was usually necessary to remove the chassis from the cabinet and to unsolder a number of leads from the rectifiers. The use of the new plug-in rectifiers greatly simplifies this problem because it is now possible to replace defective selenium rectifiers as easily as it is to replace tubes.

A 7.5-ohm plug-in type of resistor is connected in series with the low-voltage supply. The purpose of this unit is to protect the selenium rectifiers and to act as a fuse if the circuit should be overloaded.

Peaking Coils for Printed Circuits

The designs of many electronic components are being changed in order to conform with the requirements of the new printed-wiring boards. This is evident from the unusual style of peaking coils employed in the Westinghouse Chassis V-2342. Three of the four coils of the new style used in this chassis are pointed out in Fig. 4 in the close-up view of the chassis. Each coil, with its winding located at the top end of an upright coil form, has an appearance of a small mushroom. Two small studs extend from the other end of the form and make connection with the printed circuitry. Unit A of Fig. 4 is a series-peaking coil located in the plate circuit of the video amplifier. Unit B is a shunt-peaking coil connected in the grid circuit of the video amplifier. Unit C serves as a series-peaking coil in the grid circuit of the video amplifier.

The video-detector crystal used in this chassis is also pointed out in the same figure. This crystal is mounted on top of the third IF transformer can, and it is easily accessible when the cap which covers the top of the can is removed. Should it become necessary to replace the crystal, merely remove the top cap and insert the replacement unit into the clips provided. Care should be taken to see that proper polarity is maintained.

Fig. 4. Close-up View Showing Chassis with New Type of Peaking Coils.

Sync Control

The new Westinghouse chassis also incorporates a sync-separation, noise-cancellation circuit which may be unfamiliar to some of our readers. A schematic diagram of this circuit is presented in Fig. 5. This circuit is primarily designed to stabilize sync operation in weak and noisy signal areas as well as in normal or strong signal areas. By following the schematic diagram, the operation of this circuit may be more clearly understood.

The composite video signal is sampled from the plate circuit of the video amplifier and is fed to the grid (pin 7) of the 3CS6 tube through resistor R58 and capacitor C56. The positive-going signal on pin 7 is of high amplitude and causes grid current to flow; therefore, capacitor C56 charges to approximately the blanking level of the composite video signal. The bias developed on pin 7 permits the tube to conduct only on signals which are greater in amplitude than the blanking level of the input signal. This condition allows only the horizontal and vertical sync pulses to appear in the plate circuit.

In conjunction with this sync-separation action, a noise-cancellation action is provided. A fixed bias is developed on the grid (pin 1) of the 3CS6 tube, by resistor R56 and the sync control R6. The sync control should be adjusted in the home because the signal

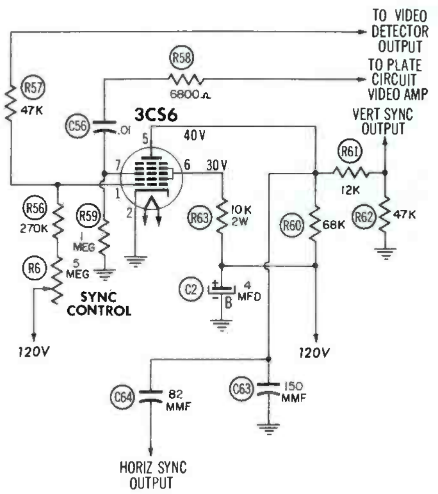


Fig. 5. Schematic Diagram of Sync-Separator, Noise-Cancellation Circuit Employed in the New Westinghouse Receiver.

strength varies in different areas. The bias is set so that the tips of the sync pulses will fall near the cutoff point of the tube.

When a portion of the composite video signal from the video-detector output is impressed on the grid (pin 1) through resistor R57, any noise pulse of sufficient amplitude in the signal will cut off the tube and will not be present in the plate circuit of the stage. Noise pulses which occur during the sync-pulse interval will also cut off the tube; but since the noise pulses usually have a shorter time duration than the sync pulses, the stability of the vertical and horizontal oscillators will be unaffected.

The sync control R6 is located at the rear of the chassis, and its exact position may be seen in the chassis photograph of Fig. 1. It is necessary to use a screwdriver for adjusting the control when the rear cover of the cabinet is in place. The sync control should not be set too far in the direction marked "Noisy Area" because the sync pulses themselves may be clipped, and sync instability may result.

Servicing Tips

The Westinghouse chassis is so designed that its center of gravity is slightly toward the face of the picture tube. The chassis has a tendency to tip forward; therefore, the manufacturer recommends that it be carried by the two top rails so that this unbalanced condition will be overcome.

The chassis is constructed of metal strips which are bolted together to form the chassis frame and of metal plates that form the top of the chassis. Some of these top plates are connected to one side of the AC power line, and they will present a shock hazard to the service technician if an isolation transformer is not employed. The side strips and the front-panel controls are insulated from the hot chassis plates. When servicing the receiver, make sure that a short circuit does not exist between the plates and the strips; otherwise, the set owner will be in danger of shock.

As an example of the precautions that must be taken when servicing this chassis, let us examine the insulation problem involved in replacing the tuner assembly. The photograph of Fig. 6 reveals the tuner mounting and indicates some of the hot and cold sections of the chassis. The fiber sleeve isolates the knob end of the tuning shaft from the tuner end which is connected to the AC line. One end of the sleeve is fashioned to fit the hole in the support bracket for the shaft; therefore, if the sleeve is installed backwards, the tuning shaft will short to the hot bracket and in turn all of the front controls will be connected directly to one side of the AC line. Care should also be taken not to remove or damage the insulation between the rear support bracket and the top rail when the tuner is being serviced.

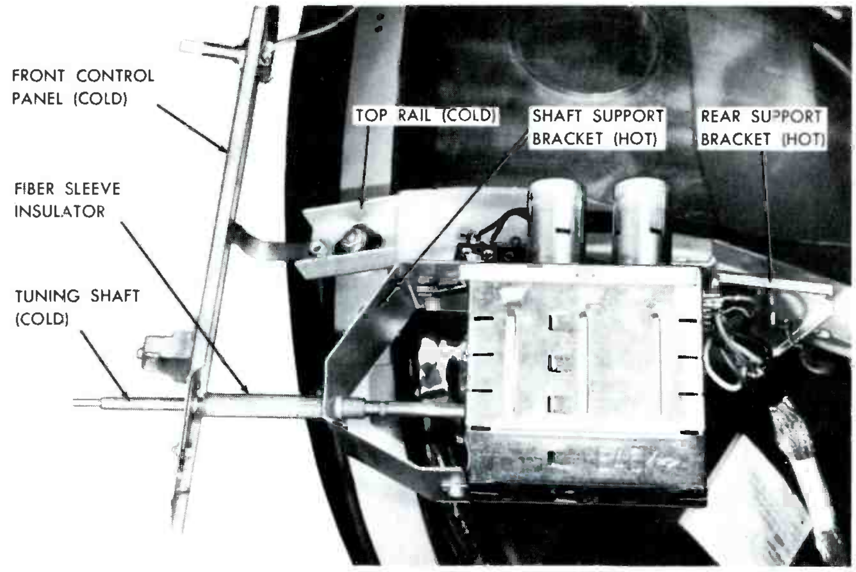


Fig. 6. Tuner Assembly Employed in Westinghouse Chassis V-2342.

The manufacturer of this receiver is also producing similar chassis featuring 24-inch picture tubes and provisions for UHF reception. All of the models now employing these chassis are so designed that the front glass can be removed and the picture tube cleaned without removing the chassis from the cabinet.

SENTINEL PORTABLE RADIO

The small battery-operated, AM receiver pictured in Fig. 7 is a Sentinel Model 359P portable radio.

One noticeable feature of this set is the ease with which the complete chassis may be removed from the carrying case. It is freed from the case by merely removing the two control knobs shown in the foreground of the figure. These knobs are of the push-on variety; and they are intended to serve a second purpose, that of anchoring the lightweight chassis firmly in place. The receiver is of a conventional design and employs four 1.4-volt miniature tubes that are

Fig. 7. Sentinel Model 359P Portable Radio.

powered by a single 1 1/2-volt A battery and a 67 1/2-volt B battery.

Consuming a great deal of the limited mounting space is a 4-inch PM speaker which furnishes adequate sound reproduction for this small receiver.

The tuning knob is marked with two triangular symbols to indicate the civil-defense frequencies of 640 and 1240 kilocycles. This lightweight portable radio also comes equipped with a strap handle and an extension strap for the shoulder.

TRANSISTOR PREAMPLIFIER BY RCA

The development of the transistor has opened a relatively new phase of electronics during the past few years. Transistors are now beginning to appear in hi-fi audio equipment because microphonics and thermal noise are practically nonexistent in transistors.

RCA has made use of a transistor as a phono preamplifier in some recent designs. This new development appears in the high-fidelity combination Models 6-HF-1 and 6-HF-2. Both models include an AM-FM radio and a three-speed record changer. Model 6-HF-1 also includes a tape recorder and separate speaker cabinet.

The phonograph employs a moving-coil, dynamic pickup which offers excellent frequency response and very low distortion. A schematic diagram of the preamplifier circuit used with this type of pickup is shown in Fig. 8. This circuit employs an RCA 2N104 transistor which mounts on the AM-FM tuner chassis. The input signal from the low-impedance pickup is impressed across the base and emitter connections of the transistor. The stage operates in a manner similar to that of a cathode-follower circuit — the transistor base acts as a grid and the emitter as a cathode. The AF output is taken from the emitter circuit and is coupled to the volume control through the function switch.

Resistor R1 is used for degenerative feedback which is required in order to reduce the input signal to an operating level, to reduce distortion, and to extend the frequency response. Normally, this is not done to input circuits because of the variations in source impedance caused by frequency variations; however, the very low impedances of the pickup and the

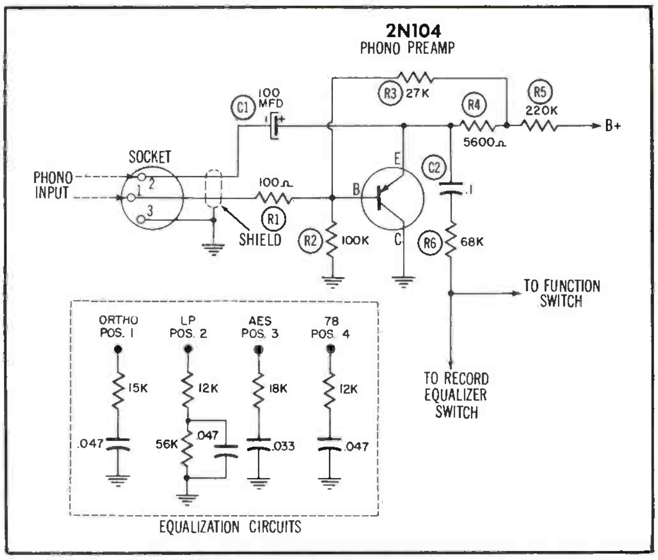


Fig. 8. Schematic Diagram of the Preamplifier Circuit Incorporated in the New RCA High-Fidelity Combination Models.

transistor make it possible to control the degeneration by means of the 100-ohm resistance. Coupling capacitor C1 is placed in the lead from the pickup to the emitter so that the pickup will be protected in case it should short to ground. If the pickup were to short, the capacitor effectively would connect the transistor base to the collector; therefore, the transistor would act as a forward-biased diode. With this arrangement, most of the current would be shunted through the transistor.

The transistor base obtains a bias voltage from the divider network formed by resistors R2 and R3. Resistor R4 is used as a load, and R5 acts as a voltage-dropping resistor. Coupling capacitor C2 isolates from the following stage the DC voltage present on the emitter, and resistor R6 is added for equalization purposes.

Because of the different recording characteristics used in the cutting of records, additional circuit compensation is usually necessary. In the RCA circuit, compensation is accomplished by means of an equalization switch. The switch is located on the AM-FM tuner chassis, and its function is to connect various equalization circuits into the output of the preamplifier stage.

A simplified diagram of the four equalization circuits used in this chassis is shown at the bottom of Fig. 8. Each group of components forms an individual circuit for each position of the equalization switch which has four positions, namely: ORTHO, LP, AES, and 78, as indicated in the diagram.

Transistors employed in amplifiers having high gain at low levels offer definite advantages over vacuum tubes used for the same purpose. For instance, in order to obtain a gain comparable to that of a transistor circuit, a vacuum-tube circuit will usually require two or more stages. From this viewpoint, it may be seen that the use of transistors is also economical. In the future, the transistor is certain to find many other useful applications in audio equipment because of its low-noise and high-gain characteristics.

LESLIE D. DEANE

Servicing Receivers of Unknown Origin

(Continued from page 33)

provide a reference to the appropriate literature.

If receivers of a certain brand name were not manufactured in fairly large quantities, service literature under this name probably does not exist. Furthermore, such a brand name may not appear in an index of service data. It is likely, however, that the data for receivers of another name would serve the purpose. The problem is how to determine the data to use and where to find it. Let us consider the methods which can be used to solve this problem.

Locating Applicable Service Data

Time is of major importance in locating the necessary information about a particular chassis. Most shops maintain a file of service literature. In some shops, this file may consist of material distributed by only one publishing company. Others may have files which consist of literature distributed by publishers and set manufacturers. The service literature which is applicable to an unidentified chassis is probably somewhere in these files. The problem is to know where to look. An up-to-date index is invaluable in helping to locate the information about a particular receiver or chassis.

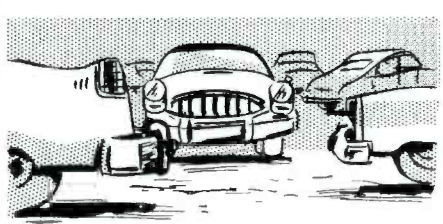
An index to service literature usually lists chassis and model numbers under the brand names of receivers. If a brand name is not known or is not listed in the index, it will be a little more difficult to locate related service literature. In some cases, it may take a considerable amount of the technician's time; but this time will be well spent if the repair of a receiver is facilitated.

If the technician is unable to locate the data in his own files, he may have to write to a manufacturer or to a publisher of service literature to obtain it. While the technician waits for a reply, the customer is not going to be happy about having to do without his receiver just because a schematic diagram or a service manual covering his receiver cannot be located.

On the other hand, if the technician is able to locate any information which will help expedite the repair of a receiver of unknown manufacture, the customer will have two reasons to be grateful. First, his receiver will be operating properly. Second, the customer has at last found someone who knows how to service his receiver, and this customer will undoubtedly want to continue using the service of such a technician even after a new receiver has been purchased.

Distinctive Chassis Design

Technicians of long experience can usually recognize a chassis as one which is similar to those built by a certain manufacturer. Such experience is invaluable in helping the technician to locate service literature. In many cases, a schematic diagram or a service manual covering the unidentified chassis does not exist; however, the technician may be able to locate a schematic diagram or even a complete service manual which conforms with the layout of circuits and components in this chassis.



In some cases, one or more of the circuits in this chassis will not conform exactly with the service literature which is to be used. For instance, a certain stage may use a different tube such as a 6SN7GT instead of a 12AU7 which is specified on the schematic diagram; and as a result, there will also be slight differences in the values of the components incorporated in this stage.

The voltage readings will also be slightly different than those indicated in the service literature. These differences stem from the fact that the tube used has different operating characteristics from those of the tube indicated in the service literature.

Slight differences in the values of components and voltages do not change the basic function of a stage. If the circuit design is similar to that shown by the schematic diagram, chances are that the normal signal waveforms will agree with those shown in the service manual. The technician should encounter little difficulty in servicing a chassis for which he has located service information that conforms generally with the circuit in this chassis.

RETMA Code Number

The technician may not be able to determine the origin of a certain television chassis from memory alone. Most chassis have certain identifying features which can be of help in such instances in locating applicable service literature. One means of identifying the manufacturer of a particular chassis is through a production-source code number which is a three-digit number assigned by the Radio-Electronics Television Manufacturers Association (RETMA) to manufacturers.

The production-source code number usually appears as part of a six-digit number. Many of the major components used in a television receiver are marked with these numbers; and in many cases, the chassis itself bears such a number. The first three digits of this six-digit number are those assigned to the manufacturer, and the last three digits specify the year and week of manufacture. Production-source code numbers on components are not likely to be instrumental in determining the manufacturer of the chassis; however, if the chassis itself bears a production source code number, chances are that the manufacturer of that chassis can be identified. The name of the manufacturer may be found on a list which shows to whom each code number was assigned. This list is released annually by RETMA and is reproduced in The PHOTOFACT Servicer. For the latest list, see PHOTOFACT Set 286.

In some cases, the production-source code number is not combined with a date code. There are a few instances where only a three-digit number appears on a chassis. This number may be stamped into the metal of the chassis, or it may have been applied with a rubber stamp. By referring to a list of RETMA code numbers, the technician should be able to determine whether the number designates the source of production or if it has some other purpose.

Tube and Component Layout

Many service technicians are familiar with the fact that certain receiver manufacturers favor the use of particular tube types or combinations of tube types and particular circuits for specific functions and that the locations of these tubes and components on a chassis follow a specific pattern. Even though the technician may not be able to recognize the pattern formed by the placement of components and the tube layout as one which is ordinarily used by a certain manufacturer, reference to a tube location guide should be helpful in determining the origin of the chassis. This can be done by finding a tube layout which matches that of the receiver.

Since a guide which shows chassis layouts or tube locations may cover several hundred receivers which have been manufactured over a period of years, knowledge of the year the receiver was made would help to confine the search for a particular layout. It has been mentioned that many of the major components are stamped with a code number. These may not have been manufactured by the same company that built the receiver; however, the last three digits of the numbers on these components will be a help in dating the set.

Once the year in which the receiver was manufactured is known, it should not be too difficult to locate a similar chassis layout. By referring to the service literature covering the receiver corresponding to the one located in the layout guide, it may be found that the data will correspond closely to that which is needed in the servicing of the receiver.

Model or Chassis Number

Many times the chassis used in a receiver bearing an unfamiliar name will be stamped with a model or chassis number. It is possible that one or both of these numbers are the same as those which appear on receivers bearing the manufacturer's brand name. In such cases, an index of service literature can be scanned to locate one of these numbers or one which is similar. Since this would require looking under several brand names, it could take several minutes of the technician's time.

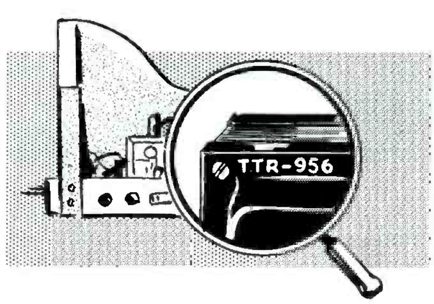
In order to save time, the technician should determine as quickly as possible whether or not the numbers listed under any specific brand name follow the pattern of the number on the chassis. Most manufacturers use a specific combination of numbers and letters to identify the receiver and chassis models in their line. Usually, the model and chassis numbers used by any one manufacturer vary only slightly from year to year. By referring to an index which lists these numbers in a specific order for each brand name, the time used to locate applicable service data can be held to a minimum.

As an example of the way in which the model and chassis numbers can be used in conjunction with an index, let us use a fictitious set of numbers. A Model 20MN42 receiver with Chassis CN59U is to be serviced. Let us further suppose that a search through the index for a similar model number is of no avail; however, some chassis numbers which might be listed under a particular name could be CN49V, CN49U, CN51X, and CN61UV. Upon checking the service literature which corresponds to each of these chassis numbers, it might be found that the data for Chassis CN49U would be applicable in servicing the unknown receiver.

As a double check, the information supplied in the literature could be checked against the features of the unknown receiver. It might be found that the chassis layout, circuit components used, and placement of controls are comparable to those pictured or defined in the literature. For all practical purposes, this literature can be used in servicing the receiver.

Part Numbers

Many of the major components of a television chassis are stamped with identifying part numbers which are as informative as a model, chassis, or code number because they usually follow a specific pattern. If the proper service literature cannot be located by any other means, the part numbers on transformers, filter capacitors, chokes, and controls should be noted. The first two, three, or four digits of some of these numbers may be alike. By comparing the part numbers of these major components to the part numbers used by different set manufacturers, the name of the company that made the receiver may be determined.



Then an index or a layout guide may be consulted to determine which set of data will serve the purpose. Again, a knowledge of the year in which the receiver was manufactured will cut down on time involved in finding the necessary information.

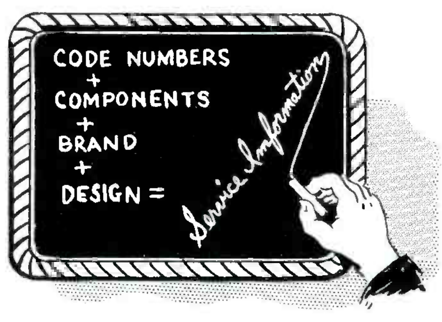
When using the numbers stamped on major components, a technician should consider the possibility that these components may not be the originals. It is highly probable that this chassis may have been serviced in a number of shops and that some of the components may have been replaced.

Part numbers may also be of help in determining whether or not certain data can be used in the servicing of receivers of unknown origin. For instance, suppose a service manual which appears to apply to a receiver of unknown origin has been located. The part numbers on several of the major components can be compared to the numbers listed in the manual. Most of the numbers compared may agree exactly. If this is true and if the circuits used in the receiver conform generally to those shown by the schematic diagram, the search may be considered successful.

Theoretical Case

Now that the methods of locating applicable data have been outlined, let us assume a theoretical case and proceed to use these methods to find the data. Suppose that a receiver bears the brand name Alpha and that the model and chassis numbers are VN-711 and CH909, respectively. By referring to an index, it is found that the name Alpha is not listed.

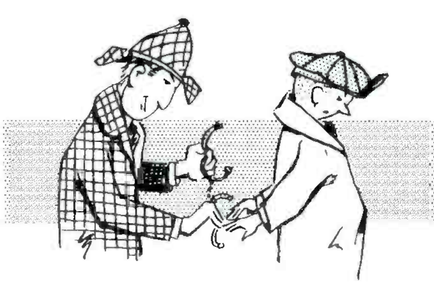
The chassis layout seems somewhat familiar, but the name of the manufacturer who built a chassis having a similar layout cannot be recalled from memory. Furthermore, a check of the model and chassis numbers listed under several names in the index does not reveal any similarities.



Upon closer inspection, the number 987326 is found to be stamped on the chassis. This is undoubtedly the combination of a date and a production-source code number. The last three digits reveal that the chassis was assembled during the twenty-sixth week of 1953. By referring to a registration list of RETMA production-source code numbers, it is found that the manufacturer is the Gamma Manufacturing Company of - - -, Indiana. Now we're getting somewhere! Let's refer to the name Gamma in the index to see if the model or the chassis number of this receiver is listed. Oh, Oh! — Another blind alley! The numbers on the receiver have no similarity to the ones listed in the index.

Well, there is one more place to look — in a tube location guide. Now, where is the guide for receivers made in 1953? Ah, here we are! Hmmm, this layout looks similar — Model XX-17. The index shows that the data for this model is on file. By comparing the receiver with the chassis photographs and the schematic diagram in the service manual, it should be easy to determine whether or not the data is applicable. Well, what do you know? Everything seems to check pretty well, except that a 6SN7GT tube is used as the horizontal oscillator instead of a 12AU7.

Just to make sure that this manual is applicable, let's check the part numbers of the major components against those listed. All check except that of the audio-output transformer. No wonder, someone had installed a replacement unit.



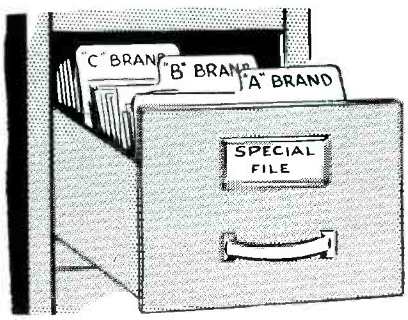
This bit of detective work would probably take about 40 minutes. The next time this set has to be serviced, no time should have to be spent looking for a service manual if a proper record is kept.

Shop Records

Once a technician has spent valuable time locating service data, he should keep a record of all pertinent facts. There are three excellent reasons for this:

1. The technician will probably be called upon to service this same receiver at some future date. An appropriate notation on the customer's service-record card will provide a future reference to applicable data for this receiver.

2. It is possible that the technician may be called upon to service another receiver bearing this brand name. Although the chassis may not be identical to the one previously serviced, it is very probable that applicable data would be listed under the same index heading under which the data for the first receiver was listed. A special cardfile which will provide such information should be maintained in the shop.



3. Over a period of time, the technician may be able to compile a list of manufacturers who have made receivers bearing brand names other than their own. With this knowledge at hand, a search for service literature can begin with a check of the data which covers receivers made by these manufacturers. This procedure will cut down on the time spent in searching for applicable material and will allow the technician to use the initial detective work to good advantage.

Summary

In all probability, receivers with unfamiliar brand names will always exist and the service technician will be periodically confronted with the problem of locating applicable service literature for these receivers. The technician who is able to overcome this problem will have a definite advantage over his competitors.

As a last resort, a technician may find it necessary to write to a publisher of service literature to see if applicable material is available. If this is done, it should be remembered that the publisher can help only when all of the available information concerning the receiver is furnished. Model, chassis, part, and code numbers as well as a sketch of the chassis layout and the location of controls should be provided. Although the publisher would have more experience and a more complete file, his methods of locating specific data would follow those suggested in this article; consequently, there are actually few reasons why a technician cannot obtain what he needs in his own files.

VERNE M. RAY

Shop Talk

(Continued from page 25)

switch is in the correct position, the meter movement will correctly indicate the value of applied voltage (or resistance). However, if the range-selector switch is in the wrong position, the meter movement deflects to the end stop (either at the right or at the left); and the deflection is no longer proportional to the input voltage. The user then must alter the setting of the range switch to bring the pointer back to the readable position.

The Volt-Ohmatic meter modifies the foregoing process by adding a feedback control circuit. See Fig. 2. The control circuit is a sensing or discriminator network which functions according to the following two broad conditions:

1. Any deflection of the meter movement which falls above full-scale deflection must be rejected. This means that the control circuit is activated. This condition does not hold when the meter is set at its highest range.

2. Any deflection of the meter movement which is less than approximately a third of the full scale also activates the control system. In other words, all readings must occur over the upper two thirds of the meter scale. This second condition does not hold when the meter is set at its lowest range.

Fig. 1. Bergen Automatic Range-Switching VTVM.

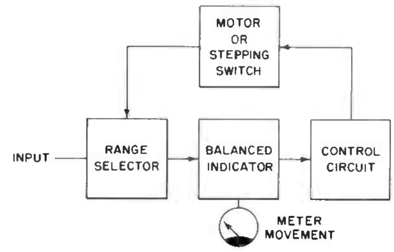


Fig. 2. Block Diagram of Range-Switching Circuitry.

These conditions are designed into the meter network so that a motor is operated whenever an inadmissible deflection is encountered. When an admissible deflection is found, the range selector stops rotating and indicates the appropriate range corresponding to the voltage being measured. (The voltage value is then given by the meter deflection which must then be within a "good" portion of the scale, since the deflection does not violate the built-in "logic" of this automatic instrument.) The same principle of operation is extended to AC and OHMS ranges.

To operate the VTVM, the user touches the probe tip to an unknown voltage or resistance and depresses the AUTOMATIC button on the probe at the same time. This causes the range-selector switch to rotate automatically and to stop at the correct range. The button is then released, and the measured value is indicated on the meter scale.

A second field in which simplification was noted at the WESCON convention was that of electronic circuitry. More and more use is being made of printed circuits. From initial applications involving only small subassemblies, the art of printed circuitry has become so perfected that the Admiral Corporation, for example, uses printed circuitry in the construction of more than half of each of their television receivers. Among the most recent uses for printed circuits is in modules in which there are multiple printed circuits. These units have already been discussed in the PF REPORTER in the August and October 1955 issues, and the service technician will certainly see more of them in the future. Modules are being manufactured by ACF Electronics and by the Aerovox Corporation; and undoubtedly, other firms are either seriously considering entering this field or are actively working in that direction.

This trend toward the use of printed circuits is receiving assistance from several directions. First, there are the demands of the armed services to put more and more electronic equipment into less and less space. Second, there is the transistor with its extraordinarily small size and low current requirements. Third, and probably most important of all, there are the new materials which our physical chemists are wresting from nature. With these new substances, we can produce miniaturized components that work just as effectively as their much larger predecessors.

Reduction in size, remember, involves much more than a mere scaling down of dimensions. A transformer, for example, generates a certain amount of heat as a result of the current flowing through it. This heat must be dissipated; but as we work toward miniaturization, we reduce the available surface area. This forces the transformer to operate at a higher average temperature; and if suitable insulating materials are not developed, component failure will be high.

Temperature also enters the picture in still another way. Overall reduction in the size of equipment, a direct consequence of component miniaturization, means that the amount of heat generated per unit volume will be higher than in equipment of conventional size because there is much less spacing between components in the small units. This leads to a higher average temperature; and this factor, added to the increased heat generated within each component itself, further aggravates the demands made upon the materials used.

The solution, as with printed circuits, depends upon the development of new substances possessing greater heat-resistant properties than heretofore possible. Some of these substances have been perfected. In transformers, silicone impregnated fiber glass and special types of adhesive tapes are now extensively used to provide improved insulation. Cores are generally toroidal or have flat laminations and are fabricated from such materials as grain-oriented steel or powdered molybdenum alloys. Special types of wire coatings, bobbin windings (in contrast to layer windings in larger transformers), and improved production techniques have combined to permit the evolution of transformers which are truly miniature in size.

The same story of improvement of materials can be retold for capacitors, resistors, transistors, or electron tubes. Capacitors are being given added life with dielectrics that are formed with silicone, epoxy- or styrene-polyester resins. Resistors are being improved through the refinement of techniques whereby certain resistive coatings are successfully deposited on glass and ceramic bases. For vacuum tubes, a synthetic mica has been developed. The heat resistance of this substance enables it to serve as a better structural, insulating material than natural mica in electron tubes that are subject to high operating temperatures. This superior ability of synthetic mica stems from the fact that it can be made chemically purer and freer from absorbed gases than natural mica.

There is steady progress in the transistor field toward development of higher-frequency and higher-power capabilities. In the matter of frequency, there are the Philco surface-barrier transistors which will give sizable amounts of gain at 30 or more megacycles. The industry is also carefully watching the experiments at Bell Telephone Laboratories on the recently developed p-n-i-p transistor. This transistor is said to have the ability to produce usable gain at frequencies as high as 1,000 megacycles!! If this is indeed true and the units can be produced in commercial quantities, we are certain to see some remarkable changes in the next few years.

In the matter of power-handling capabilities, the advance has produced some significant victories, too. The substitution of silicon for germanium in transistors has doubled the permissible heat dissipation at the collector and has extended the operating temperature from 75 to 150 degrees centigrade. Internal transistor structures are also being modified so that greater currents can be handled without damage to the unit. IBM recently announced a transistor that acts like a thyratron and can handle 100 ma of collector current. Experimental models have been made to handle currents as high as 15 amps for short periods of time.

These are just some of the changes which are being made in the design of electronic components, but they shed enough light to reveal the trend. At each convention, it is possible to evaluate the progress that has been made since the previous meeting and, in this way, to sort of keep an eye on the progress of the electronics industry.

There is one final item that appeared at the WESCON show and which in time may be of extreme interest to service technicians. If the modular concept of circuit construction catches on, then there will most certainly be a concerted effort toward the establishment of standardized circuits. As a matter of fact, preliminary work along these lines has already been started. Various segments of the industry, in cooperation with the National Bureau of Standards, are setting up a variety of standardized circuits which will serve the functions of most conventional circuitry in electronic devices.

While the immediate purpose of this program is to reduce the multiplicity and complexity of circuits in military equipment, it will have far-reaching effects in home radios and television sets. Think how much simpler your inventory problem would be, say, if 30 to 35 different modules answered your replacement needs for a large majority of receivers. Not only would there be less money tied up in inventory, but it is almost certain to lead to a simplification in servicing. As a matter of fact, the entire concept of servicing would change. Instead of thinking in terms of defective components, you would think in terms of entire stages. These are just the more obvious changes that would take place; there are many more secondary effects which we have not yet begun to appreciate.

A careful observer at the WESCON show would have seen all of these trends and others besides; but from the viewpoint of the service industry, these were the most important. Of course, some of the innovations described at a show may simply "peter out" and never reach us. But even if they do not, you always come away from one of these conventions knowing a little bit more than when you went in, and what you learn is well worth the price of admission. So, if one of these conventions ever reaches your area, take time out to browse around. It will be a profitable experience.

MILTON S. KIVER

Notes on Test Equipment

(Continued from page 11)

The leakage may increase even to the point where it becomes a complete short. It may decrease, or it may disappear entirely. Sometimes it may change and then become stabilized at another value.

The instrument incorporates an ohmmeter which is very sensitive to changes of resistance. In use, the test leads of the instrument are connected without regard to polarity across the capacitor to be tested; and after a brief warm-up period, the METER ADJUST control is adjusted so that the meter needle will be exactly centered over the GOOD sector of the meter dial. The normal resting position of the meter needle when the instrument is turned off is slightly to the left of center position of the dial.

The GOOD sector is a heavy black line less than one-tenth inch wide, and it is located at the center of the dial. On either side of this line are the BAD sectors of the dial. BAD sectors are placed on both sides of the dial center because the leakage resistance of the capacitor under test may either increase or decrease under the influence of the pulsed voltage from the Model 383.

After the capacitor to be tested has been connected and the needle has been adjusted to the center or GOOD position of the dial, the function switch is turned to the TEST position. This puts the pulse-generating circuits in operation, and the peak voltage of the pulses can then be set to the desired value by means of the PULSE VOLTAGE control.

Pulse voltages ranging from 15 volts to 900 volts are provided. The higher values are useful when making a breakdown test or a high-sensitivity type of leakage test. The instruction manual states that the operator should avoid handling the test leads while the function switch is in the TEST position. The pulse voltages are not dangerous to life but can cause an unpleasant shock. The energy content of the pulses is too low to damage most circuit components; however, the pulses should not be applied to such elements as crystal diodes and low-voltage tube filaments.

The instrument can be used to test for leakage in capacitors in several ways — a static test, a dynamic test, and a supersensitive test may be performed.

In the static test, the function switch of the instrument is set to the ADJUST METER position and the test leads are connected across the capacitor to be tested. The METER ADJUST control is turned to bring the pointer to the center position on the meter. The function switch is next turned to the TEST position, and the PULSE VOLTAGE control is advanced to the rated working voltage of the capacitor. The function switch is returned to the ADJUST METER position, and the position of the meter pointer is noted. If the pointer has moved into either of the BAD sectors, the leakage resistance of the capacitor has been changed by the pulse voltage and the capacitor should be considered as leaky.

The dynamic test is set up in much the same manner as the static test, although the meter pointer does not have to be centered. After the pulse voltage is applied, it is allowed to remain for several seconds while the pointer is watched for any drift up or down the scale. Any such drift indicates that the capacitor is leaky.

The high-sensitivity test is used principally in those cases in which the leakage resistance is high, and the pointer movement may be slight as a consequence of this high resistance. In this test, the instrument is set up in the same manner as that for the static test up to the step in which the pulse voltage is adjusted; but instead of adjusting for the rated voltage of the capacitor, the pulse-voltage control is rotated fully clockwise. At this position of the control, the pulse voltage is cut off internally. Then the pulse-voltage control is turned back to the 800 mark. At this point, approximately the full pulse voltage is applied to the capacitor.

If the pulse voltage is increased gradually, the leakage resistance may stabilize. By applying the full pulse voltage, such stabilization is prevented; and a more sensitive indication can be obtained. If the pointer moves into the BAD sector and then slowly drifts back to the GOOD sector, the fact that it has shifted indicates that the capacitor is leaky. The pulse-voltage control is then turned fully clockwise again, and the leads across the capacitor are reversed. When the pulse-voltage control is turned back to the 800 mark, the pulse voltage will be applied to the capacitor in a polarity that is the reverse of that applied during the first part of the high-sensitivity test. This reversal temporarily counteracts any stabilization of leakage resistance which may have occurred during the first application; and if an indication similar to the first one is obtained, then the first indication that the capacitor is leaky is confirmed.

Capacitors may be tested for insulation breakdown by application of a pulse voltage of 150 per cent of rated voltage. The literature accompanying the instrument states that good capacitors should stand this excess amount of voltage without damage.

In summary, the following observations based upon experience acquired in our laboratories may be made concerning the behavior of the Simpson Model 383 tester. It was noticed that the pointer deflection was generally greater for large amounts of leakage and was smaller for small amounts. Low-resistance circuits caused the pointer to oscillate in step with the pulse voltage. The average or midlle position of the pointer is the correct one in this case. This behavior detracts little from the final indication because the large amount of leakage that would be harmful in a low-impedance circuit would also cause a large amount of deflection of the pointer and so could be easily detected in spite of pointer oscillation.

Eventhough the pointer deflection is so slight as to be almost imperceptible in some cases in which the value of the leakage resistance is very high, the technician will probably want to replace such capacitors if they are used in critical circuits. Examples of this type of circuit would be the deflection oscillators and frequency-control circuits in a TV receiver.

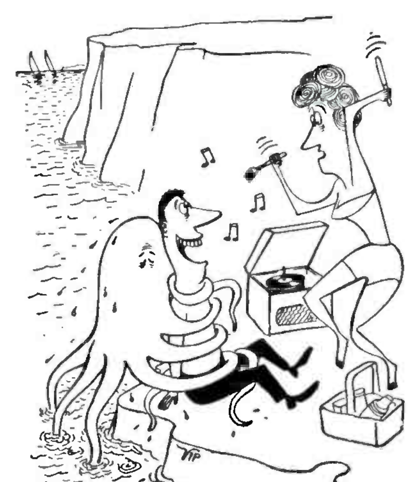
Although the Simpson Model 383 was designed primarily to test for capacitor leakages, a great number of other applications can be made, according to the manufacturer. Some of these are: leakage checks between individual windings and between windings and cores of various transformers; leakage checks between wires that are cabled together; and checks for leakage and voltage breakdown in switches, terminal boards, sockets, and other components. The pulse voltage can even be used as a voltage source for making some of the service calibrations of Geiger counters.

Replacement Transformer for Capacitor Tester

We hear there may be a number of the Solar Model CR 160 capacitor testers sitting unused on service technicians' shelves because of burnt-out power transformers. This model appears to have been particularly susceptible to this type of trouble.

Those technicians who have been wondering where to find a replacement transformer will, no doubt, be interested to learn that the Stancor P-6459 power transformer is an exact replacement. It is manufactured by the Chicago Standard Transformer Corp., Elston and Addison Streets, Chicago 18, Illinois.

PAUL C. SMITH



"Oh, Honey. Relax. He's obviously overjoyed about our JENSEN NEEDLE."

Polar Graphs

(Continued from page 27)

a radius of 95 per cent and at an angle of 10 degrees. This is point No. 2 on the graph.

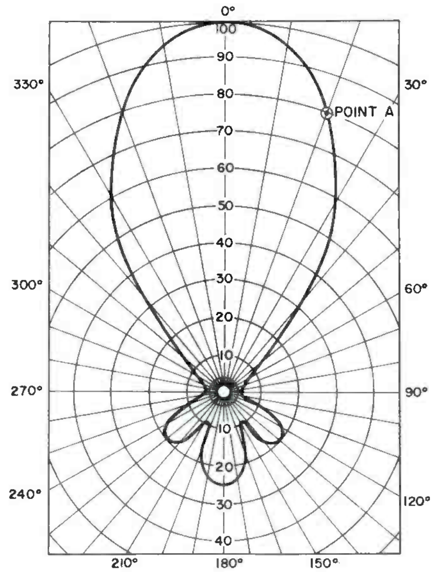


Fig. 2. Antenna Field Pattern Recorded in Polar Co-ordinates.

By stopping the antenna every 10 degrees throughout the full 360 degrees of rotation, a series of plot points can be recorded. Fig. 3 shows the plot points from zero to 180 degrees of rotation. These points on the graph can be connected together by a single line to form one half of the whole curve which represents the directivity pattern of the antenna. In this graph, the points from 180 to 360 degrees have been connected together to form the other half of the antenna pattern.

The point-to-point method of plotting a polar graph does not produce a completely accurate curve. For example, the changes in signal strength over very small intervals of rotation are not included in the final curve. The method is also a tedious and time-consuming process; therefore, most companies or persons who record patterns showing antenna directivity usually make use of an automatic system of recording.

Automatic Recorders

To produce a polar graph, an automatic recorder must be capable of translating changes in received signal strength into mechanical movement and must also maintain its rotating mechanism in synchronism with the rotation of the antenna. One popular type of automatic recorder has a recording pen which is mounted over a turntable. The pen rides along a straight guide rail in such a way that it can move away from or toward the center of a sheet of polar-graph paper placed upon the turntable. The driving mechanism of the pen is actuated by changes in the strength of the received signal. The turntable and the antenna rotator are both driven by synchronous motors so that at any one time they will turn with the same speed and in the same direction.

The pen rests at the center or pole of the polar graph when no signal is being applied to the driving unit of the pen. When a signal is being applied, the pen is driven from the pole toward the outside edge of the graph. The radial distance which the pen travels is directly proportional to the strength of the signal received on the antenna. Since the turntable turns as the antenna turns, a polar graph is automatically traced on the paper.

To record an antenna field pattern on an automatic recorder, the antenna must first be rotated to the heading from which the maximum signal is received. This is the zero-degree position. The main lobe of a field-pattern graph should touch the radius-100 circle at the zero-degree position. A control on the recorder can be adjusted so that the pen will start on that circle. Then, when the antenna is rotated, the pen will describe a continuous-line plot of antenna directivity.

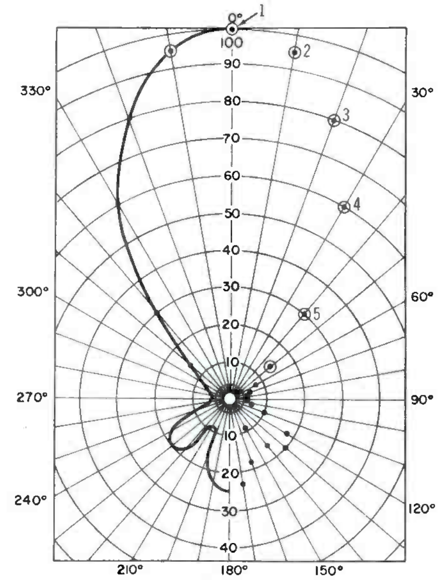
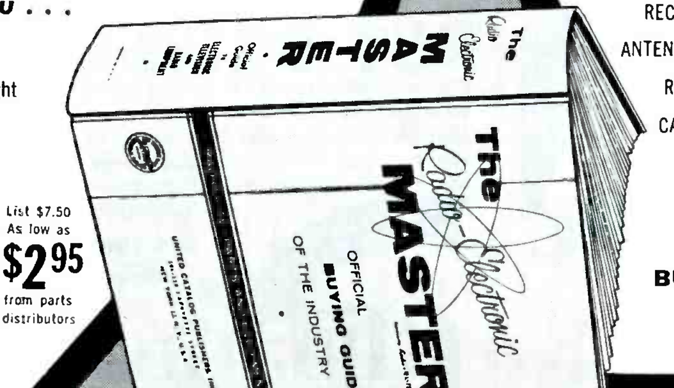


Fig. 3. Polar Graph Recorded by Point-to-Point Method.

By using an automatic polar recorder, the engineer is able to make permanent records of antenna field patterns for any number of frequencies and to perform the work in a reasonably short space of time.



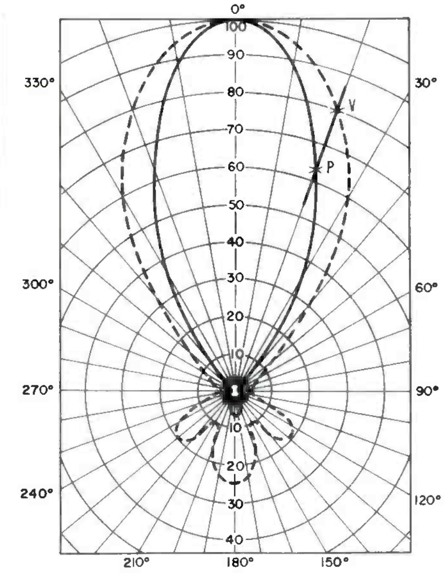


Fig. 4. Power and Voltage Graphs of the Same Field Pattern.

Power Curves Versus Voltage Curves

The shapes of the lobes of a polar field pattern determine the directivity of the antenna. These shapes can be very misleading if it is not known whether the graph is presenting voltage or power information.

Fig. 4 shows two graphs for one antenna. The dotted-line graph presents the field-pattern information in terms of voltage received by the antenna. The solid-line graph presents the same information but is in terms of power received by the antenna. The graph recorded in terms of power has a narrower forward lobe and smaller rear lobes than the graph recorded in terms of voltage information. The power curve seems to represent an antenna with sharper directivity, but this is not true. It is important that the type of information being presented by a polar graph be understood before a proper evaluation of the potential performance of an antenna can be made. Most published graphs are labeled to indicate whether voltage or power readings have been recorded.

Voltage and Power Conversion

A voltage curve can be plotted from a power curve very easily when the information is presented as the percentage of maximum signal received. Point P shown in Fig. 4 indicates that 64 per cent of maximum power is received at an angle of 20 degrees from true heading. Point V in Fig. 4 can be calculated by taking

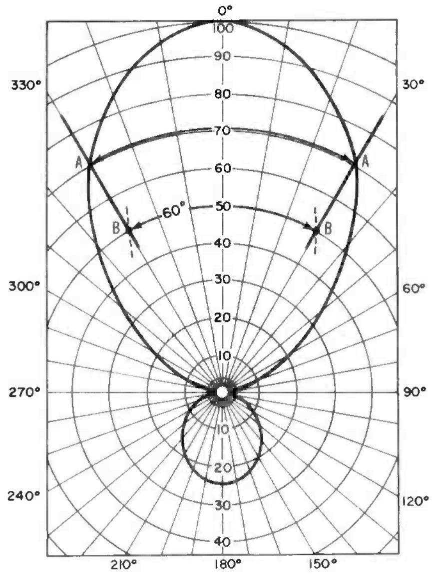


Fig. 5. Half-Power Points on a Voltage Curve.

the square root of this percentage of maximum power.

Point V $= \sqrt{P} = \sqrt{.64} = .80.$

The maximum receivable voltage is 80 per cent at 20 degrees from true heading.

The power curve can be derived from the voltage curve by calculating the square of the percentage of maximum voltage at each antenna position. From Fig. 4, for example,

Point P $= V^2 = .80^2 = .64.$

Half-Power Points

When plotted with voltage information, many polar graphs are shown with an arrow marking the half-power point. On a voltage curve, the point which corresponds to the half-power point is 70.7 per cent. The graph in Fig. 5 shows a voltage curve with the half-power points marked A at radius 70.7 per cent. If a power curve is plotted on this graph, the curve will cross the 50-per-cent radius at point B. The 70.7-per-cent points on a voltage curve designate an angle along the legs of which the power received by the antenna will be 50 per cent lower than the maximum receivable power. In the graph of Fig. 5, the half-power points occur 30 degrees on each side of the true heading. The angle between the half-power points is 60 degrees. This is referred to as the half-power angle.

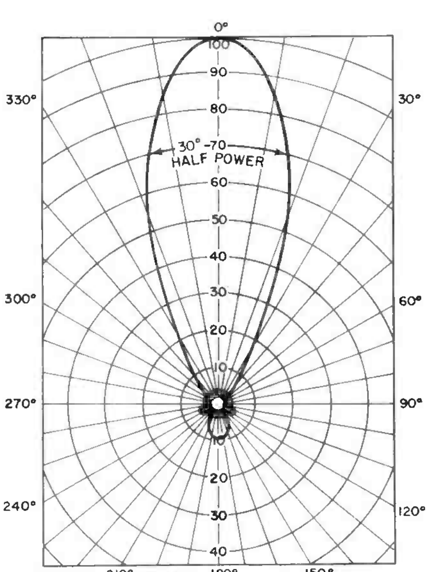


Fig. 6. Field Pattern Having a High Front-to-Back Ratio.

Front-to-Back and Front-to-Side Ratios

The front-to-back ratio of an antenna is a comparison between the voltage developed by a signal from a source in front of an antenna and one developed by a signal from a source in back of the antenna. Front-to-side ratio is the comparison between the signal received from the front and that received from the side. Interference from electrical equipment is also received by the antenna according to these same ratios. The advantage of ratios of high value is that they indicate the ability of the antenna to reject signals from directions other than the one from which the signal is arriving. This directional characteristic allows the antenna to receive a maximum amount of the desired signal and a minimum amount of interference.

The antenna field pattern shown in Fig. 5 has a rear lobe extending to a radius of 25 per cent. The signal voltage that can be received from the rear of this antenna is 25 per cent of the signal received from the front. This antenna then has a front-to-back ratio of four to one. Many antennas will have more than one rear lobe, and the lobes may be irregularly shaped. An estimate of the front-to-back ratio can be obtained by averaging the signal voltages represented by the rear lobes in order to arrive at a fair value of the signal received from the rear of the antenna. The field pattern in Fig. 4 indicates a front-to-back ratio of approximately 4.5 to 1.

The front-to-back and front-to-side ratios are important factors in determining the amount of objectionable interference that will be picked up by the antenna. An example of an antenna having a high front-to-back ratio is the single-channel Yagi. This antenna also has a very narrow forward lobe. A typical field pattern for a single-channel Yagi is shown in Fig. 6. The half-power angle is 30 degrees, which means that a deviation of only 15 degrees from the true heading will result in a power reduction of 50 per cent. An antenna with such a narrow field pattern should be very carefully oriented at the time it is installed.

Field Patterns of Vertical Directivity

Field patterns of the vertical directivity of an antenna are seldom encountered in the television field, and it is only in special installations that the vertical directivity of an antenna is of importance to the technician.

The vertical directivity of an antenna is recorded in the same manner that horizontal directivity is recorded, except that the antenna is rotated in a plane which is perpendicular to the horizontal axes of the receiving elements after the antenna has been given a true heading. The vertical field pattern is useful only when signals arrive at the receiver from directions at various angles with the horizontal direction.

Signals arriving from great distances are often reflected from ionized layers or clouds and arrive at the receiving antenna from an angle above the horizon. An antenna with a wide vertical field pattern will receive more of this signal than an antenna with a narrow vertical pattern. Such reflected signals are sporadic and cannot be depended upon for good television reception. Very often, a reflected signal of this type will interfere with a desired signal; and in such cases, an antenna with a narrow vertical field pattern will have low sensitivity to the reflected signal.

In nearly all television installations, the desired signal arrives at the receiving antenna from a horizontal direction; consequently, a graph of the vertical field pattern will usually be of little practical value to the antenna technician. As a result, the vertical field patterns of antennas are seldom published; whereas, the horizontal field patterns can be obtained for most commercial antennas being sold at the present time.

The antenna-directivity patterns can become a useful tool for determining the correct antenna to be used in a particular area. It is well to remember that the polar field pattern does not designate the gain of the antenna but does present information pertaining to the directivity of the antenna.

GEORGE B. MANN

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INDEX TO ADVERTISERS

December, 1955

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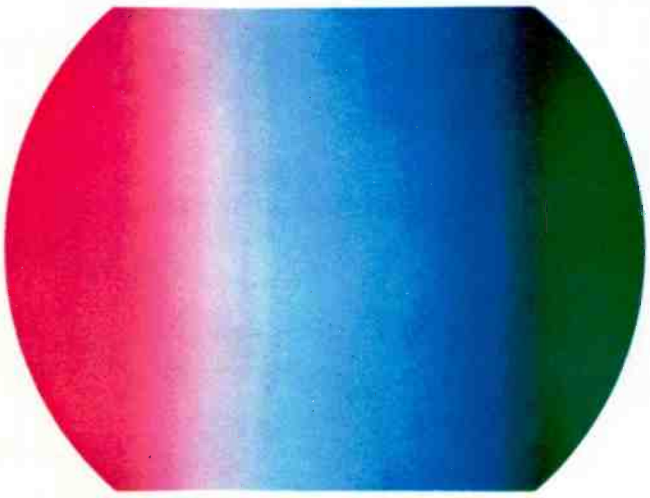


Fig. 2. Normal Pattern Produced When RAINBOWS Control Is Set at +1 Position.

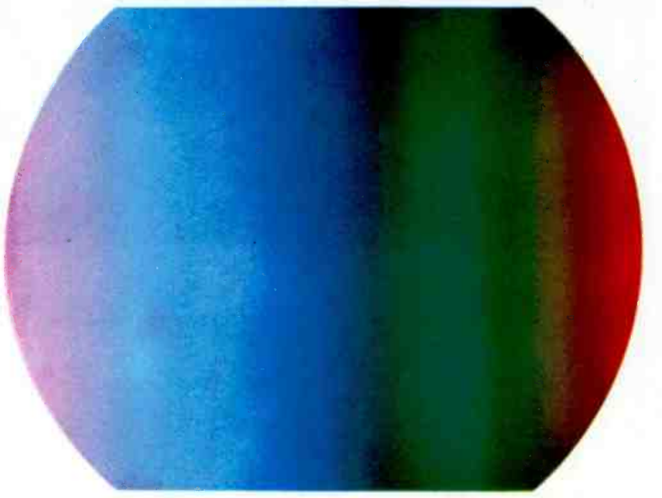


Fig. 3. Pattern Indicating Improper Setting of Hue Control.

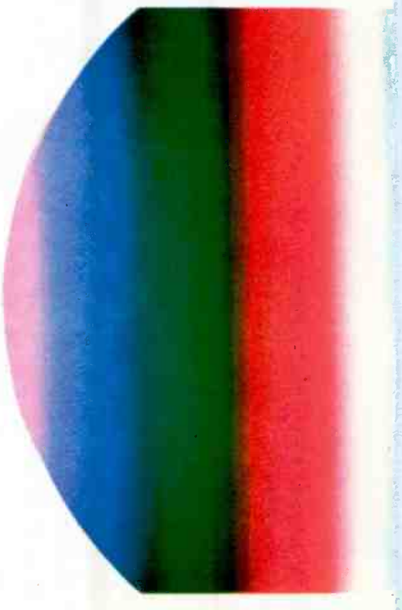


Fig. 4. Normal Pattern Produced When R

Fig. 1. Win-Tronix Model 150 Rainbow Generator.

GENERAL DESCRIPTION

The Win-Tronix Model 150 rainbow generator produces signals which can be used to test and adjust color receivers. Not only can the unit be used on the bench, it can be used as a portable instrument. The controls are neatly arranged and clearly marked to facilitate the selection of the desired signals. Fig. 1 is a photograph of the Win-Tronix generator.

SIGNALS PROVIDED

The Model 150 provides an RF signal which is tunable from channels 2 through 6 on fundamental frequencies. This RF signal is modulated 30 per cent by the 3.58-mc subcarrier. The color subcarrier is phase modulated in a linear manner. When the modulated RF signal is applied to the input of a color receiver that is operating properly, a rainbow pattern is produced on the screen. From 1 to 8 rainbow patterns can be obtained by adjustment of the RAINBOWS control. When the generator is adjusted at the +1 position of this control, all color phases from 0 to 360 degrees are scanned. Fig. 2 illustrates the pattern that is seen on a receiver that is operating normally when the RAINBOWS control is set on this +1 position. This picture represents one rainbow pattern which contains bars of red, magenta, blue, cyan, and green. The red, blue, and green bars are most evident. The magenta bar appears as a narrow transition bar between the red and blue bars, and the cyan bar appears as a narrow transition bar between the blue and green bars. Fig. 4 illustrates the normal pattern when the RAINBOWS control is adjusted to the +3 position.

A 3.58-mc reference signal is provided when the RAINBOWS control is set at the CAL (zero) position. This signal can be used as a reference signal for alignment of the 3.58-mc oscillator and amplifier. This reference signal may be crystal controlled if desired. A dark pink or blue background (depending on the type of receiver being tested) is produced on the screen when the 3.58-mc reference signal is being used. See Fig. 7.

A separate luminance signal is produced by the generator. This luminance signal is generated by modulation of the RF carrier with a 60-cycle signal and provides a reference for matrix and adder checks or adjustments. When the luminance signal is applied to the receiver, the screen is divided horizontally with a dark bar at the top half and a light bar at the bottom half.

CONTROLS

The four controls located on the front panel of the instrument are labeled as follows; POWER, CHANNEL, FUNCTION, and RAINBOWS. The POWER control is a slide type of switch which turns the instrument on and off. The desired channel of operation is obtained by adjustment of the CHANNEL control which is a variable control with a calibrated dial that designates the channels from 2 through 6. The FUNCTION control is positioned in the upper central portion of the panel. This control is a slide type of switch which is marked CHROMA at the left and LUMINANCE at the right. The color signal is available at the output of the instrument when the FUNCTION control is switched to the CHROMA position. When the switch is moved to the right, the color signal is removed and only the luminance signal is available at the output of the instrument.

The RAINBOWS control is a variable type, and it governs the number of rainbow patterns produced on the screen. It has a dial that is calibrated from 10 to -1, and the zero position of this dial is marked CAL. The 3.58-mc reference signal is obtained when the RAINBOWS control is in the CAL position. When the control is set at +1, the sequence of colors from left to right in the rainbow pattern will be red, magenta, blue, cyan, and green. The reverse sequence of colors will be produced when the RAINBOWS control is set at the -1 position.

Another function switch is located on the rear panel of the instrument. This switch is used when crystal control of the 3.58-mc reference signal is desired. A socket for the installation of a 3.58-mc crystal is incorporated in the instrument. When the crystal is employed, the switch on the rear panel is placed in the upward position and the FUNCTION control is placed in the CHROMA position. For operation without the crystal, the crystal switch is placed in the downward position.

The output is available from a jack located on the rear of the instrument, and the output cable is a 300-ohm twin lead.

CHECKING RECEIVER OPERATION

Connect the output cable of the generator to the antenna terminals of the receiver being tested. Set the channel selector of the receiver to an unused channel from 2 to 6. The CHANNEL control on the generator is set for the same channel to which the receiver is adjusted. The FUNCTION control is switched to the CHROMA position. The RAINBOWS control can be set at any position on the dial. Adjust the fine-tuning control on the receiver and the CHANNEL control on the generator for the brightest raster and the presence of color. A number of settings on the CHANNEL dial will produce rainbows because of normal beats and sidebands; however, a dark raster will be obtained when the CHANNEL control is set at the channel frequency. Tune the CHANNEL control to either side of this setting in order to produce a bright raster.

Adjust the RAINBOWS control to obtain a stationary pattern. A single rainbow pattern like that shown in Fig. 2 should be used for the initial check of the receiver. Adjust the brightness, contrast, saturation, and hue controls of the receiver in an attempt to produce the proper pattern. If the receiver produces a satisfactory pattern, its operation can be considered normal.

If a satisfactory picture cannot be produced, analyze the symptoms in order to determine which section is not operating properly. All color troubles will fall into these three categories: (1) loss of color, (2) wrong color, and (3) loss of color synchronization. After determining the proper category of the symptoms, substitute tubes in the stages involved. If no improvement is noted, proceed as outlined in the servicing section.

SERVICING

The operation of the color stages of the receiver can be checked with the signal available from the Win-Tronix Model 150 rainbow generator. In every case, it is assumed that the receiver operates normally when receiving a monochrome transmission.

NO COLOR

If no color can be produced, the trouble may be in the RF-IF section or in the color section of the receiver. In order to narrow the trouble to the fewest possible sections, check for the presence of the color signal at the input of the demodulator stages. Fig. 11 illustrates the color signal which should be present at the input of the demodulators. If the signal is not present at this point, the trouble must lie somewhere between it and the input of the receiver.

Do not overlook the possibility that the tuning range of the tuner might be insufficient. Check the setting of the fine-tuning slug or trimmer. If color cannot be received even though the fine-tuning range is known to be correct, check the alignment of the tuner and IF amplifiers. If the receiver employs a color-killer stage, check to see if this stage is cutting off the bandpass amplifier. If it is, check the operation of the color-sync section as outlined under "Loss of Color Synchronization."

Color demodulation should take place if both the chrominance signal (Fig. 11) and the CW signal (Fig. 12) are present at the demodulators. If either is absent, locate the defective stage by tracing backward through the circuits with an oscilloscope. After the defective stage is located, voltage and resistance measurements will usually make identification of the defective component possible.

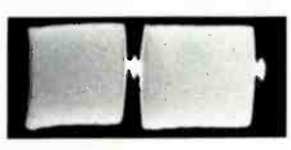


Fig. 11. Chrominance Signal at Input of Demodulators.

Fig. 12. CW Signal at Input of Demodulators.

WRONG COLOR

Defects associated with wrong color can be classified into two main categories: (1) complete or partial loss of one of the color-difference signals, and (2) a phase error in either the chrominance signal or the CW reference signals at the input to the demodulators.

If any color is produced, the CW reference oscillator is operating and the reference and chrominance signals are being fed to at least one of the demodulators. The first step is to determine whether or not both demodulator circuits are working. This can be done by noting the effects on the pattern as the hue control is rotated. In receivers that are operating normally, the colors on the screen will vary through a range of hues as the hue control is rotated. Fig. 3 illustrates a picture which has improper colors. Note that the blue and green bars cover most of the screen. The red bar is practically off the screen, and a little red is showing at both sides. The hue control is properly adjusted if the red and blue bars cover approximately 80 per cent of the screen and the green bar covers approximately 20 per cent of the screen.

If only one of the color-difference signals is present, each of the color bars will remain predominantly at one of two hues. If the receiver demodulates on the I and Q axes and if the Q signal is lost, all the color bars will appear predominantly a red-orange or a greenish-blue color, as they do in Fig. 5. This pattern is to be compared with the normal pattern in Fig. 4. If the I signal is being lost, the color bars will appear predominantly green or magenta like those in Fig. 6.

If the receiver demodulates on the R - Y and B - Y axes and if either of the demodulator sections fail, the following conditions will exist. If the B - Y signal is lost, the bars will appear predominantly red or cyan. If the R - Y signal is lost, the bars will appear predominantly greenish-yellow or blue.

Another significant thing that will be noted when checking a receiver that has lost one of the color-difference signals is that some of the bars may lose all color at certain settings of the hue control. After it has been determined which signal is absent, a signal-tracing procedure should disclose the faulty stage.

Figs. 8, 9, and 10 are color patterns which result from the loss of the red, green, and blue signals, respectively. Although the loss of any one of these color signals would affect the operation of the color receiver during monochrome reception, the patterns are shown in order to provide a comparison with Figs. 5 and 6 which are patterns that result from the loss of a color-difference signal.

Fig. 7. Pattern Produce[d] ... trol Is Set at CAL Positio[n]

Fig. 8. Pattern Indicati[ng]

Fig. 9. Pattern Indicatin[g]

Fig. 10. Pattern Indica[ting]

ꓘ* Reference Chart No. 10

EL 150 RAINBOW GENERATOR

RAINBOWS Control Is Set at +3 Position.

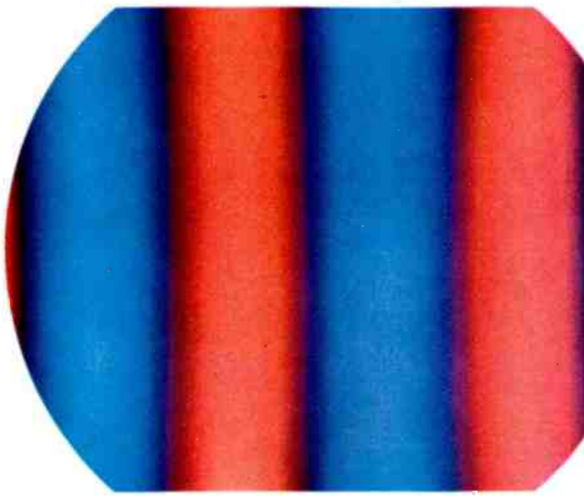


Fig. 5. Pattern Indicating Loss of Q Signal.

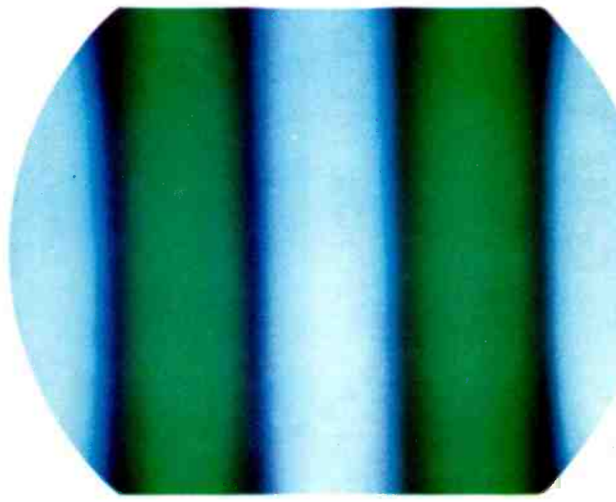
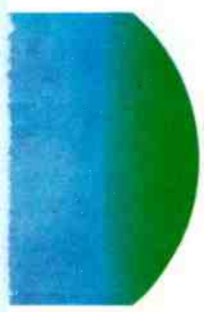
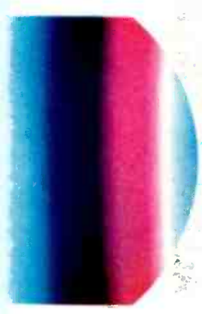


Fig. 6. Pattern Indicating Loss of I Signal.

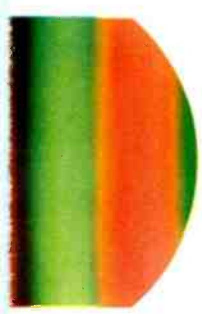


l When RAINBOWS Con-
n.

ng Loss of Red Signal.



ıg Loss of Green Signal.



ing Loss of Blue Signal.

Checking Demodulator Action

Defects associated with phase errors in the CW reference signals or in the chrominance signal can be located through the use of the signal produced by the generator. Adjust the contrast, brightness, hue, and saturation controls; then if the receiver cannot produce a pattern like that shown in Fig. 2, check the operation of the demodulators. Inject a signal into the receiver; and with an oscilloscope, check the signal present in the I channel. Adjust the hue control to obtain the waveform shown in Fig. 13. This is a plus I signal and consists of a sine wave upon which is superimposed a square-wave pulse. Fig. 14 illustrates a waveform that would be obtained if there were an incorrect setting of the hue control. If the hue control is adjusted, the position of the square-wave pulse can be varied with respect to the sine wave. If the receiver under test employs an R - Y instead of an I demodulator, adjust the hue control to obtain the waveform shown in Fig. 15.

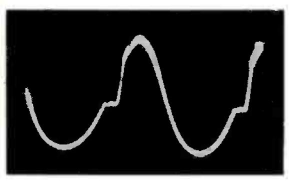


Fig. 13. A Normal Plus I Signal.

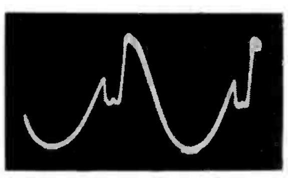


Fig. 14. A Plus I Signal Indicating Improper Setting of Hue Control.

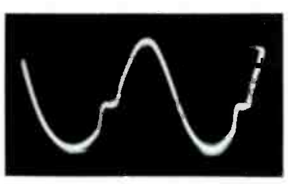


Fig. 15. A Plus R-Y Signal.

With the hue control properly adjusted, connect the oscilloscope to the Q channel. Without readjusting the hue control, check to see if the waveform obtained in the Q channel is like the normal plus Q waveform shown in Fig. 16. The result of an incorrect condition is shown by the waveform of Fig. 17. If the receiver being tested employs a B - Y instead of a Q demodulator, the waveform in the B - Y channel should appear as shown in Fig. 18.

If the signal is not correct in the Q channel (or B - Y channel if one is used), an adjustment of the quadrature transformer must be made. (In some receivers, the order of checking the signals in the color-difference channels may be reversed. Consult the receiver service data to determine the proper order.)

After making the quadrature adjustment, check the signal in the other color-difference channel. If necessary, readjust the hue control. If the colors are not satisfactory, check the operation and alignment of the matrix.

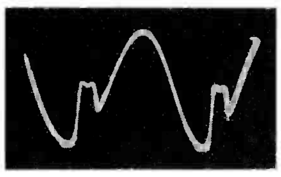


Fig. 16. A Plus Q Signal Indicating Proper Adjustment of the Quadrature Transformer.

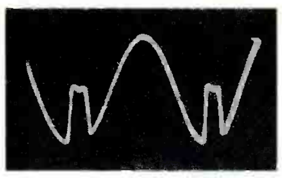


Fig. 17. A Plus Q Signal Indicating Improper Adjustment of the Quadrature Transformer.

Another method of checking for correct adjustment of the hue control and the quadrature transformer is by the use of Lissajous patterns on an oscilloscope. This method is made possible by the linear sweep of the Model 150 generator. An example of a correct pattern is shown in Fig. 19A. It is produced by feeding the signal from the I channel to the vertical input of the oscilloscope and the signal from the Q channel to the horizontal input. The gains of the vertical and horizontal amplifiers in the oscilloscope are adjusted to obtain equal deflection so that the Lissajous pattern approximates a circle as closely as possible. The notch in the circle of Fig. 19A results from the square-wave pulse in the signal from the generator, and its position changes as the hue control is rotated. Fig. 19B shows a pattern produced when the hue control is improperly adjusted.

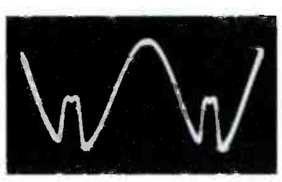


Fig. 18. A Plus B-Y Signal.

Fig. 19. Lissajous Patterns (A) With Hue Control and Quadrature Transformer Correctly Adjusted and (B) With Hue Control Incorrectly Adjusted.

When the pattern is a perfect circle, the quadrature adjustment is correct. When the reference signals are not 90 degrees apart, the pattern will be an ellipse. Fig. 20 illustrates the results when the quadrature transformer is misadjusted. In Fig. 20A, the transformer is misadjusted in one direction and in Fig. 20B in the opposite direction.

Figs. 21 through 23 illustrate the signals that are obtained at the grids of the picture tube when the Win-Tronix Model 150 color generator is used. Fig. 21 shows the signal on the red grid, Fig. 22 on the green grid, and Fig. 23 on the blue grid. These waveforms can be referred to when the matrix is being adjusted and when the operation of the color-difference amplifiers is being checked.

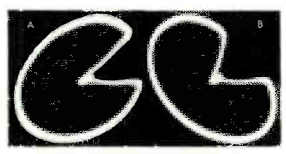


Fig. 20. Lissajous Patterns (A) With Quadrature Transformer Misadjusted in One Direction and (B) With Quadrature Transformer Misadjusted in Opposite Direction.

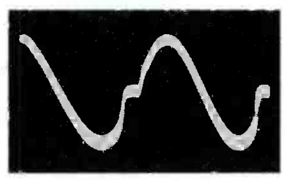


Fig. 21. Signal on Red Grid of Picture Tube.

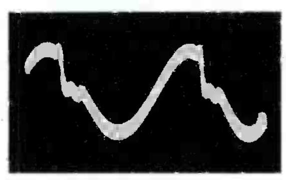


Fig. 22. Signal on Green Grid of Picture Tube.

LOSS OF COLOR SYNCHRONIZATION

If the reference oscillator of the receiver does not synchronize with the color-burst signal, color demodulation takes place at a random rate. Under these conditions, diagonal or horizontal stripes of variegated colors appear in the picture. They may or may not move, depending upon the operating frequency of the reference oscillator. When loss of color synchronization is experienced, trouble in the burst amplifier or color-sync stages should be suspected.

If some color is produced, two things are known: (1) the color signal is being applied to the demodulators, and (2) the CW reference oscillator is operating. The problem is to find out why the color burst and the CW oscillator are not in step.

Fig. 24 illustrates the waveform present on the plate of the burst amplifier when the Model 150 generator is employed. The large spike is caused by the keying pulse obtained from the horizontal-output stage. Note that the color burst is present during the entire retrace time because of the nature of the signal from the generator.

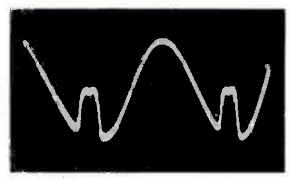


Fig. 23. Signal on Blue Grid of Picture Tube.

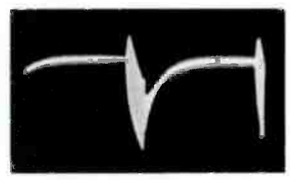


Fig. 24. Signal on Plate of Burst Amplifier.

If there were no color burst, rotate the horizontal-hold control and note whether the color burst appears. When checking some receivers or when using an oscilloscope which has only medium gain at 3.58 megacycles, it may be necessary to increase the vertical gain of the oscilloscope to maximum in order to see the color burst.

If the color burst is present in the output of the burst amplifier, trace the signal to the color-sync section. The type of sync circuit used in the receiver being serviced will dictate the servicing procedure that should be used in the color-sync stages; but in the majority of receivers, voltage and resistance checks will disclose the defective component.

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Reference Chart No. 10

A PHOTOFACT COLORBLOCK Which Outlines the Uses of the Win-Tronix Model 150 Rainbow Generator in Adjusting and Servicing Color Receivers.

Prepared by the Editorial Staff of the PF REPORTER for the Electronic Service Industry—December, 1955

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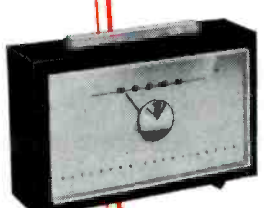

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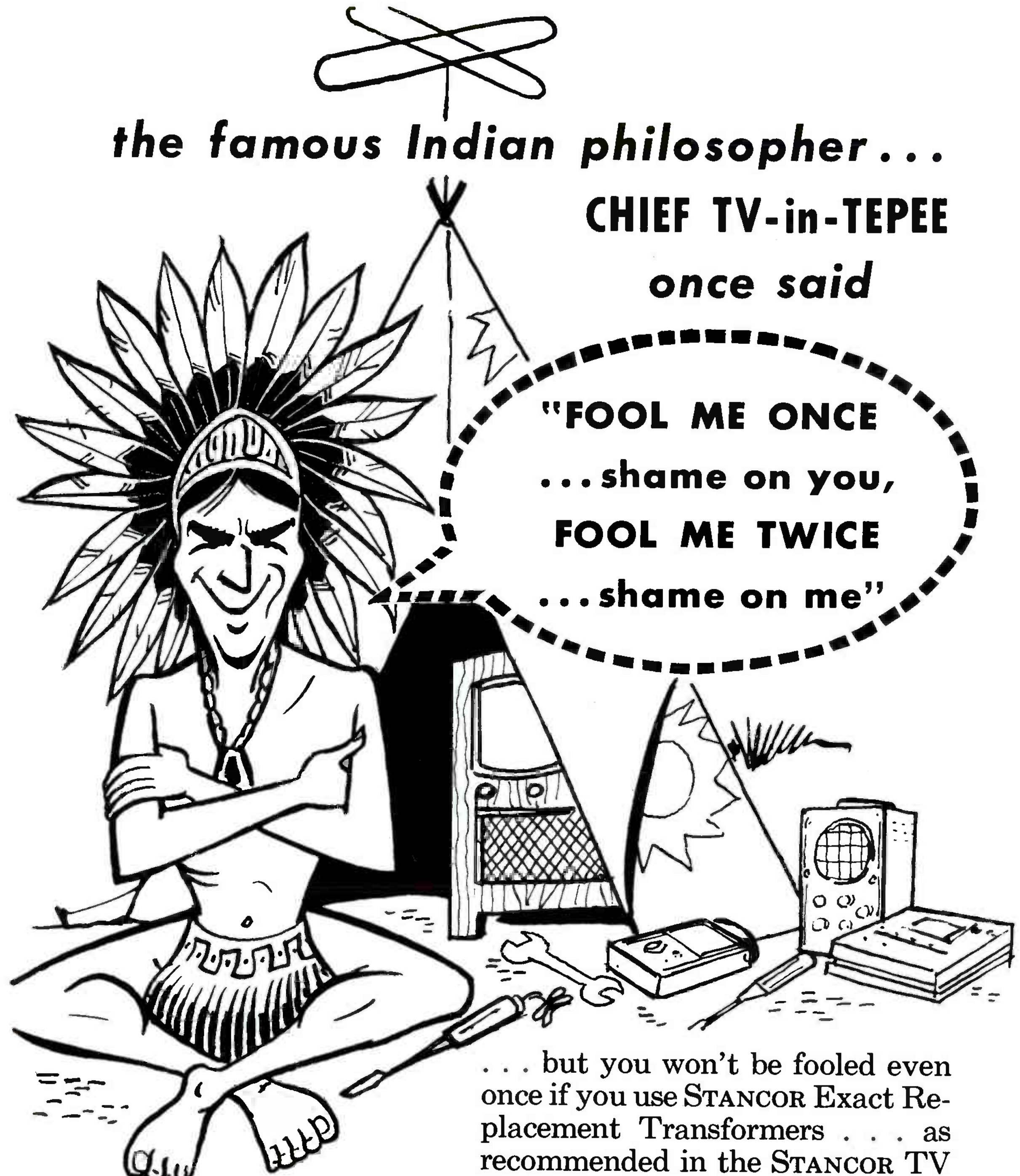

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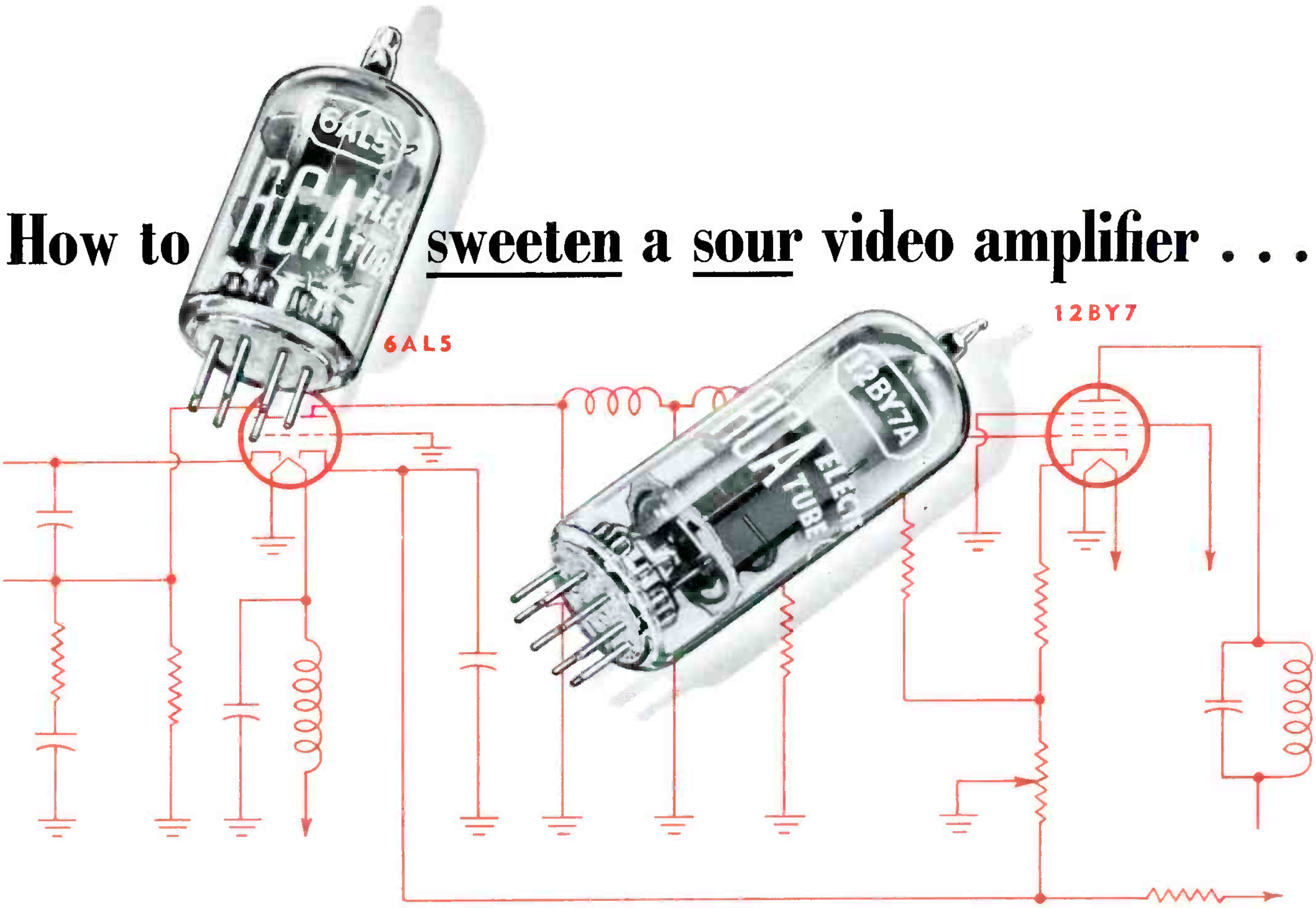

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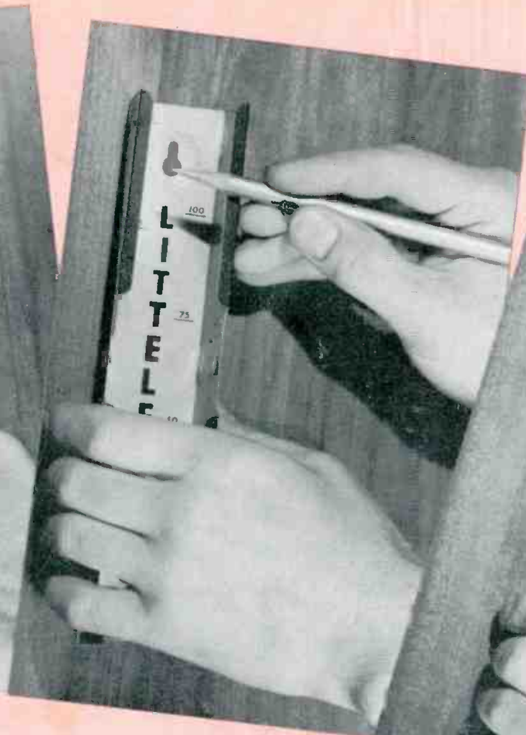

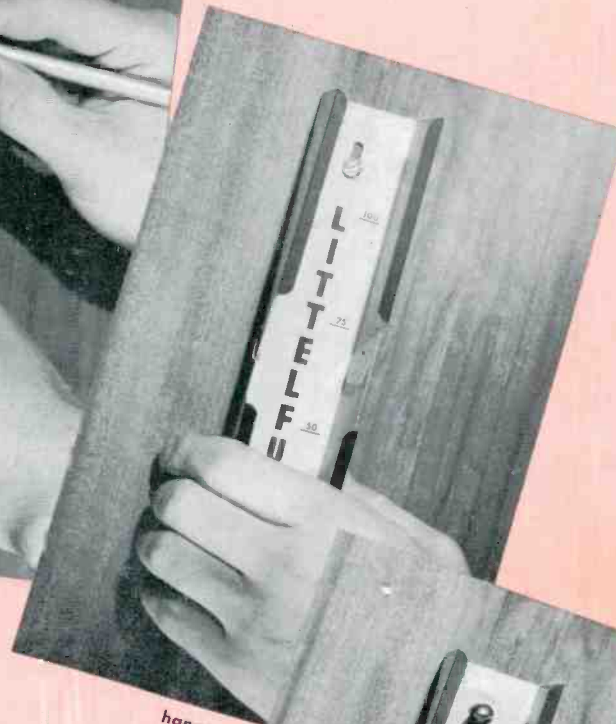

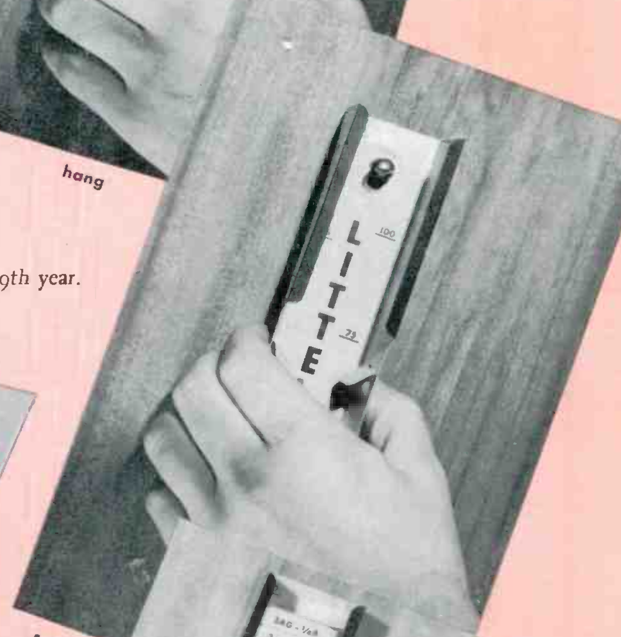

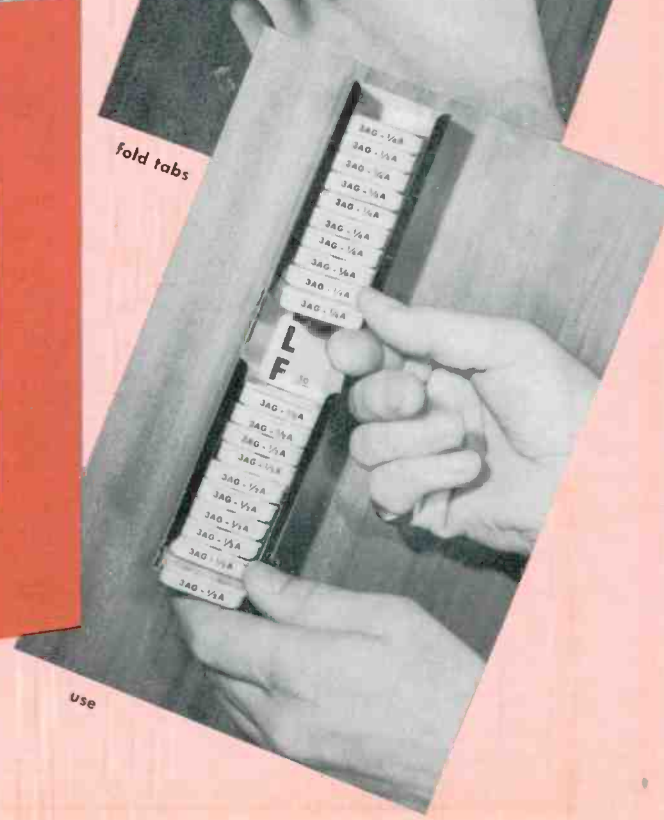

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