Howard W. Sams

PHOTOFACT

INDEX

AND TECHNICAL DIGEST

Sept. · Oct. · 1952

including

INDEX No.

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COVERING PHOTOFACT FOLDER SETS 1 THRU 182

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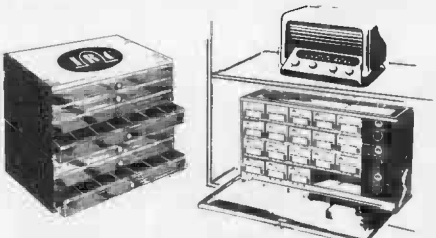
HOW TO ORGANIZE YOUR RESISTOR STOCK FOR SPACE ECONOMY AND EASY USE WITH IRC ALL-METAL KITS AND CABINETS



Improve Your Shop Appearance and Efficiency—End Cigar Box Confusion

Tired of taking time out to go and buy parts? Want a neater, better looking, more efficient shop? Then buy your resistors, chokes and controls in convenient, all-metal IRC kits and cabinets. *At no extra cost*, these compact units put the parts you use most right at your finger tips! And at the same time, you get a neat stocking arrangement that saves space and gives your shop an attractive, business-like appearance.

Pay Only the Price of the Parts Get Kits and Cabinets at *No Extra Cost!*

It costs nothing extra to buy the resistors, chokes and controls you need in these handy Resist-O-Kits and Resist-O-Cabinets. You actually pay only the standard net price of the parts. IRC provides the complete selection of assortments tailor-made to your requirements. And prices begin as low as $4.50.

Beautifully Lithographed Resist-O-Cabinets with any of 3 Fast-Moving Assortments

IRC supplies the popular Resist-O-Cabinets in three wanted assortments—½ watt, 1 watt, and Combination, including ranges most widely used in television. The Combination assortment also includes IRC deposited carbon, close-tolerance PRECISTORS. Four-drawer cabinets have 28 separate compartments—each with range identification. Drawers have special non-spill feature and cabinets are designed for handy stacking. Beautifully lithographed in blue, yellow and silver. Dimensions 5⅜″ x 5 15/16″ x 10⅞″. Dealer Prices: ½ watt Assortment No. 4, $10.00. 1 watt Assortment No. 5, $12.45. Combination Assortment No. 6 (½ to 2 watts), $14.95.

Flat, Pocket-Size Resist-O-Kits for Service Calls and Small Bench Stocks

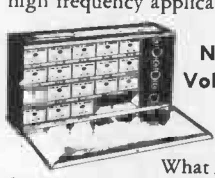
This handy, all-metal kit slides easily into your pocket—takes up scant room on your bench. A real convenience for service calls! Ten compartments keep ranges from mixing and lid snaps securely shut. Each resistor in kit has range clearly marked on body. Resist-O-Kits measure 11/16″ x 3⅞″ x 6⅝″. Price:—$4.50. Your Choice of Two Assortments—½ watt (Assortment No. 7) or 1 watt (Assortment No. 8)—in No-Extra-Cost Resist-O-Kits.

Get the Types of Resistors You'll Need for Most Radio and Television Servicing

IRC Advanced Type BT Fixed Composition Resistors, used in all assortments, easily meet the stiff requirements of television. Compact, lightweight, fully insulated BT's combine extremely low operating temperature and superior power dissipation—actually beat Army-Navy specs in most characteristics.

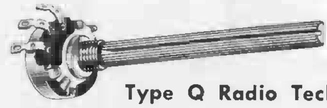
IRC Type BW Insulated-Wire Wound Resistors, used in Resist-O-Kits *and* Resist-O-Cabinets, are unusually stable and inexpensive units for low-range requirements. They have an excellent record in TV circuits and high stability attenuators. Molded bakelite housing seals out moisture and eliminates any possibility of grounding.

IRC Deposited Carbon PRECISTORS, included in the Combination Resist-O-Cabinet Assortment, combine accuracy and low cost in close-tolerance applications. They are ideally suited to critical television circuits and other applications where stability over long periods of time is important. Low voltage coefficient and low capacitive and inductive impedance make them outstanding in high frequency applications.

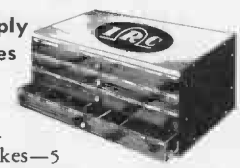


New Convenience in Volume Control Stocks with IRC's Volume Control Cabinet

What Resist-O-Cabinet does for your resistors, IRC's Volume Control Cabinet does for your Type Q Controls. Each IRC Volume Control Cabinet is stocked with 18 new Type Q Controls plus switches and special shafts. With this stock, you can handle over 90% of all AM, FM and TV Single Carbon Control replacements. Individually marked compartments contain controls—3 special drawers hold shafts, switches and spare parts. The Volume Control Cabinet *costs you nothing extra;* you pay only for its contents. Cabinet measures 4½″ x 7⅜″ x 14½″. Price:—$18.54.



Type Q Radio Technician's Volume Control Covers More than 90% of Replacement Needs. Special Knob Master Fixed Shaft Feature and Interchangeable Fixed Shafts give you the widest possible coverage of replacement needs with a nominal control stock. The Knob Master Fixed Shaft handles most knob requirements—gives all the adaptability of a Tap-in shaft with the security of a permanent or fixed shaft. Interchangeable Fixed Shafts convert the Type Q Control to a "special" in just a few moments. Type Q Control, itself, features small 15/16″ size, short ¼″ bushing, rugged construction. It fits smaller sets easily—yet handles the requirements of large receivers without trouble.



Handy Bench Supply of Insulated Chokes in 4-Drawer Metal Cabinet

This assortment contains 140 IRC Chokes—5 each of 28 different units, in two sizes from 0.47 to 10 microhenries. Each value is in a separate, identified compartment. Cabinets are compact, all-metal, handsomely lithographed—and may be stacked with IRC Resist-O-Cabinets. Price:—$29.40—the cost of the Chokes alone. No extra charge for the Cabinet.

IRC Insulated Chokes Make Accurate Replacement Easy

Available in a wide range of size-and-characteristic combinations, IRC Chokes make it easy to meet space and electrical requirements. You can get them in two sizes—both types fully insulated in molded phenolic housings for protection against high humidity, abrasion or physical damage, and possibility of shorting to chassis.

GET NEW CATALOG BULLETIN OF IRC ALL-METAL CABINETS AND KITS

Your name and address on a post card brings you our new Catalog Bulletin DC2A—with details of Resist-O-Kits, Resist-O-Cabinets, Volume Control Cabinets and Choke Cabinets. If you want to make your servicing more efficient and more profitable, get the full story today. There's no obligation.

IRC

Wherever the Circuit Says —/\/\/\—

INTERNATIONAL RESISTANCE CO.

423 N. Broad Street, Philadelphia 8, Pa.

Pick of the Trade

Of an amount expended, in a period of two years, by the Atomic Energy Commission for equipment and supplies, $40 million went into electronic equipment, and another 8½ million went into electronic laboratory equipment.

As a matter of fact, of expenditures placed in forty-one industrial categories electronic equipment ranked fourth.

Electronic equipment has been and will increasingly continue to be a great force in this new science.

These figures have only to do with Government expenditures. But the small industrial use of atomic energy and nuclear products is beginning to grow. The manufacture and sale of instruments and other products to industry, hospitals, agriculture, mining, and oil, is expanding rapidly as more companies gain experience in using and handling radioactive materials. Here, a new market, aside from the expanding Government one, points to immense expansion ahead.

WBB in *Electronic Markets*
June, 1952

★ ★ ★

ONE MAJOR DRAWBACK OF GERMANIUM TRANSISTORS, both point-contact and junction, is that above 75 or 80 degrees centigrade they become unstable or may not operate. Reports from the field indicate that silicon, abandoned in early transistor development for more promising germanium, remains stable at higher temperatures.

★ ★ ★

UHF "IN." Applicants for UHF-TV stations are wooing community-system operators, for the simple reason that they can provide a "built-in" audience the day a UHF station begins telecasting.

One converter at the master antenna can bring a UHF signal down to a VHF channel to be fed to the entire system—obviating the need for each set owner to buy a converter and UHF antenna at $50 or more.

★ ★ ★

NEW BATTERIES. For portable-radio use, new alkaline dry-cell batteries are light-drain devices, rated at about 500 milliampere hours and able to withstand up to 15-milliamperes current drain. The same design, changed slightly by the additon of mercuric oxide to the electrolyte, gives a heavy-drain battery for other uses.

★ ★ ★

Several new radios are using two 1½ volt A batteries connected in parallel . . . The new alkaline batteries are similar in action to the Mallory mercury cell . . . Batteries of the carbon-zinc type, for portable-radio use, are being revamped and improved designs are expected to be on the market . . . The new carbon-zinc B battery will be of the flat-type, and the new cylindrical A battery will be twice the length of the usual 1½ volt cell.

★ ★ ★

GE MARKET RESEARCH indicates that 53 million TV sets will be in operation by 1960, more than three times the present number and five million more than the number of homes expected to have electricity by that time.

Between seven and ten million homes will have two television sets.

★ ★ ★

ALTHOUGH COVERAGE OF 82 CHANNELS will be provided in the ultimate TV receiver, a survey of 30 manufacturers reveals that the need to maintain present low prices prevents immediate production of such sets.

Only two receiver models so far announced provide complete coverage of VHF and UHF channels without additional parts or accessories. Some companies have engineering models built, and at least one front-end manufacturer offers a tuner covering channels 2 thru 83.

—*Electronics*, July, 1952

PF PHOTOFACT INDEX

AND TECHNICAL DIGEST

VOL. 2 • NO. 5 SEPTEMBER-OCTOBER, 1952

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ABOUT THE COVER: The photograph is of Raymond Holshur, owner of Ray's Radio and TV Service, of Warren, Indiana. Mr. Holshur writes: "Would like to thank you for the swell job your Photofacts have done for my shop. I have all of your publications. Keep up the good work."

MILTON S. KIVER
President, Television Communications Institute

Shop Talk

Of prime importance in any signal generator is accuracy. For unless you can depend upon the scale markings, you might just as well not use the instrument.

To check the calibration of a generator, some standard signal is required. This might be a crystal oscillator, or another generator, or perhaps the signal of a broadcast station whose frequency is known. This latter method affords an excellent comparison standard, especially since crystal oscillators or other signal generators are not always on hand, while everyone can avail himself of a broadcast signal.

To use the broadcast signal as your standard, a suitable receiver is required. In the television band this would mean a television receiver. Tune the receiver to one of the local channels. Let us say this is channel 3 where the video RF carrier is 61.25 mc. Loosely couple your signal generator to the lead-in line-perhaps by clipping the generator leads onto the body of the transmission line near the antenna terminals. (This is for unshielded line. For shielded lines, it may be necessary to connect generator leads directly in parallel with transmission wire.) Then, with the generator initially set to 61.25 mc, slowly rotate generator dial until you see a number of dark bars on the screen. The point where you get as few bars as possible represents about as close to zero beat as you can come with your generator and this will represent 61.25 mc on your generator. (On either side of this point the number of bars will increase.)

A similar procedure can be followed with any other received video signals.

Another reference frequency in a television receiver is 4.5 mc if the set is an Intercarrier set. Attach your generator leads to the grid of the first sound IF tube and tune in a station. Now rotate the signal generator dial above and below 4.5 mc until you hear zero beat in the loudspeaker. Wherever this occurs represents 4.5 mc on your generator dial.

A calibration test which is not as accurate as the foregoing but which will serve as a rough check is to use the video IF carrier frequency. Tune a station in on a television receiver and adjust picture and sound for normal operation. If this has been done carefully, then the video IF carrier frequency will be that frequency for which the video IF system was designed. Let us suppose this is 25.75 mc. To check your signal at this frequency, couple the generator loosely to the video IF system. Then set the generator dial to 25.75 mc and note whether visual zero beat is obtained on the picture tube screen. Rotate the dial carefully to determine the exact zero beat point.

None of the foregoing tests take very long to perform and they can serve as a convenient check on the accuracy of your instrument.

If you discover that your instrument's calibration is off, the method of correction will depend upon the instrument. If the manufacturer warns against tampering with the calibrating adjustments, then by all means follow his advice. In these instances some provision is made for returning the instrument to the manufacturer for readjustment. If the instrument cannot be spared, your only recourse is to draw up a calibration chart in which you list the dial frequency and next to this the correct frequency. Try to check the calibration of a number of points over the dial. Then when you require a frequency value lying between these points, you can interpolate between two adjacent known frequencies.

Most manufacturers include information in their operating manuals on the procedure to follow for recalibrating their instruments. In most instances it is recommended that one calibrating frequency fall at the high end of the band and another frequency taken for the low end. A trimmer capacitor is the usual adjustment for bringing the instrument in line at the high end. At the low end, the coil inductance is varied either by an adjustable core or by changing the turn spacing (in air core coils).

Where the calibrating frequencies available to you are limited and you cannot come near the high or low ends of a band, then it is suggested that you draw up a calibration chart as outlined above. This will do until you have occasion to follow the recommended procedure of the manufacturer.

* * *

When a set is brought into the shop for repair, most service men automatically make the assumption that the set was in good operating condition before it went bad. With radio sets, this assumption is almost always true. But in television this is far from being so, especially with people who have never owned a television set before. The set may have been defective when it left the factory and the defect went unnoticed by the customer. Or the set owner may have noticed the defect, but as long as the set was giving him some semblance of a picture, he had decided to wait awhile before calling for service.

What frequently makes these "factory-based" troubles hard to find is the fact that they do not stem from any clear cut defective component. Thus, consider the case of a receiver that exhibited poor lock-in of the picture at low contrast control settings. In checking through the video amplifier stages it was found that what should have been a 4700-ohm resistor had the value and markings of a 270,000-ohm resistor. What had apparently happened here was that the color code markings on the 270,000-ohm resistor were read backwards. If you were checking through this circuit you would have found that the 270,000-ohm resistor recorded a value on the VTVM which agreed with its markings. If you did not have the schematic diagram

♦ ♦ Please turn to page 73 ♦ ♦

Carry This ONE Astatic Dual-Output Cartridge

AND YOU ARE READY FOR MOST 78 RPM REPLACEMENTS

Astatic Universal Model L-12-U Cartridge—Output Is Low (1.2 Volts) with Condenser Harness On; or Slip It Off when High Output (4.0 Volts) Is Needed.

PRINCIPAL FEATURES

1. Stamped steel housing.
2. Needle chuck limiting feature which restricts motion of the chuck both radially and lengthwise, prevents dislocation of chuck, and protects against crystal breakage from rough handling and when changing needle.
3. Dual-output, 1.25 or 4.0 volts at 1,000 c.p.s.
4. Range to 5,000 cycles.
5. Minimum needle pressure, 1 oz.
6. Net weight, 19 grams.
7. Furnished with complete installation instructions and listing of cartridges the L-12-U replaces.

YOU ARE virtually never at a loss when you carry the amazingly versatile Astatic L-12-U Crystal Cartridge. It's the one cartridge that replaces the great majority of 78 RPM units you encounter in your day-to-day business and, at the same time, gives assurance of reproduction qualities better or equal the previous cartridge when new! It isn't a CURE-ALL. But it is the closest thing to it that has been developed since the early days of the industry. It is your best answer for simplification of inventory, for avoiding lost time and problems of servicing, WITHOUT SACRIFICE OF QUALITY RESULTS. Performance, in every application where recommended, is guaranteed by Astatic, the leader.

CARTRIDGES FOR WHICH ASTATIC RECOMMENDS REPLACEMENT WITH THE L-12-U

SHURE			
P30	P88	P93C	W57A
P30B	P88S	P93D	W57AN
P30C	P89	P93S	W58A
P30D	P89S	P94	W59A
P30G	P90	P94B	W60A
P30S	P90B	W40A	W60B
P30W	P90C	W41A	W61B
P35	P90D	W42A	W65B
P35S	P90S	W42B	99-180
P87	P92B	W42BH	99-181
P87B	P93	W42H	99-182
P87S	P93B	W56A	

WEBSTER		
E4	N1	N10P
E9	N2	N11
F1P	N3	N11P
F2P	N4	Q1
F3P	N5	Q2
F4P	N6	
F5P	N6P	
F6P	N7	
F7P	N7P	
F7P2	N8	
F9P	N9	
F10P	N10	

ELECTRO-VOICE	AMERICAN	ADMIRAL
H-12	CR-1	409A1
H-60	CR-2	409A2
L-12	CR-4	409A3
L-12S	S-1	409A10
M-12	S-2	
10		**PHILCO**
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50		352671-1
60		

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A guide to... TV MODEL IDENTIFICATION

by C.P. Oliphant

The numerous markings that are found on a television chassis can be very confusing to the service technician unless he is provided with a thorough explanation of the method and meaning which accounts for them. When a schematic, or specific information pertaining to a particular chassis, is desired, it may be difficult to decipher those markings that are useful in obtaining the correct information. Some markings may be used as guides by the field technician, while others are for use in the production of the receiver. This discussion has been developed in an attempt to supply the service technician with information which is useful in understanding the markings, and to furnish a comprehensive chart that may be used as a reference.

There are four sets of numbers associated with a television receiver, some of which are more important to the service technician than others. These numbers are classified, in this discussion, as Model, Chassis, Run, and Serial numbers. The importance of each number will depend upon the method of chassis marking employed by each manufacturer. In a number of cases, as seen from the chart, it is more important to know the Chassis and Run numbers, when employed, than to know the Model or Serial number, for obtaining service information.

Model numbers ordinarily pertain to the complete television receiver and are mainly used to give a description as to cabinet style. In some cases, the size of picture tube and year of production are a part of the Model number in the form of a code. These codes are pointed out in the chart.

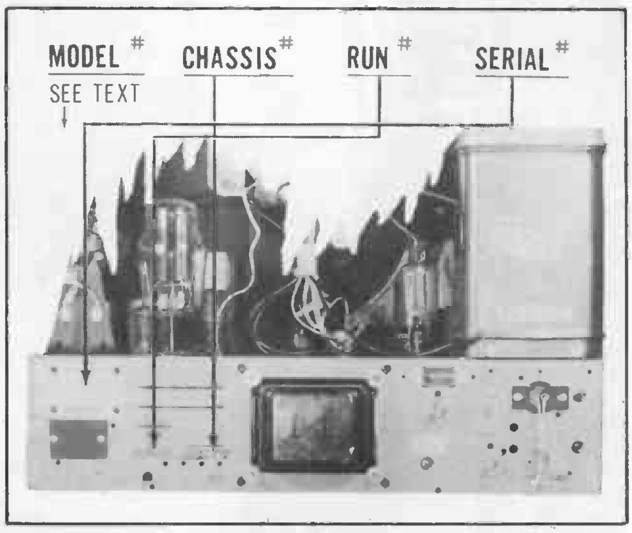
The chassis number, when employed, usually furnishes more specific information than any other number. In those cases where the chassis number is partly or completely obliterated, a knowledge of the methods employed by the manufacturer in deriving the chassis number may be helpful in obtaining the correct service information. As an example, the first two digits in an Admiral chassis number indicate the number of tubes, including picture tube, employed. Let us assume that a chassis (number unknown) is found to have 21 tubes. Reference to the Photofact Cumulative Index shows that there are presently 3 chassis listed which have 21 for a prefix. Thus the number of folders potentially covering this receiver has been reduced to three. Examination of these three folders should disclose the correct coverage.

Run numbers are employed to designate electrical and mechanical changes in a chassis and may be used in conjunction with the chassis number. Not all manufacturers employ the use of a run number; instead, they may have other methods of designating a change. In the case of the Olympic chassis, the different production changes are shown in service data by designating the serial number at the time a change is made.

The serial number is assigned to a chassis for the purpose of identifying a specific receiver, rather than a type of model. Some serial numbers give useful information, as far as the type of chassis is concerned, while others do not. For example, the Sylvania serial number, through a coding system, gives information pertaining to the chassis. This fact is brought out in the chart.

The following chart has been compiled to show the methods that several manufacturers employ in marking their sets, and to give the approximate location of these various markings.

ADMIRAL



MODEL NUMBER: This number is printed on a paper label along with the tube layout diagram, the license information, and voltage and current rating. The label is usually glued to one of the lower inside walls of the cabinet on consoles and combinations and on the bottom of table models. It may also be located on an inside wall on table models and in the upper part of the cabinet on consoles and combinations.

CHASSIS NUMBER. This number is rubber stamped in ink on the rear apron of the chassis. The first two numbers indicate the number of tubes, including the picture tube, employed in the chassis.

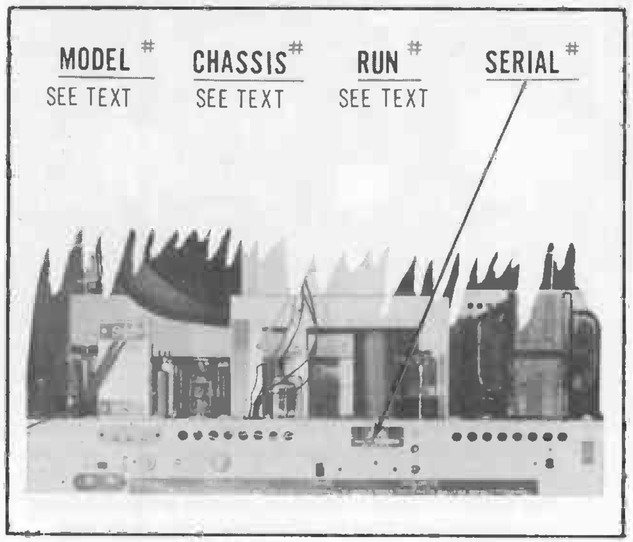

HIS CHOICE IS Regency LARGEST SELLING VHF BOOSTER . . AT ANY PRICE!
JACK K. POFF, MANAGER
DISTRIBUTOR SALES DEPARTMENT
ERIE RESISTOR CORPORATION
ERIE, PENNSYLVANIA
ANOTHER DX ENTHUSIAST PHOTOGRAPHED
AT HOME WITH MRS. POFF
BURTON BROWNE ADVERTISING
ALSO MAKERS OF THE Regency UHF CONVERTER

RUN NUMBER: The run number is also rubber stamped in ink on the rear apron of the chassis. It may be placed under the chassis number or to its right or left side.

The first run of a chassis usually does not carry a run number. Run No. 1 is assigned to the chassis at the time of the first important change to the circuit. Thereafter, the run number increases numerically as to the number of important electrical changes. Therefore, service data, and all supplemental data that corresponds to the run number of the chassis, should be used.

SERIAL NUMBER: The serial number is a series of digits that is printed on a cardboard tag which is rivited to the rear apron of the chassis. It includes any letter that might be ink-stamped after the digits. This number is assigned to the chassis by the manufacturer for the purpose of recording the set.

ANDREA



MODEL NUMBER: This number is usually found on a sticker inside the cabinet and consists of a combination of letters and digits which are coded as follows:

V - Television
T - Table Model
C - Console Model
CO - Console, Radio-Phono Combination
J - Chassis Type
K - Chassis Type
L - Chassis Type

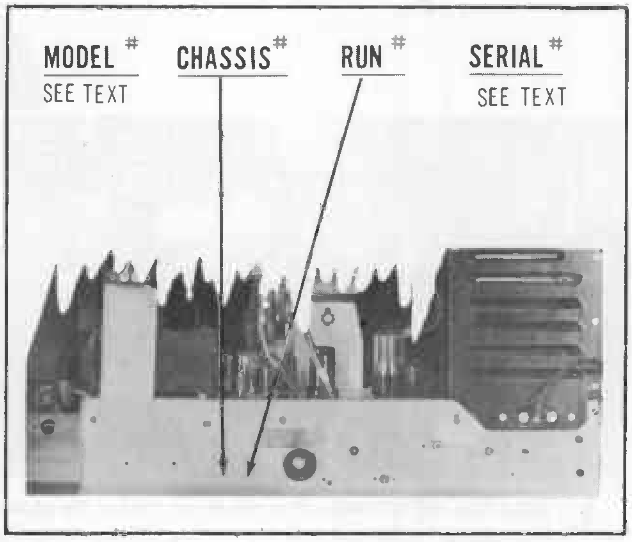
Any other letter signifies the type of wood used in the cabinet. The number following the letter code denotes the size of the picture tube. If a third digit appears after the picture tube size it indicates a different type of picture tube is being employed. For example, Model COVK-125, is a console, radio-phono combination, employing the VK-12 chassis with the digit 5 denoting the type of picture tube being used. Model CVK-126 is a consolette, also employing the VK-12 chassis with a different type of picture tube as shown by the digit 6.

CHASSIS NUMBER: The chassis number is included in the model number and consists of all letters and digits that appear after and including the letter "V". For example, the chassis number VL20 is included in the model number 2C-VL20.

RUN NUMBER: No run number is being employed.

SERIAL NUMBER: The serial number is embossed on a metal plate and is found rivited to the middle of the rear chassis apron.

ARVIN



MODEL NUMBER: The breakdown of the Model 5204CM is as follows: The first digit (5) is a design number which is assigned by the Engineering Department and has no meaning to the serviceman. The second two numbers (20), indicate the size of picture tube. The last figure (4), denotes the exact model in this particular series. The letter "C" stands for console and the letter "M" for mahogany.

The model number is found along with the serial number on a sticker placed on the back cover of the cabinet.

CHASSIS NUMBER: These numbers always contain the prefix "TE" which identifies the series of numbers as being the chassis number, such as TE-290 and TE-300. The chassis number has no particular meaning to the serviceman, other than knowing this number in order to obtain the correct service data for a particular chassis.

The chassis number is stamped on the rear apron of the chassis.

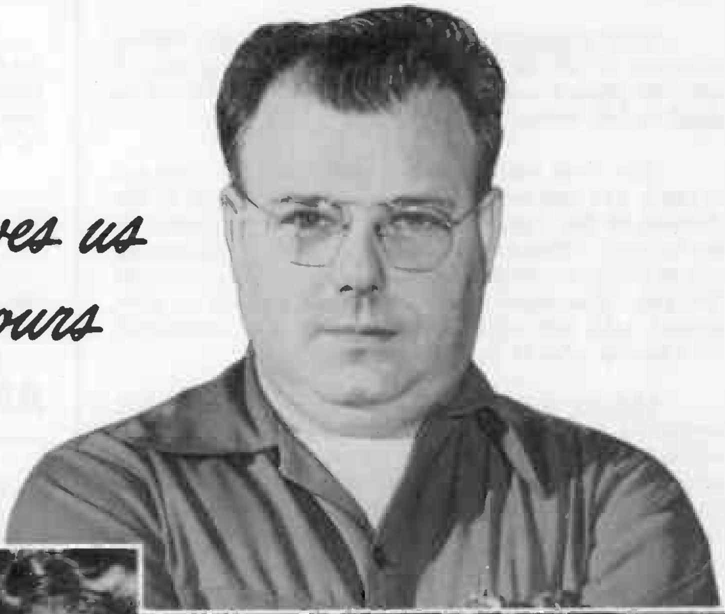
RUN NUMBER: This is a number such as -1, -2, -3, etc., always being placed after the chassis number. The digit signifies the number of production changes that have been made in a particular chassis.

SERIAL NUMBER: This number is assigned to the chassis for the purpose of recording the set. It is printed on a sticker along with the model number and is found on the back cover of the cabinet.

Bill Clemens says—

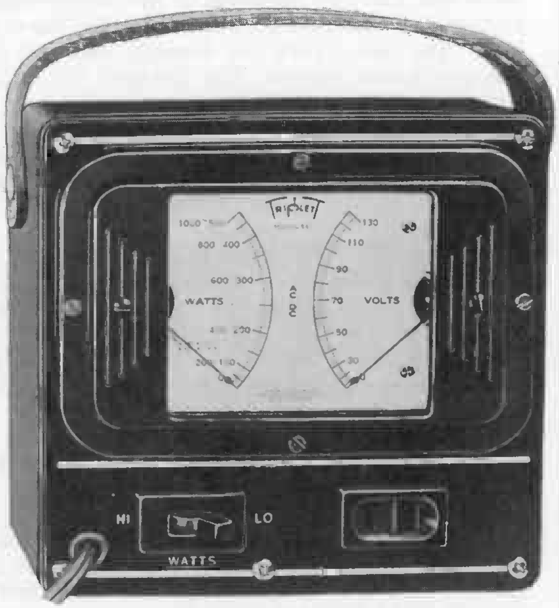
Midget Radio Service (a 3-Man Shop)
129 S. Elizabeth St.,Lima, Ohio

"TRIPLETT 660 saves us 50 to 100 man hours per month."



1. ISOLATING THE TROUBLE—Plug the power cord of the chassis into LOADCHEK and note the reading. With your eye on the large meter remove the rectifier tube and you can tell immediately which side of the tube the trouble is on. You have already eliminated 50% of your probing time.

2. LOCATING THE SHORT—With Loadchek you can quickly check the shorted side, part by part, without laying down tools or picking up test leads. Here, the trouble was a short in the transformer, spotted without having to warm up set. Overloads are round the same way.



Locates trouble in a hurry

The above pictures illustrate but one of the many time-saving uses of Triplett 660 Loadchek. This versatile instrument accurately measures power consumption, enables you to see instantly any deviation from normal load, without disconnecting a single part . . . finds trouble in a hurry.

For Radio and TV servicing—for almost any kind of electrical trouble-shooting—LOADCHEK saves hours of painstaking work every day. At its moderate cost no service technician can afford to be without it. Try one today—and see! Write for free booklet.

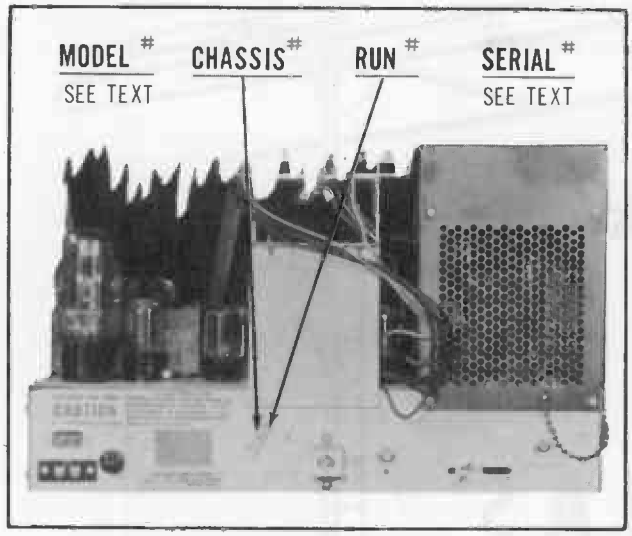
TRIPLETT ELECTRICAL INSTRUMENT CO., BLUFFTON, OHIO, U.S.A.

Suggested U. S. A. DEALER NET $29.50

Price subject to change without notice.

Triplett

CAPEHART



MODEL NUMBER: The model number of current sets is derived from a definite pattern which is as follows:

1st Character.	The number of the model series of the year.
2nd Character.	Type of set. (T - Table model, C - Open face console, H - Half-door console, W - Three-way combination, S - Spinet.)
3rd & 4th Characters.	Picture tube size.
5th Character.	Year of production.
6th Character.	Type of wood. (M - Mahogany, B - Blond, F - Fruitwood or French Provincial.)

For example, the model number 1T172M indicates that the receiver is the first model series of the year, a table model, 17" picture tube, year 1952, and a mahogany cabinet.

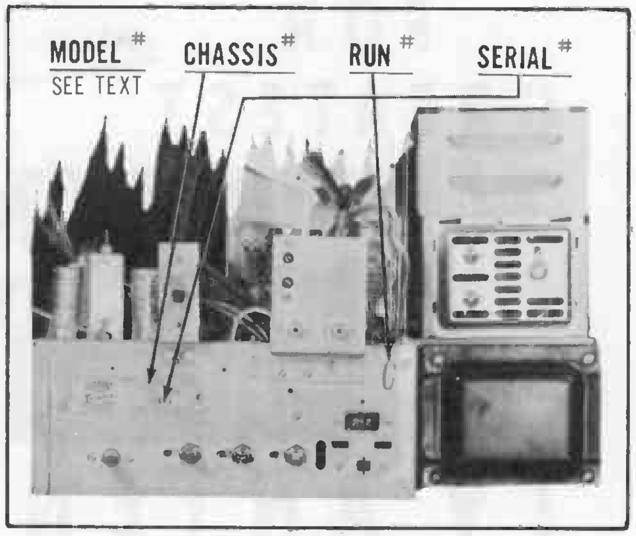
The model numbers previous to the ones described above do not follow a definite pattern. The model number is printed on a label placed on the rear door of the cabinet.

CHASSIS NUMBER: A chassis series identification is employed in addition to the chassis number which is assigned to a given chassis. This series number is preceded by CX, while the chassis number is preceded by a C or CT. For instance, Chassis CT-27, CT-37, CT-38, CT-39, CT-45, CT-47 are all included in the CX-33DX series. The CX series number need not be known, since the C or CT number, which is stamped on the rear apron of the chassis, identifies the chassis for servicing purposes.

RUN NUMBER: The run number is shown following the chassis number. If a particular chassis should be stamped C-286-3 the three indicates the production run of chassis C-286. The run number of any given chassis may or may not indicate the number of changes on that chassis since the first run might have been assigned a number such as 2 or 3.

SERIAL NUMBER: The serial number is found printed on the same label as the model number.

DUMONT



MODEL NUMBER: All models are given names, such as Carlton and Sumter, for the individual cabinet styles which utilize a given chassis.

CHASSIS NUMBER: All chassis are assigned an RA (Receiving Apparatus) number. These numbers range from 101 and up; however, all consecutive numbers have not been used. The chassis number may be determined from the serial number, as stated below under "Serial Number".

RUN NUMBER: The minor engineering changes which occur while a chassis is in production are identified by a code marking on the rear of the chassis. Prior to the Telesets RA-160-162 the code consists of either one or two letters. Beginning with the RA-160-162 chassis, the code consists of a letter or letters followed by a number. For example, the code of the first production chassis was RC3. When the first important engineering change was made, the letter "C" was dropped and the code changed to R4. Further production changes are designated by the letter "R" followed by the successive digit.

SERIAL NUMBER: The serial number assigned to each chassis follows a set pattern and is stamped on a plate mounted to the rear of the chassis. The first serial number of any chassis consists of three digits, the last two digits of the RA number and the number 1. By this method, the first serial number of the RA-109 chassis would be 091. On all successive RA-109 chassis, the 09 remains the same and the rest of the numeral is increased for each chassis produced.

MISC. MARKINGS: Production code dates are large block letters stamped on the major receiver components; such as the power transformer, the tuner, and the vertical output transformer; and on the rear of the chassis. These code dates consist of a number followed by a letter and identify the warranty time interval allowed for the return of defective components. These production code dates give no reference to the type of chassis and will not be found in service material.

FOR GREATEST TV PICTURE *Quality*

AMPHENOL INLINE

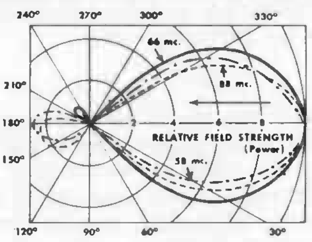
TV ANTENNAS

OUTSTANDING MECHANICAL SPECIFICATIONS

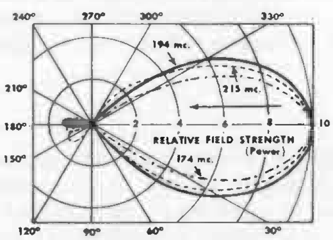
Part	Material	Yield Strength	Size	
		psi	o.d.	Wall
Mast (galv.)	¾" Thinwall Steel Conduit	32,000	0.922"	.049"
Large Folded Dipole	3S ½ H Al.	19,000	.500"	.049"
Small Folded Dipole	3S ½ H Al.	19,000	.375"	.049"
Reflector	3S ½ H Al.	19,000	.500"	.049"
Crossarm	3S H Al.	26,000	.875"	.065"
Center Support & T Casting	Al. Alloy 45,000 psi tensile strength			

EXCELLENT RADIATION PATTERNS

These are the radiation patterns of the AMPHENOL Inline antenna at 58 mc., 66 mc., and 88 mc., in the low band, and 174 mc., 194 mc., and 215 mc. in the high band. Notice the uniformity of these lobes at all frequencies. The lack of lobes off the sides and negligible ones off the back maintains high front-to-back and front-to-side ratios necessary for the rejection of various interferences. The presence of a single forward lobe is usually a very desirable feature, especially when it is wide enough to provide adequate interception area for some differences in transmitter location, changes in the wave front's direction of travel, or physical movement of the antenna in high winds. Furthermore, it is not too critical of orientation. It is necessary only to aim it and forget it.



Horizontal radiation pattern of Amphenol TV Antenna Model No. 114-005.



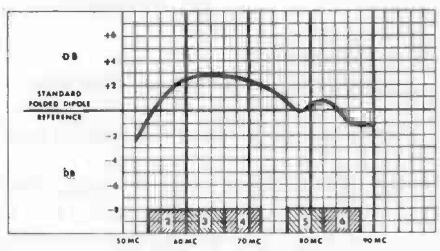
Horizontal radiation pattern of Amphenol TV Antenna Model No. 114-005.

HIGHER GAIN

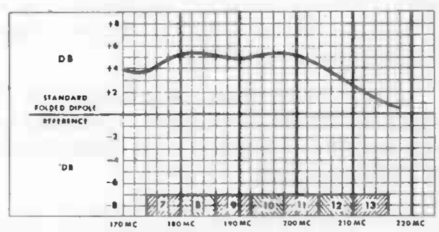
These gain curves of the AMPHENOL Inline antenna represent the intercepted voltage of the AMPHENOL Inline Antenna as plotted against the intercepted voltage of a reference folded dipole cut to the frequency being compared. There is no channel in either the low band or high band where there is more than a three decible change within the channel that can cause picture modulation or "fuzziness." Gain of the AMPHENOL Inline antenna is quite flat over all channels.

You will find more gain designed into the high band because of greater need for it, due to higher losses at these frequencies. Also, notice the drop-off on channel six. This is at the edge of the FM band and is subject to FM interference, so the Inline's gain is purposely held down at that frequency.

The excellent broadband characteristics, impedance match, single forward lobe radiation patterns on all channels, maximum gain, lightning protection, and superior mechanical features of the AMPHENOL Inline Antenna make it the antenna for greatest TV picture quality!



Gain of Amphenol Model No. 114-005 Antenna over a reference folded dipole, 54 to 88 mc.



Gain of Amphenol Model No. 114-005 Antenna over a reference folded dipole, 174 to 216 mc.

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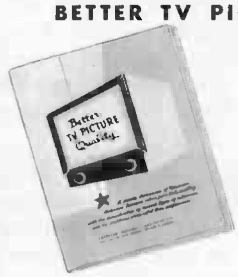

Write for this book containing the characteristics and test performance data of various types of antennas.

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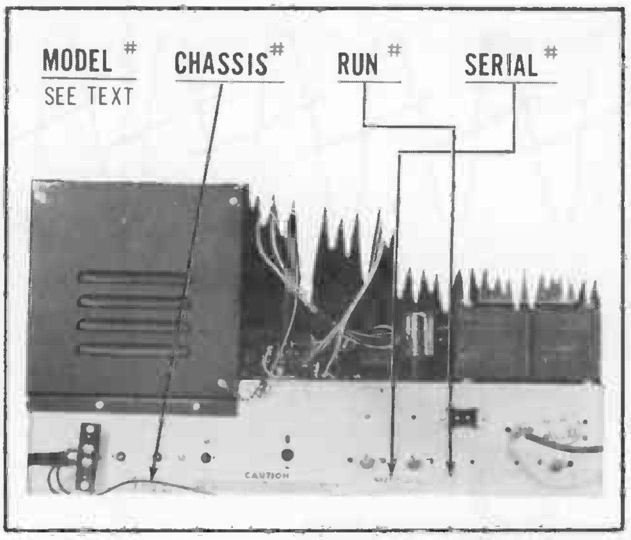
EMERSON



MODEL NUMBER: The model number is found stamped on the back of the fibre board that covers the rear of the cabinet. It denotes the series to which a set is assigned.

CHASSIS NUMBER: In records and service literature identity, the chassis number always begins with the three numerals 120. However, since these three numbers always remain the same, they are not used preceding the chassis number in the actual stamping; therefore, a 120162A chassis would actually be stamped 162A. This number is found rubber-stamped on the rear apron of the chassis. On earlier receivers this chassis number was not stamped on the chassis itself, and in such cases the chassis number can be obtained by noting the numbers and letter preceding the dash in the serial number.

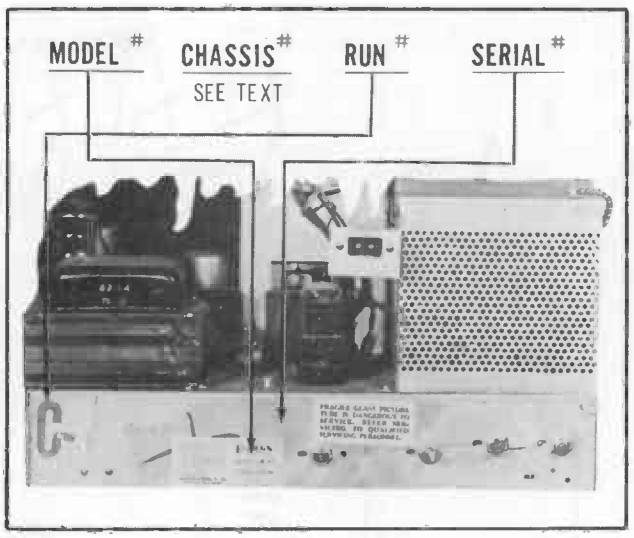
RUN NUMBER: The use of a triangle letter or number is employed to describe any changes that are incorporated in the receiver after the initial production. The first run of a set does not carry a code triangle number or letter. When a change is made of importance to the service industry, the letter "A" would be inserted in the code triangle. If another important change is made at a later date this letter would be changed to the letter "B". Previous to the use of letters, numbers were used in the code triangle, such as from 1 to 9, but at the present only letters are being used.

The code triangles can be found rubber-stamped on the rear apron of the chassis next to the AC input.

SERIAL NUMBER: The serial number is printed on a sticker and is placed on the rear apron of the chassis. It is preceded by the chassis number which is printed in very dark numerals.

MISC. MARKINGS: All other numbers or letters that appear on the chassis are for production use only and do not affect the service coverage.

FADA



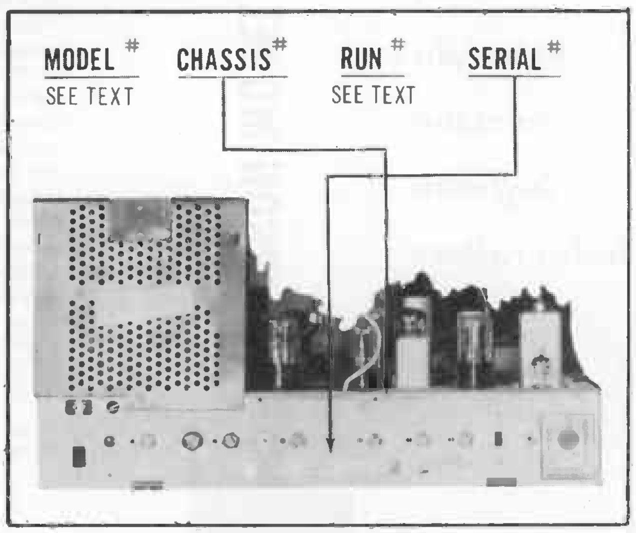
MODEL NUMBER: This number is shown on the License Label which is glued to the rear apron of the chassis and gives a description of the type of receiver.

CHASSIS NUMBER: The use of a chassis number is not employed.

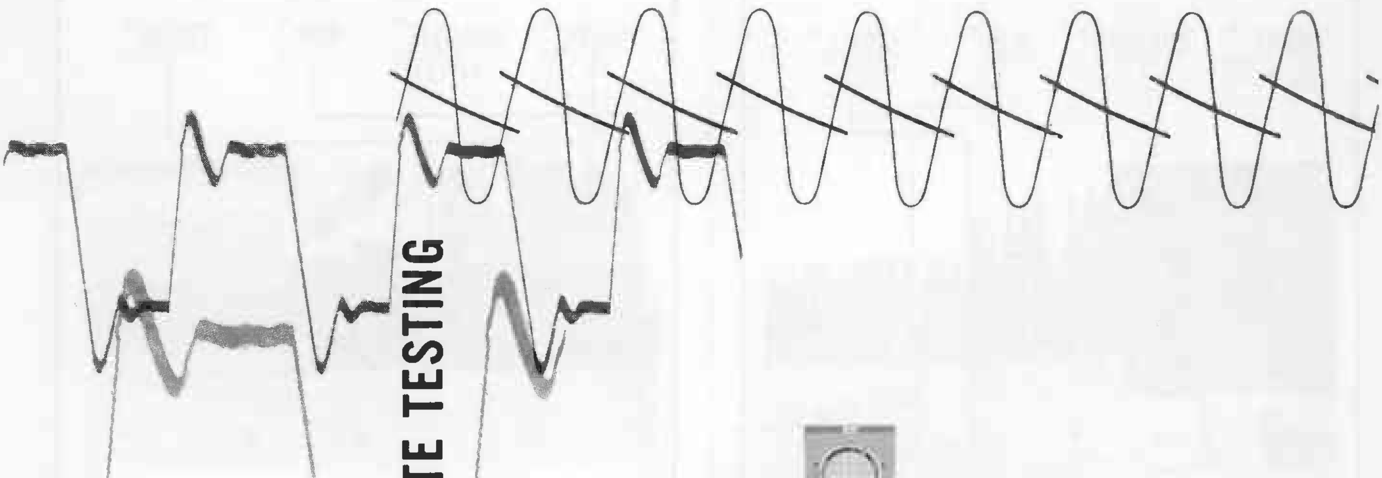
RUN NUMBER: Circuit changes are indicated by a large letter rubber-stamped on the rear apron of the chassis.

SERIAL NUMBER: The serial number is stamped on the rear apron of the chassis. This number is used to identify the individual chassis and does not serve any other purpose. This method is being discontinued and the "Fada, Black and White Registration" serial number labels are now used to register the receiver as to date of sale, warranty, etc.

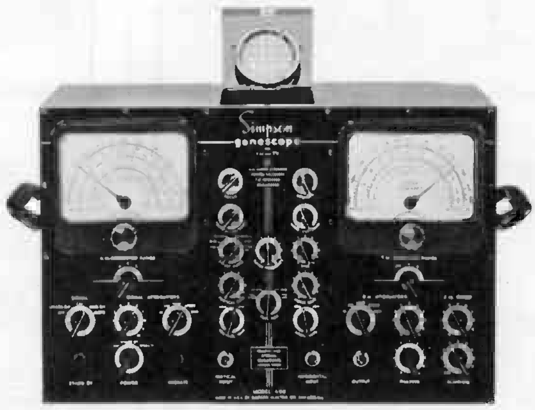
HOFFMAN



MODEL NUMBER: This number is applied to the back cover of the cabinet and is also enclosed on a pink inspection slip stapled inside the cabinet. The model number is used as a description of the set



SIMPSON MODEL 480 GENESCOPE FOR ACCURATE TESTING



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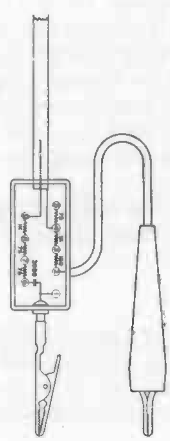

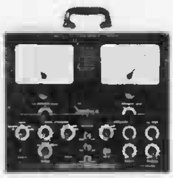

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itself. The first number or numbers denote the picture tube size, the letter denotes the type of wood and the remaining numbers denote the series. Therefore, Model 7M103 would be interpreted to mean 17 inch picture tube, mahogany cabinet and series 103.

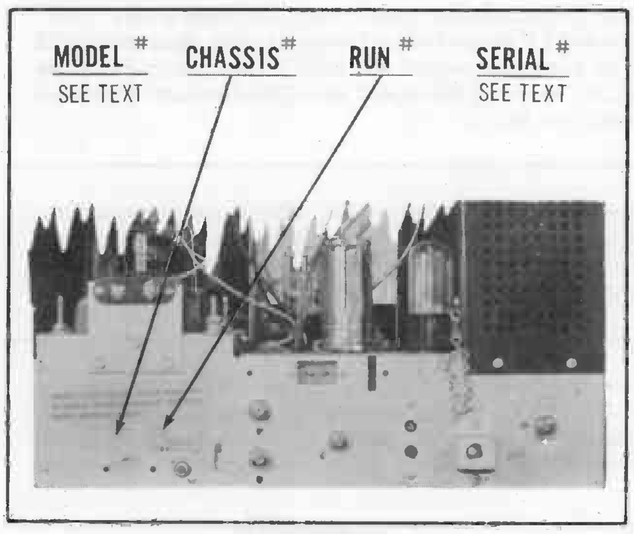
CHASSIS NUMBER: This number is rubber-stamped on the rear apron of the chassis. These numbers are run consecutively with the number of the chassis as it comes from the engineering laboratories and do not give any information other than identifying the chassis while in production.

RUN NUMBER: The different production changes are designated by the serial number.

SERIAL NUMBER: This number is embossed in the rear apron of the chassis and provides information pertaining to the receiver. The first letter is used to denote the month during which the set was built while the first number shows the year. The following numbers indicate the number of the set. From the serial number B110356 it is found by the above method that the set was built during the month of February in 1951, with B standing for February, and the first 1 indicating 1951. On various occasions there may be two letters preceding the number such as BX110356 - where X indicates a pilot run for that particular set with all other designations remaining the same.

MISC. MARKINGS: All markings found on the rear apron of the chassis, other than the ones explained above, are used in the production of the set and have no meaning to the service technician.

MAGNAVOX



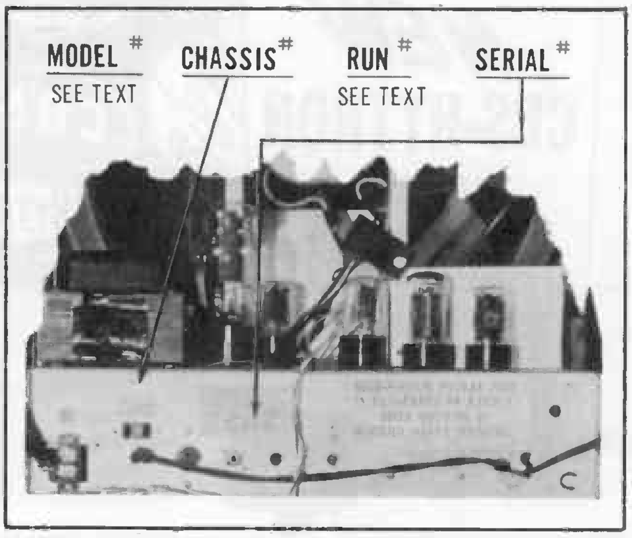
MODEL NUMBER: The model number is found embossed in a metal plate which is attached to the edge of the chassis ledge.

CHASSIS NUMBER: The chassis number is rubber stamped on the left rear apron of the chassis and is identified by the fact that it is preceded by the letters CT which is the designation for television. The identification letters are then followed by three digits which identify the chassis by number. Any letters which might appear after the chassis number will be explained in the following section.

RUN NUMBER: The production run of the chassis is identified along with the chassis number. It is signified by one or two letters following the chassis number, as shown by the CT331EA chassis. Any electrical changes which are different from the original production are indicated by a change in the first suffix letter. Therefore, the letter "E" means there have been five revisions since the original 331 chassis. The second suffix letter refers to any mechanical change that has been made. If a mechanical change is made on the CT331EA chassis the new designation would be CT331EB.

SERIAL NUMBER: The serial number, along with the model number, is found embossed on a plate and attached to the edge of the chassis ledge.

MAJESTIC



MODEL NUMBER: The model number, which can be found on a printed label pasted to the back cover of the cabinet, only refers to the cabinet design and gives no reference to the chassis design.

CHASSIS NUMBER: This number, which is classified as a "Series Number", is found rubber-stamped on the rear apron of the chassis. A typical series number would be 106-3 where the digit three denotes that this particular chassis is run number three of the series 106.

RUN NUMBER: This number is stamped with the chassis number. It consists of all digits that appear after the dash in the chassis number.

SERIAL NUMBER: The serial number is found printed on a label and pasted to the rear apron of the chassis.

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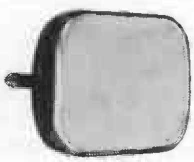

For example, CBS-Hytron originated: the GT tube . . . the subminiature tube . . . the rectangular picture tube . . . specialized, low-cost TV receiving tubes. CBS-Hytron's new picture-tube and miniature-tube plants are the most modern in the world. Such aggressive leadership guarantees you the newest and best in tubes.

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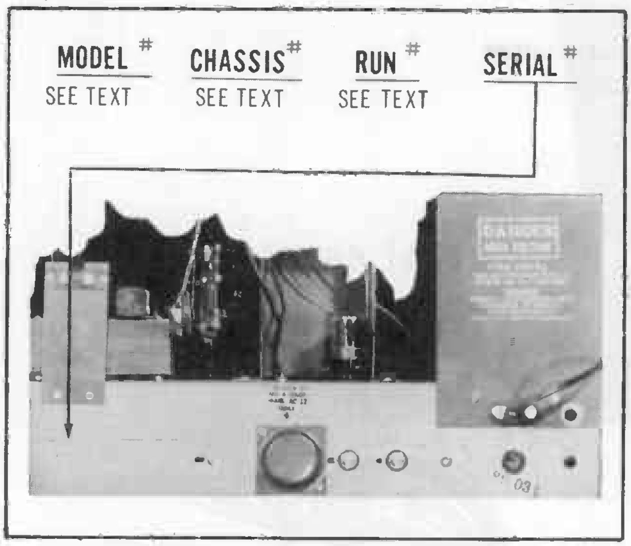


MODEL NUMBER: These numbers consist of two letters, a three digit number and one or two letters following the three digit number. When "MM" is used as the first two letters a leader line is indicated and when "JM" is used a deluxe line is indicated. The first number of the three-digit number in the leader line begins with the number 6, while in the deluxe line it begins with the number 7. The next two numbers designate the picture tube size. Following the three digit number is either a "T" or a "C" designating a table or console set. Therefore, Model JM720C is a deluxe receiver number seven with a 20-inch picture tube in a console cabinet. The model number is found on the tube layout chart inside the cabinet.

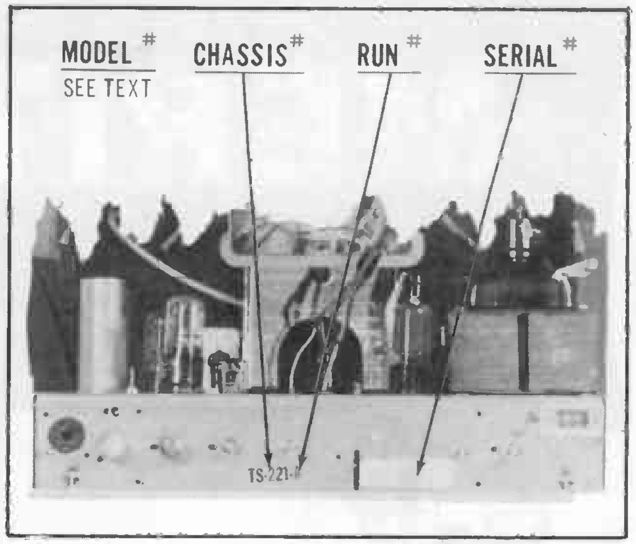
CHASSIS NUMBER: The chassis number is found on the tube layout chart inside the cabinet. A typical chassis number is 9018.

RUN NUMBER: The run number is the letter and first three digits of the serial number.

SERIAL NUMBER: The serial number is stamped in the upper left corner of the rear apron of the chassis. The last five digits comprise the sequence in which the chassis is produced during any given run.

MOTOROLA

MODEL NUMBER: The model number is found stamped on a sticker on the outside of the back cover. The present method of identification is shown by using model 21T4EA as an example. The "21" denotes a 21-inch picture tube. "T" represents a table model. "4" is the cabinet styling, and "EA" refers to the cabinet material. The cabinet styling of other models may be designated by using more than one digit. Other identifications for the model type are: "C" for model with detachable console-height legs; "K" for console; and "F" for combination. In very rare cases the first two digits may not denote the picture tube size. Such is the case for the 20F1 and the 21F1 in which both chassis employ a 20-inch picture tube.



Other methods have been employed to denote the picture tube size in the model number. In the Model 7VT1 the size of the picture tube is denoted by the number 7 which represents a 7-inch tube. In the Model VF103, the picture tube is a 10-inch tube as denoted by the first two digits.

CHASSIS NUMBER: The chassis number is ink-stamped on the rear apron of the chassis. It is identified by the prefix letters "TS". The first digits denote the chassis series and the letter or letters following this number represent the issue of the chassis. The first issue is designated by the letter "A". Any number following the issue letter is explained in the following section.

RUN NUMBER: This number is found at the end of the chassis number. The first run of a particular chassis is stamped "00", the second run is stamped "01", etc. When the issue is changed to "B" the run number reverts to "00".

SERIAL NUMBER: The serial number is found printed on a sticker and placed on the rear apron of the chassis.

MUNTZ

MODEL NUMBER: These numbers, such as M21 and 2053A, are found on a sticker that is applied to the inside wall of the cabinet. In the model numbers starting with a digit the first two numbers indicate the picture tube size, while the remaining numbers and letters describe the type of cabinet.

CHASSIS NUMBER: The chassis number is printed on the serial number label that is attached to the rear apron of the chassis and also stamped with the name stamp on the rear of the chassis apron. The first two digits signify the number of tubes, including the picture tube, which are employed in the receiver. The remaining letter and number are for the purpose of identifying the chassis.

RUN NUMBER: No run number is employed in the production of the receiver.

♦ ♦ Please turn to page 87 ♦ ♦

Audio-Facts

by Robert B. Dunham

When describing present day high fidelity amplifiers, certain specifications and ratings are usually given. As an example, those listed below can be found in a current catalog in the description of a well-known amplifier.

Power Output: Rated 15 watts.
Maximum 24 watts.

Frequency Response: ±0.5 db 10-100,000 cps at 8 watts.
±0.1 db 20-20,000 cps at 15 watts.

Harmonic Distortion: 0.1% at 15 watts.

Intermodulation Distortion: 0.2% at 8 watts.
0.25% at 10 watts.

Hum: 90 db below 15 watts output.

Damping Factor: 20.

Some of these are familiar, while others may seem rather vague in just what they are, why they are important enough to be listed, or how they are measured. Some have taken on greater importance because of the development and increased use of present day wide range equipment. These ratings and specifications do have meaning and as familiarity is gained with such equipment, their importance in relation to the design, operation and maintenance, becomes more apparent. The replacement of a resistor, capacitor, tube or such in a critical circuit, if not done with a knowledge of the tolerances and care demanded, can introduce non-linearity and unbalance to such extent as to seriously disturb the operation of a good amplifier. So it is well for anyone servicing or operating high fidelity equipment to be acquainted with these characteristics, what they are, how they are measured, and how to prevent or correct any deviation from normal values.

Power Output -

Power output, usually given in watts, is the power developed in the load (usually a speaker during normal operation) in the output circuit of the amplifier. With a signal source such as an audio oscillator connected to the input of the amplifier and the correct load connected in the output, the measurement can be made with a suitable alternating current or voltage meter. A non-inductive resistor of the correct resistance value to match the output and of sufficient wattage to handle the power developed, is usually connected to the output terminals for this test, rather than the speaker. With the reading obtained by connecting a VTVM (the most satisfactory voltmeter for this purpose) across the resistor, the power output can be calculated by means of the equation -

$$P = \frac{E^2}{R}$$

An AC meter, preferably a thermocouple ammeter or milliammeter, in series with the resistor will provide a value in amperes to calculate the power in watts with the equation -

$$P = I^2R.$$

An audio frequency output power meter is available which will give a direct reading in watts when connected to the output of an amplifier. The impedance of the meter can be set to match the output impedance of the amplifier for convenience.

Frequency Response -

Frequency response measurements are primarily made by connecting a signal whose frequency can be varied, such as an audio frequency generator, to the input of the amplifier and measuring the output level. As the input frequency is varied, at a certain level, the output is measured for gain or level. Various methods are used and we intend to elaborate on this in future writing.

Distortion -

Frequency response has been thought of as being the last word when considering the qualifications of a high fidelity amplifier. Originally bass tones were difficult to reproduce; consequently, a good low frequency response was considered of foremost importance. With the improvement of speakers, output transformers, etc., the low frequencies were not such a problem and the high frequencies became the chief concern. Recently the very low frequencies have received attention.

But actually with the reproduction of very low and high frequencies a minimum of distortion becomes the prime objective. With the extension of the frequency response to the extreme high and low ends of the audio spectrum, the effects of distortion, hum, and noise become very disturbing and fatiguing to the listener.

Distortion can be classed as (1) amplitude; (2) frequency; and (3) phase shift. Amplitude distortion is due to non-linearity. Frequency distortion is caused by non-uniform amplification at all frequencies. Phase shift originates in signal delay, which varies with frequency. In each case the signal has become distorted and the output is not an amplified exact replica of the original.

In amplitude distortion the signal output waveform is no longer symmetrical and has changed from its original shape. This is because of the non-linear action of the tube or circuit elements and the harmonics and intermodulation effects produced. Harmonic distortion is the result of not only the original tone (fundamental) being reproduced, but also of harmonics of one, two, three, or more times that of the fundamental also appearing in the output. One or more of these harmonics can be present (usually the lower ones are predominant) with the total amount stated in percentage of the total output of the amplifier.

By feeding a pure single frequency signal into the input of the amplifier under test, the output waveform can be observed on the screen of an oscilloscope connected to the amplifier output. The presence of harmonic distortion can be seen by this method and some estimate of amount made, but the exact measurement should be made by means of wave analyzers and other suitable equipment.

Music, and most all sounds, are complex, being composed of many frequencies and harmonics, which give them their individual characteristic qualities. This is quite different from the pure sine wave of the single frequency used in the measuring of harmonic distortion. For this reason, the measure of harmonic distortion does not follow the effect upon the ear as closely as does the measure of intermodulation distortion.

Intermodulation distortion is the product of two or more different frequencies being amplified simultaneously by a non-linear amplifier. When checking for this type of distortion, two signals, one usually between 40 and 100 cps, the other between 3000 and 12000 cps, are fed into the input of the amplifier. Due to any non-linearity, harmonics will be formed for each one, also the sum and difference frequencies of the fundamental tones will appear in the output along with the sum and difference frequencies of the harmonics and of the harmonics to the fundamentals.

This really results in a complex waveform containing many unwanted and annoying changes. A large portion of these "beat" frequencies have no harmonic relation to the original frequencies and are dissonant, therefore not sounding musical but registering as discordant, distracting noise to the ear. Evidently the human ear is not disturbed nearly so much by the harmonics of the fundamental frequencies because they have musical relationship, but does rebel at noise and dissonance. Consequently the measure of intermodulation distortion does more nearly measure the disturbing effects heard by the ear.

Wave analyzers and distortion meters of various forms are employed in the measurement of this type of distortion. This is a long story in itself and will be discussed at greater length in the future.

Phase shift distortion is not mentioned in the ratings listed, but it does fit in with these characteristics and warrants some discussion here. Phase shift is time delay of the signal as it progresses through the amplifier. If all frequencies are delayed the same amount the ear can detect no difference in the output signal. But if the delay varies with frequency, such as that caused by a coupling capacitor of too low capacity value offering high reactance to low frequencies, then the result can be a very noticeable distortion of the original form of the signal. Any capacitor, inductance or network in the circuit which discriminates against certain frequencies, can cause this type of distortion. As can be seen, unless care is taken to minimize these delays, their effect can be very great in the operation of an amplifier whose frequency response covers an extremely wide range.

Hum -

Hum is certainly an old, old story. It is something that cannot be tolerated by the present day user of high fidelity equipment. Many times this rating also includes noise, since this is a measure of the unwanted things that come out of the speaker in the absence of, or with, the desired signal. Noise includes thermal noise in the tubes, and noise of circuit elements such as resistors and capacitors. The measurement of hum and noise, combined or separate, can be made with many instruments - such as an oscilloscope, wave analyzer or suitable output meter. The subject of hum and noise has been discussed many, many times, on hundreds of pages, in books, magazines, and such. To this we aim to add out bit in later issues.

Damping Factor -

The damping factor, as listed here, refers to the damping action of the amplifier upon the cone or moving portion of the speaker. Ideally, when a sharp single signal pulse is applied to the speaker, the voice coil should move the cone during that time and come to a sudden, dead stop at the end of the pulse. But, instead, since the cone is suspended and actually moves mechanically under springlike tension, after the pulse stops the cone continues to move, due to inertia, coming to rest after making a more or less short train of oscillations. This of course is not a true clean reproduction of the original sound, and creates an effect known as "muddiness". The voice coil moving in the powerful magnetic field while making these extra oscillations, develops a voltage by generator action. Now, if the damping factor of the amplifier is high enough, its internal resistance will be low enough to effectively short-circuit the voice coil and brake its spurious movement. This is the same as dynamic braking of an electric motor by shorting the armature with the field excited. The damping action of an amplifier is usually obtained by means of inverse feedback, but this is a subject also undergoing much discussion.

The complete absence of graphs, waveforms, etc., may have been noted, but since we aim to cover these subjects more thoroughly in the future we contemplate using as many reproductions of actual waveforms and illustrations as possible. This is to serve merely as an introduction. We feel that these are interesting and worthwhile subjects since the field of high quality audio equipment is certainly expanding and warrants a thorough understanding and knowledge.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UHF

A description of circuits and equipment for Ultra High Frequency reception.

by MERLE E. CHANEY

Part III

PF INDEXES Nos. 30 and 32 provided discussions of current trends in the field of UHF reception, along with the description of a number of commercial UHF converters and tuners. It was noted that all the units employ the superheterodyne principle for reducing the frequency of the incoming signal to one that can be applied to the receiver's video IF circuits. This is done in a one step conversion process or by a double conversion process. At any rate, the end result is the same.

Although the basic principles of operation were common for all the UHF devices described, there were a number of variations that made the units particularly useful for specific purposes. Some of the converters are units that connect to the receiver in much the same manner as boosters. This provides for reception of UHF television signals by any receiver. Thus, a receiver operating on 21 megacycle IF's, separate or intercarrier sound, can work very satisfactorily on UHF by employing a converter.

In order to supply a demand for built-in UHF tuning devices, some manufacturers are offering units designed for installation in the receiver during the manufacturing process and in some instances have developed a means for installing UHF tuners in the field when a demand for them warrants it.

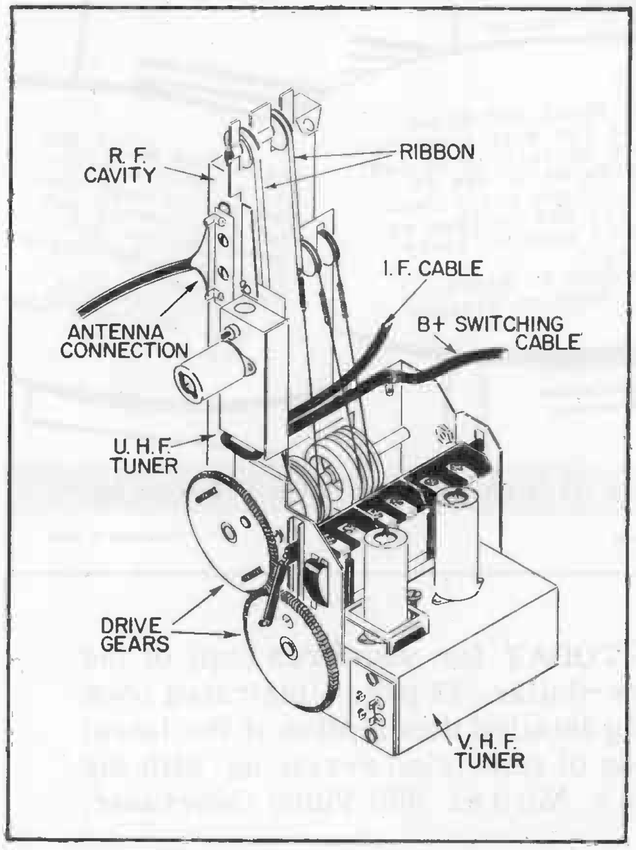

Figure 1. Raytheon UHF and VHF Tuner Units.

Following is a description of two more UHF tuning devices: the Sylvania Model C31M UHF Converter, and the Raytheon UHF Tuner Unit.

RAYTHEON UHF TUNER MODEL UHF-100

Raytheon's Model UHF-100 is designed for incorporation in Raytheon television receivers. It is attached to the receiver over the VHF tuner by means of four mounting screws. A drive gear mounted on the VHF tuner allows tuning of both the UHF and VHF unit by a common control. Two cables from the UHF tuner are connected to the under side of the television receiver to provide the necessary electrical connections to the UHF tuner. Switching between UHF and VHF channels is provided by adding a switch to the back of the chassis. This requires a few minor wiring modifications to allow the added switch to transfer B+ from one tuner to the other. A drawing of the UHF tuner mounted in place over the VHF tuner unit is shown in Figure 1.

The UHF Tuner Model UHF-100 employs a preselector, crystal mixer, local oscillator, cascode amplifier, and a UHF-VHF switch. A schematic for this tuner is shown in Figure 2.

RF cavity type tuning is employed in the preselector circuit with inductive coupling between stages from the antenna to the mixer. Preselector tuning involves changing the cavity length through the use of a ribbon attached to the dial cord and tuning mechanism. It is said this type tuning has the advantages of high selectivity, low insertion losses, uniform bandwidth and good shielding against oscillator radiation.

Oscillator tuning is provided in a similar manner to that used for preselector tuning. However, the length of the oscillator cavity is varied by means of a shorting bar instead of the ribbon arrangement used in the preselector RF cavity. The oscillator grid current may be measured by removing the jumper in the low side of the oscillator grid return resistor.

Mixing of an incoming UHF signal and a signal from the UHF oscillator is accomplished by a type CK-710 crystal. Because of the single conversion process the resultant intermediate frequency is the frequency of the receiver's video IF stages. To provide a signal of adequate amplitude to the video IF circuits, a low noise type 6BQ7 is employed as a

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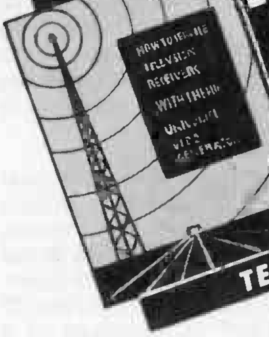

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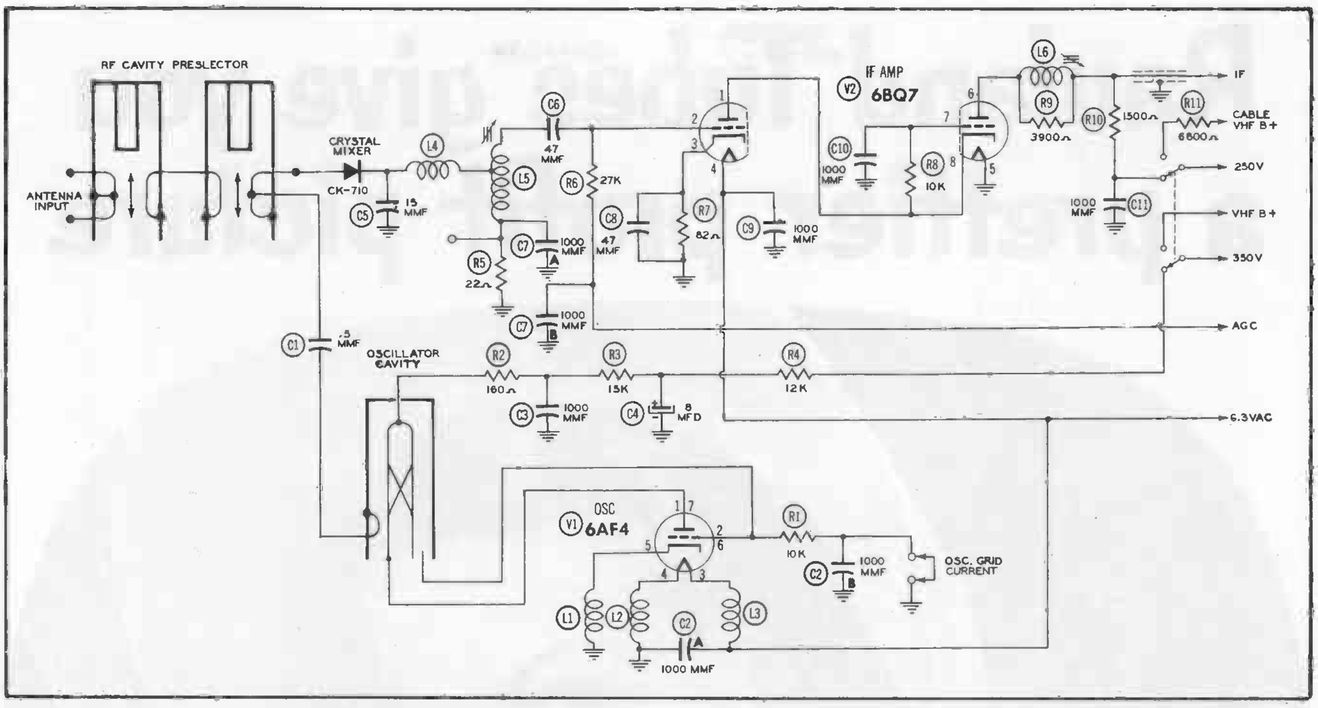

Figure 2. Schematic of Raytheon UHF Tuner.

cascode-coupled amplifier. The signal is amplified by the cascode amplifier and tuned to a center frequency of 25 megacycles.

Several interesting features are found in the Raytheon UHF-100 Tuner. Among them is the fact that the tuner forms an integral part of the television receiver and is tuned by the same operating controls as those used for VHF.

Application of AGC to the input triode of the cascode amplifier reduces any tendency to overload in the presence of strong UHF signals.

Since no RF amplification is employed, there is slightly less sensitivity than when the VHF signals are received. However, it is said that a receiver equipped with this tuner will have an overall sensitivity of 150 microvolts.

SYLVANIA UHF CONVERTER MODEL C31M (Chassis 1-506-1)

The Sylvania Model C31M is a UHF converter unit, continuously tunable over the full UHF band. It is designed for use with most of the existing television receivers. A front cabinet view of the unit is shown in Figure 3. Two-knob control is employed to operate the converter. The knob on the left operates the OFF-VHF-UHF selector switch and on the right is the tuning control.

A schematic for the Model C31M converter is shown in Figure 4. The input is designed for a 300 ohm balanced line. A UHF signal tuned by the converter is fed to the preselector circuits. Although RF amplification is not provided, the preselector circuits achieve a maximum of selectivity consistent with the required bandwidth of 12 megacycles. The output of the preselector circuits is fed to a type 1N72 crystal mixer. Also coupled to the mixer is a signal from the local oscillator. A type 6AF4 tube is used as the oscillator and operates on the low side of the carrier frequency. Adequate shielding to prevent oscillator radiation is aided by the low potentials applied to the tube consistent with stability, and the low injection voltage requirements of the crystal mixer. Note that the coupling between the mixer and oscillator circuits consists of the cathode to filament capacitance of the 6AF4 tube.

The intermediate frequency resulting from beating the incoming UHF signal and local oscillator signal is designed for 82±6 megacycles. This new frequency from the mixer output is transformer-coupled to a type 6BQ7 tube. The first triode section consists of a grid-driven and neutralized amplifier stage, while the output triode is a grounded grid amplifier. A bandwidth of 12 megacycles is maintained by a double-tuned transformer in the IF output stage. The signal is then fed to the selector switch and from there to the VHF receiver antenna input terminals.

Because of the 12 megacycle bandwidth of the converter output, between 76 and 88 megacycles, the

Figure 3. Cabinet View of Sylvania Model C31M UHF Converter.

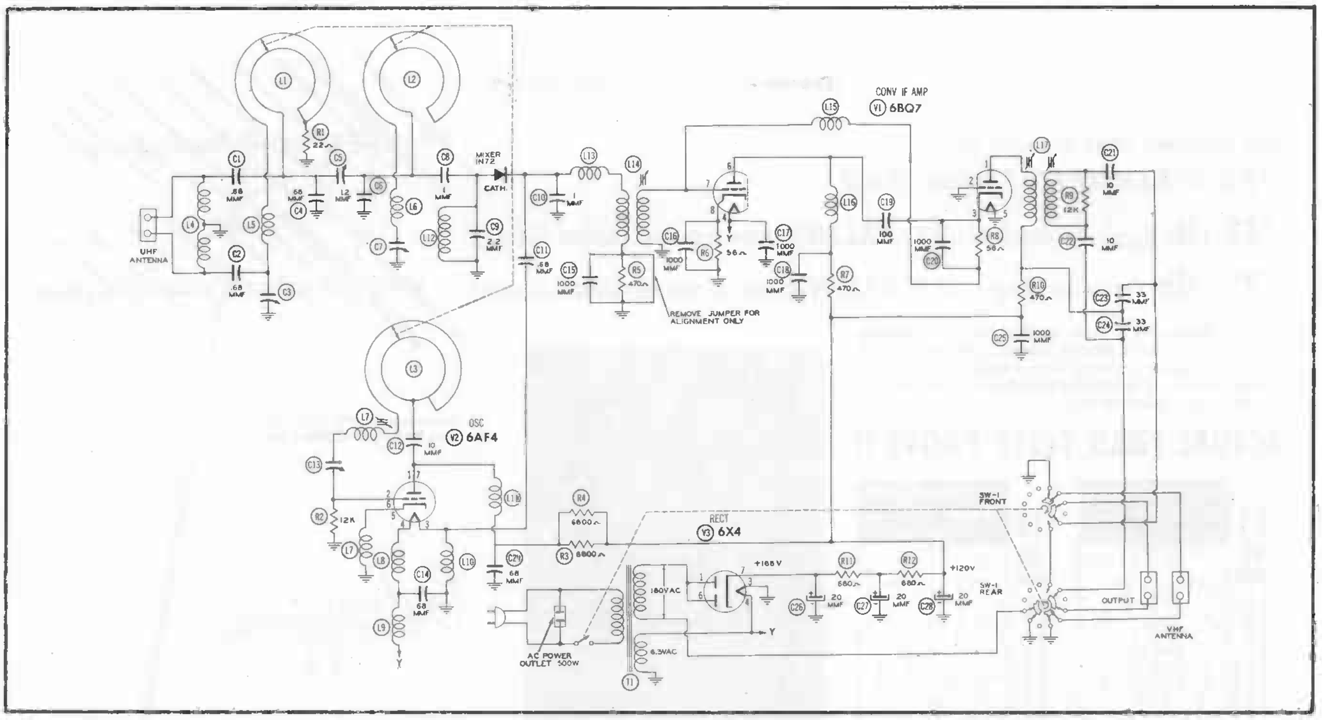

Figure 4. Schematic of Sylvania Chassis 1-506-1 UHF Converter.

signal applied to the VHF receiver may be received on either channel 5 or channel 6 position of the receiver's RF tuner. Should a strong VHF signal be received on one of the channels, then the other VHF channel position may be used to receive the converted UHF signal.

The power supply employs a line isolation type transformer with a filament winding. Conventional RC filtering is used to supply B+ to converter IF and oscillator stages.

The Sylvania Model C31M UHF converter is easily connected to a television receiver, as the connections are very similar to those used when connecting a booster. To achieve maximum performance from the unit, it is necessary to maintain the correct impedance match of 300 ohms throughout.

Installation of the unit in conjunction with a television receiver requires a few simple procedures. The built-in, di-fan UHF antenna may be connected to the UHF antenna terminals, or if additional gain is required for some installations, an external UHF antenna may be employed. The VHF antenna leads are removed from the receiver terminals and reconnected on the back of the converter to terminals marked "VHF" antenna. A short lead, then, is connected from the converter terminals marked "Output" to the receiver's antenna input terminals. If the receiver has an AC outlet, this source may be employed to power the converter. If there is no AC outlet on the receiver, the receiver's power cord may be plugged into the power receptacle on the back of the converter and the converter plug inserted into a wall socket receptacle.

To operate the converter after the installation is completed, power is supplied to both converter and receiver. If the receiver's AC outlet is used to supply converter power, the converter selector switch may be left in the "ON" position, in which case, the receiver's ON/OFF switch controls the power to both. If the receiver's AC plug is inserted into the converter's power receptacle, then both sets must be turned on and off individually.

The three positions of the selector switch perform the following functions:

1. OFF Position. In this position, the converter power is off, the UHF output is grounded, and the VHF antenna leads are connected through the switch directly to the receiver antenna input terminals.

2. VHF Position. This position is employed when it is desired to switch back and forth between VHF and UHF position. Although the converter output is grounded and the VHF antenna is switched to the VHF receiver input, power is supplied to the converter filaments. This eliminates the necessity of waiting out the normal warmup period when switching from VHF to UHF.

Keeping the filaments on also allows for drift to be stabilized. Thus, switching from VHF position to UHF position is an automatic function accompanied by no more delay than switching between VHF channels.

3. UHF Position. In this position, the VHF antenna is grounded; power is supplied to the UHF filament and B+ circuits; and the converter output is connected to the receiver input terminals.

It is recommended in servicing this converter unit that particular care be exercised to insure that performance will not be accidentally impaired. Because of the high frequencies involved, lead length, lead dress, and component sizes are highly critical. Sylvania recommends that no alignment or servicing of the converter other than the following be made in the field.

The 6X4 rectifier tube may be replaced without affecting alignment, and the replacement of the 6BQ7 has little or no effect upon alignment. A Sylvania type 1N82 may be used in place of the 1N72. Crystal replacement should not affect alignment. If the 6AF4 oscillator is replaced, Sylvania recommends complete factory alignment.

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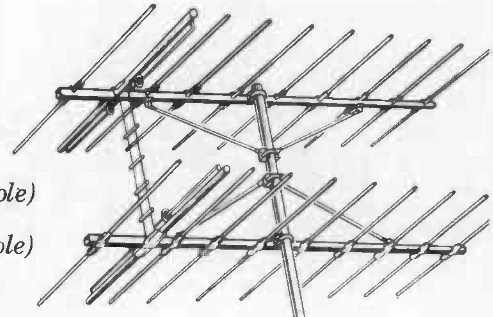

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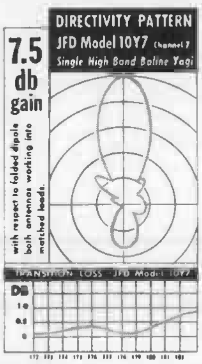

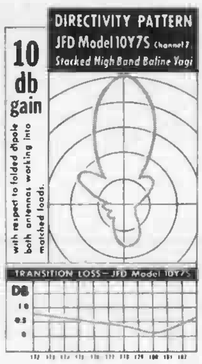

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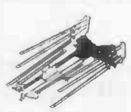
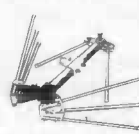
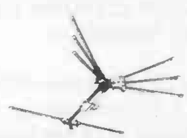


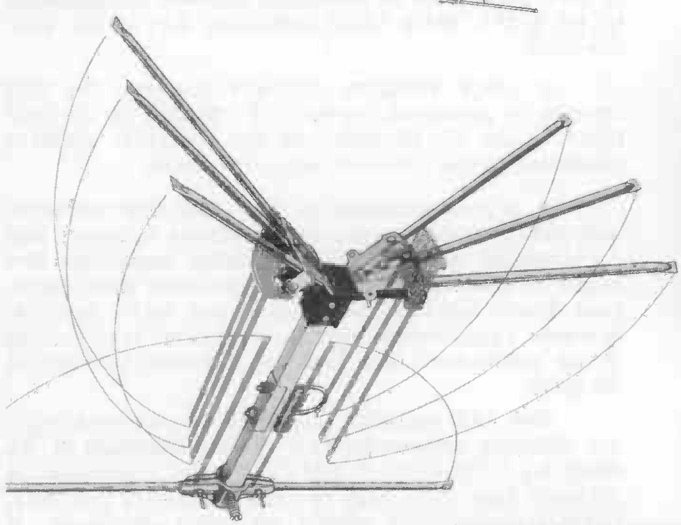
1. Pre-assembled JFD JeTenna as packaged. Note its compactness of construction and craftsmanship of design.



2. As the JeTenna swings open, dipole elements fan instantly into exact position by riding along unique fulcrum indices.



3. JeTenna elements lock into position effecting 35° forward inception angle and 40° dipole angulation for greater signal pickup. Reflectors snap into place for quick tightening by wing nuts.



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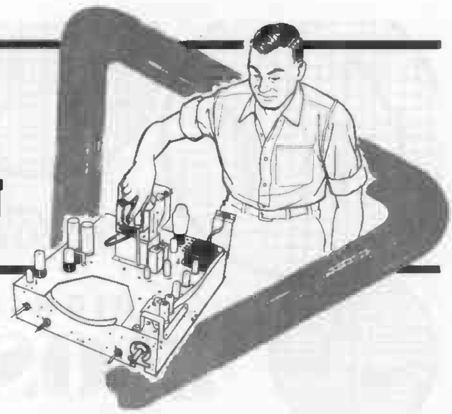


by GLEN E. SLUTZ

Light the Screen with an Auxiliary High Voltage Supply

The majority of direct view television receivers on the market today employ the "flyback" type of high voltage supply as pictured in Figure 1. This system bases its operation on the pulse which occurs in the horizontal deflection circuit during the brief period of horizontal retrace. A series of operations is necessary before effective use can be made of this pulse, however. First, the voltage surge is increased by autotransformer action. Then it undergoes rectification and filtering. And finally the second anode of the picture tube receives it in the form of a high level DC potential. Ranging from 9 to 15 kilovolts (depending upon picture tube size and type), the second anode voltage serves to give the electron beam within the tube the velocity needed to produce screen fluorescence.

Because the high voltage output of a "flyback" system is dependent upon the energy developed in the horizontal sweep output, it follows that any change in the nature and amount of this energy will produce a corresponding change in the high voltage. Troubles frequently do arise which appreciably alter the sweep, both in the shape of the voltage and current waveforms and in the amplitude of these waveforms. If the alteration is sufficient to seriously impair the high voltage development, complete absence of picture and raster may result. When this happens, the service technician finds himself deprived of one of his best servicing aids - the image on the picture tube screen. It is hoped that the following method, if adopted in such cases, will restore this image, thereby enabling the technician to profit from the clues which the screen pattern may provide.

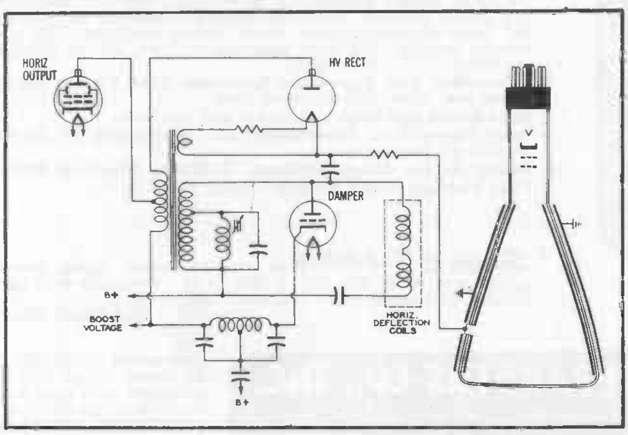


Figure 1. Typical High Voltage Supply Based on the "Flyback" Principle.

This is a substitution procedure; basically it consists of substituting the high voltage supply of a second receiver for the one in the set under investigation. Two considerations should be observed in the selection of the auxiliary receiver:

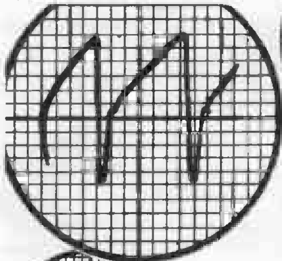
1. The high voltage developed by the second receiver should be approximately that which is normally available in the test receiver.

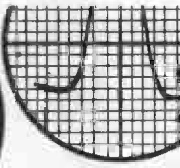
2. Both chassis must be isolated, either by power transformers or impedance networks, from the power lines.

The latter condition is satisfied in nearly all television receivers. Figure 2 is an outline sketch of the bench set-up involved. The procedure is given in steps on the drawing for purposes of clarity.

Step 1 calls for the removal of the cap lead which connects the horizontal output transformer to the high voltage rectifier tube in the test receiver. It is important that this lead be positioned well away from the metal of the chassis to reduce the possibility of arc-over while the set is in operation. Step 2 is the removal of the anode lead to the picture tube; this lead, too, should be dressed away from the chassis. Step 3 is the connection of the anode lead of the second receiver to the picture tube in the test receiver. If an extension is required, well-insulated wire should be used. (For a detailed description of a suitable extension, refer to page 25 in PHOTOFACT INDEX of Nov.-Dec., 1951.) Finally, in Step 4 the chassis of both receivers are joined together. This connection is important because it completes the ground return portion of the circuit. After performing these steps and checking the set-up carefully, turn the brightness control on the test receiver down to a minimum setting. Then switch on both receivers. After the tubes are warmed-up, advance the brightness control on the test receiver slowly until an image appears on the screen. The brightness adjustment must be performed in this manner to reduce the danger of burning the screen phosphor in case there is total lack of deflection in the test receiver.

If a nearly normal picture is obtained in this substitution test, the logical place to look for the trouble is in that part of the receiver which has been replaced, namely, the high voltage circuit. A defective rectifier tube, a shorted high voltage filter capacitor, or an open high voltage filter resistor are possibilities. If, on the other hand, no image can be obtained, even under these test conditions, the trouble is probably in the picture tube itself, such as an internal short between the second anode coating and some other element in the tube. This defect can be





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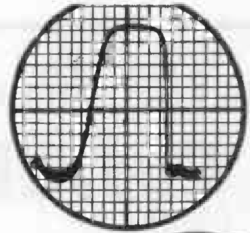

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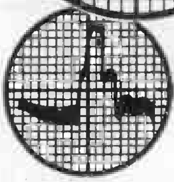

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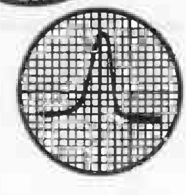

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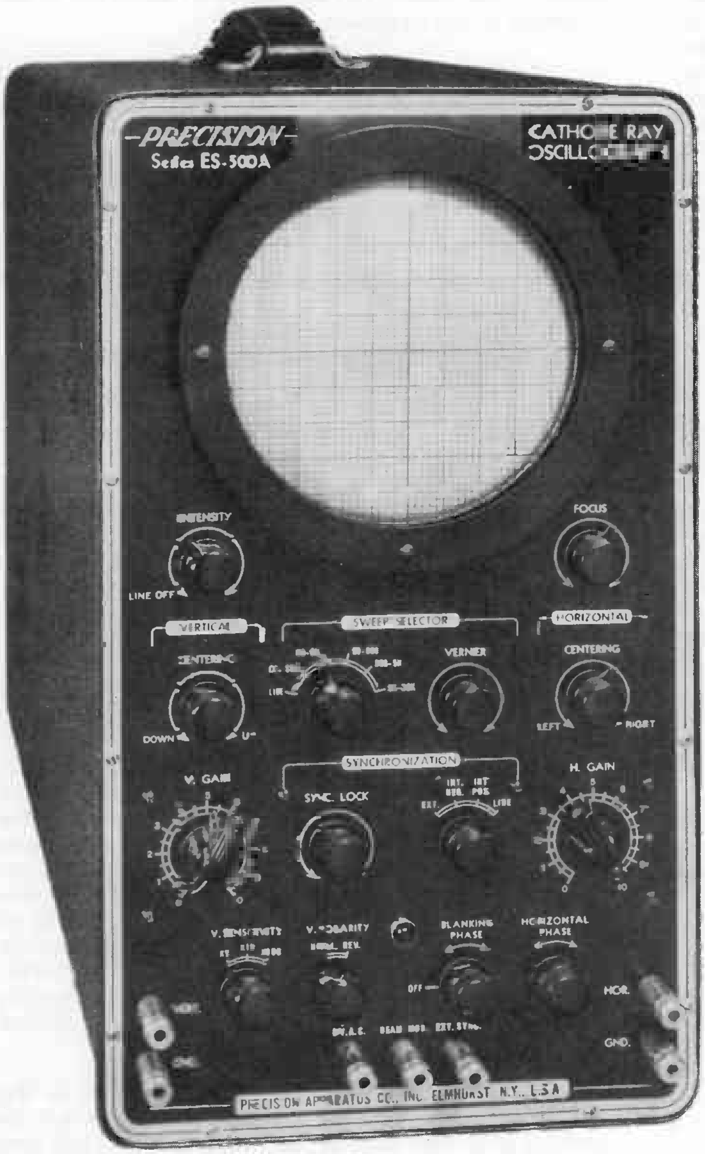

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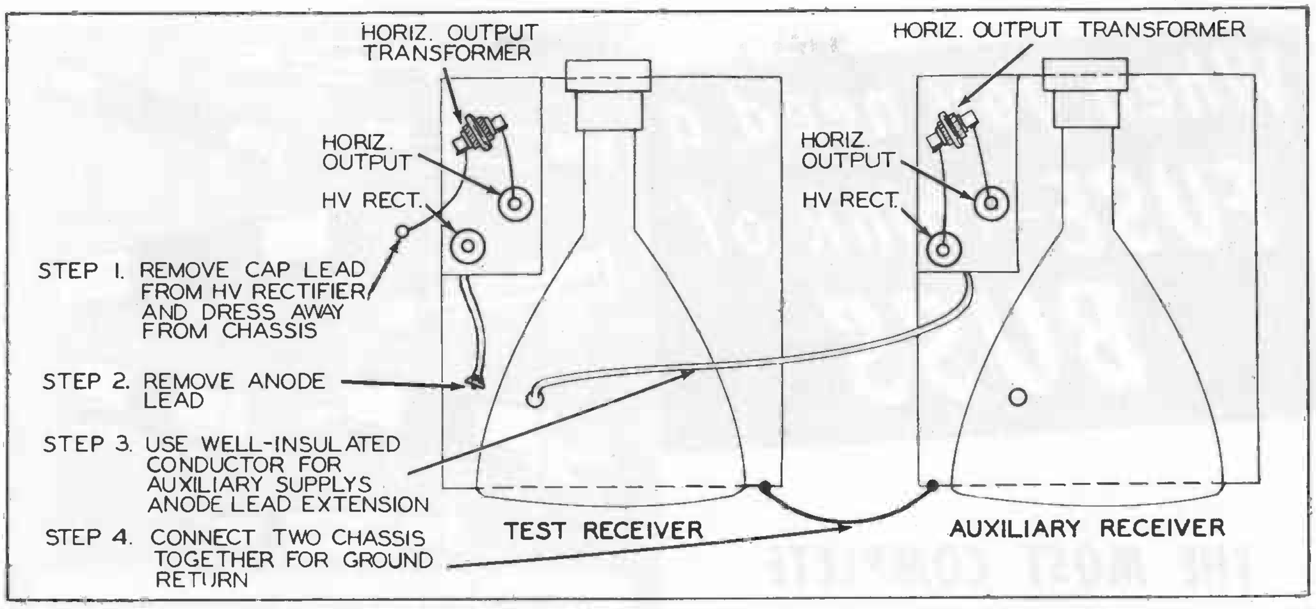

Figure 2. Bench Set-up for Using Auxiliary High Voltage Supply.

detected by testing for high voltage on the anode lead from the auxiliary supply, first with it disconnected from the picture tube and then with it connected. If a short is present, loss of high voltage will occur when the anode lead is joined to the tube.

More frequently, however, some kind of image will be seen in this substitution test. It may be only a dot in the center of the screen or a vertical line on the screen; either case indicates a complete lack of horizontal deflection. Sometimes an image similar to Figure 3 may be seen, pointing to a probable damper tube failure. Possibly a very small but almost linear picture may appear on the screen. Such a symptom might indicate the presence of one or more defects in the horizontal output stage and transformer, provided a scope registers normal drive on the control grid of the horizontal output tube. But whatever the image may be, the true value of this substitution procedure lies in the troubleshooting clues which a visible screen pattern of some sort can provide.

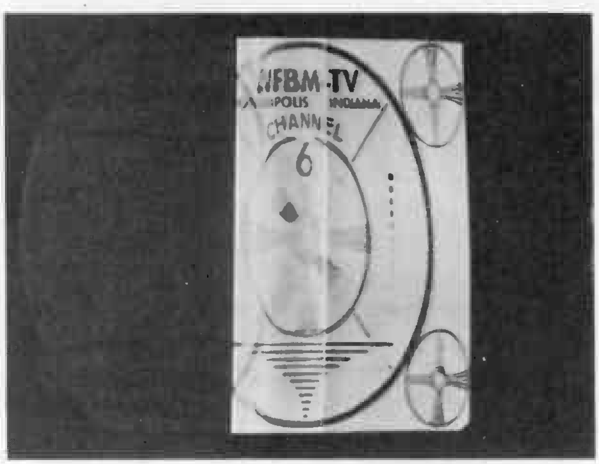

Figure 3. Damper Tube Failure Might Produce an Image Similar to this as Seen Through the Use of an Auxiliary High Voltage Supply.

Killing that Residual Spot -

Have your customers expressed annoyance or concern over the spot of light which often remains on their television screens after they've turned off their sets? (See Figure 4.) This problem has a relatively straightforward solution - one which usually satisfies the perturbed set-owner.

The spot in question comes as a result of the combination of a hot cathode, a residual bias on the picture tube, and a highly positive second anode. These conditions have a tendency to remain for a brief time after the receiver has been turned off. The cathode continues emitting electrons, the bias allows some electrons to flow, and the second anode attracts them in an undeflected beam to the screen surface. This beam produces the bright spot which lasts until one of the above conditions subsides below the level needed to sustain the beam.

The second anode voltage is dissipated by the beam current; the speed of this action depends upon the amount of beam current flowing. The greater the beam current, the more rapidly the high voltage decays. This characteristic leads to the method which

Figure 4. Typical Spot on Television Screen After Receiver is Switched off.

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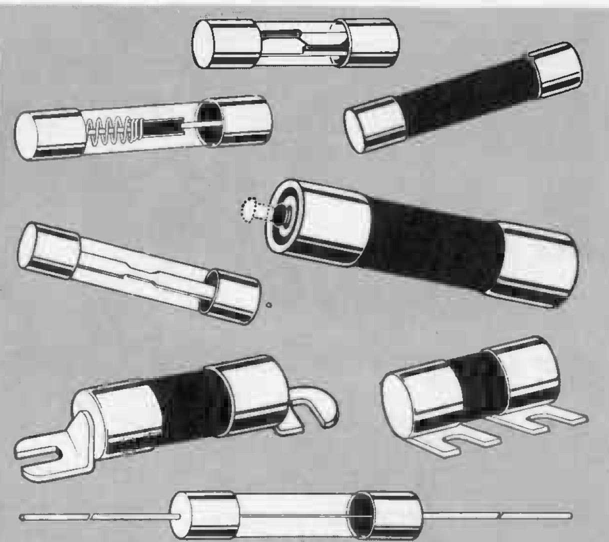

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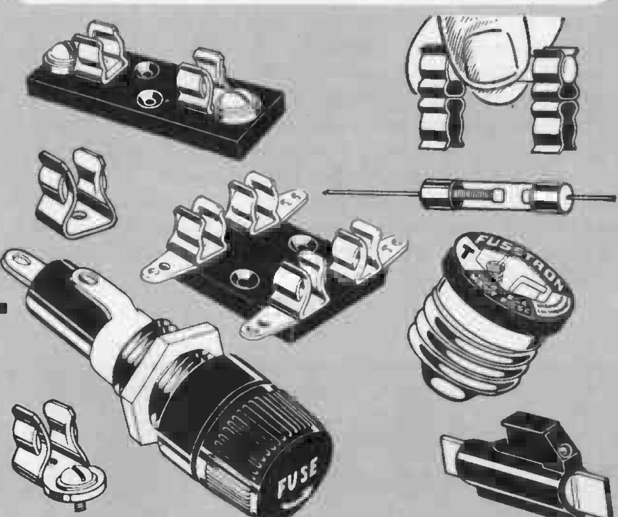

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may be used to eliminate the spot. The idea is to increase the beam current so that it "bleeds" the charge from the high voltage anode very quickly after the receiver is switched off. Beam current is generally controlled by the brightness control. Consequently, turning up the brightness of the receiver prior to shutting it off will cause the spot to be extinguished before deflection falls to zero.

A few manufacturers have adopted essentially this same basic idea in the spot-removing circuits which they have incorporated in many of their models. In one instance a switch, ganged with the On-Off switch in the set, opens the brightness control circuit in such a way that the bias on the control grid of the picture tube is greatly reduced and a heavy beam current flows while deflection collapses. This results in little or no residual anode voltage and hence no spot on the screen. However, the owner of a set not having this special feature can achieve its effect simply by advancing the brightness control before switching off the receiver.

Oscilloscope Connections for Tracing Horizontal Line Displacement Troubles

For most testing applications the horizontal sweep generator of an oscilloscope may be synchronized satisfactorily by the signal being applied to its vertical deflecting plates, namely, the waveform under investigation. However, there are times when the use of a synchronizing source outside of the 'scope is advantageous. Most oscilloscopes have a terminal marked "external sync" and a switch which controls the source of synchronization for the sawtooth generator. In the "external" position of this switch, the synchronizing pulse is obtained from the "external sync" terminal; in the "internal" position, synchronization of the horizontal sweep comes from within the 'scope, usually from a point in the vertical amplifiers.

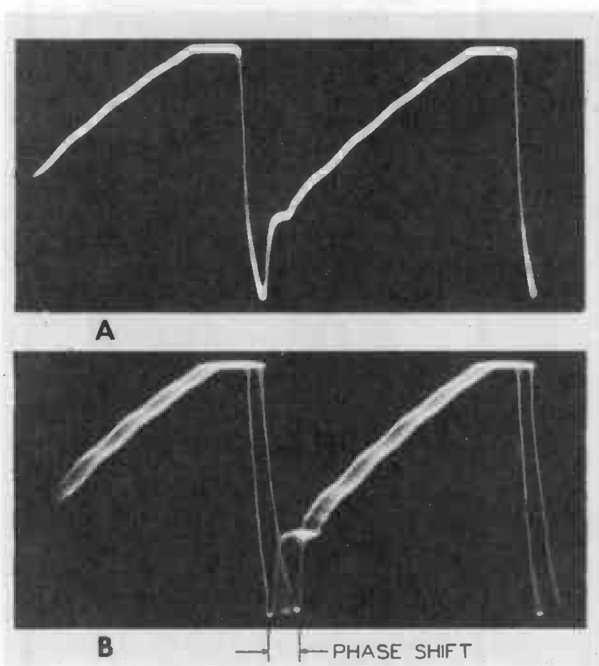

Figure 5. Waveform on Grid of Horizontal Output Tube (A) with Internal Synchronization of 'Scope, and (B) with External Synchronization of 'Scope.

As an example of a service situation in which external synchronization might be an expedient, consider a case where horizontal "pulling" is present in the image on a television receiver. There are several varieties of this type of trouble. The pulling may be only at the top of the picture, or it may be a weave over the whole picture. Sometimes it takes the form of a "wiggle" effect brought about by the horizontal displacement of alternate scanning lines. An oscilloscope may be connected to the control grid of the horizontal output tube in a TV receiver afflicted with horizontal pulling; and, unless external synchronization is employed, a positive indication of phase shift is not evident. This is because the horizontal sweep generator in the oscilloscope slows down or speeds up in time with the phase shift present in the viewed signal. With internal synchronization, therefore, the waveform on the grid of the horizontal output tube might look something like the pattern in Figure 5A. This waveform furnishes no clues as to the reason for the horizontal pulling in the picture.

However, if the oscilloscope is switched to "external sync" and a pulse is coupled from the sync separator in the receiver to the "external sync" terminal on the 'scope, the horizontal sawtooth sweep in the 'scope will lock in step with the sync pulses from the transmitter. Figure 5B shows the deflection waveform under these conditions, and the phase shift causing line displacement is immediately apparent. By using an externally synchronized oscilloscope to check back through the horizontal sweep section of the receiver, the technician may find the source of this trouble.

The above situation is only one of a number of instances where external synchronization can provide additional avenues of usefulness for the modern oscilloscope. Intensive work with the instrument will lead to others.

Replacing the 17RP4, 17VP4, 20LP4, and 21LP4 Picture Tubes

Certain types of cathode-ray tubes have found only limited use in television receivers. Consequently, their replacement by type number is difficult because of scarce supply. However, in the case of the four tubes listed in the left column below, each one of these may be replaced with its available, equivalent tube type listed in the right column.

Tube Type	Replace With
17RP4	17HP4
17VP4	17LP4
20LP4	20HP4A
21LP4	21FP4A

Sylvania Electric Products Inc. has begun double-branding the first three of the above tubes as an indication that the pairs are identical. Their type numbers appear as follows: 17HP4/17RP4; 17LP4/17VP4; and 20HP4A/20LP4. Double-branding the 21FP4A is not being done because the 21LP4 is not a registered type; although at one time a few tubes under this title were used in receivers. Any replacement need for a 21LP4 should be met with a 21FP4A.

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Examining DESIGN FEATURES

by MERLE E. CHANEY

ARVIN TELEVISION CHASSIS TE 331

A triode tube section is employed in the Arvin TE 331 chassis as a video detector and a delayed AGC rectifier. In effect, the triode functions as a dual diode.

The schematic of Figure 1, shows that the cathode and grid of V2 (one triode section of a type 12AU7 tube) function as a video detector diode. Note that the low end of the video detector circuit is connected through a 100 ohm resistor to a voltage divider network between +130VDC and ground. This places the two tube elements at a positive potential of about 2.4 volts above ground. Since both the diode tube elements are at the same potential in relation to ground, the linear operating characteristics required for video detection will not be impaired.

The detected video signal is applied through the .1 mfd. blocking capacitor to the grid of the video amplifier tube.

The AGC rectifier employs the cathode and plate of the same triode. Note that the plate is returned through R8, R9, and R10 to ground, These resistors form the AGC diode load network. With +2.4 volts maintained on the cathode and the plate returned to ground, it is seen that before any AGC voltage can be developed, that the applied signal must exceed 2.4 volts. The delay on the developed AGC bias permits the tuner RF and video IF amplifier stages to operate at maximum gain for weak signals.

To facilitate the reception of weak signals, a "local-distant" switch is connected to the AGC diode load network. This switch connects the AGC from the tuner across only a portion of the AGC diode load. Thus, maximum gain may be realized in the tuner RF amplifier by maintaining the tuner bias at a minimum as in the "distant" position of the switch.

In "local" position of the switch, the full voltage developed across the diode load resistors is applied to the tuner RF amplifier. This minimizes the chances of a strong or local signal overloading the RF and video IF amplifiers.

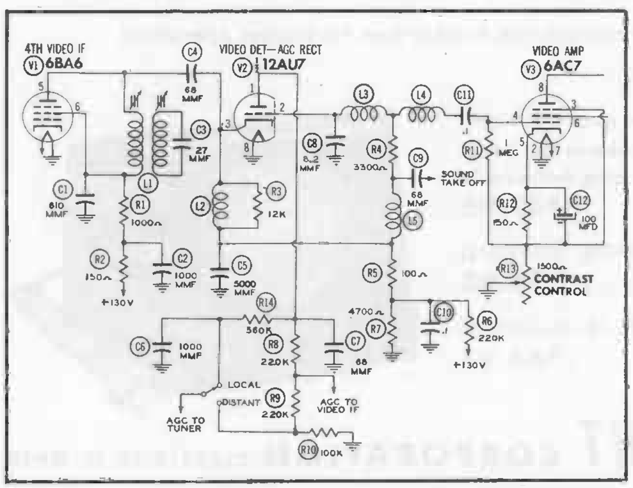

Figure 1. Triode Tube Functioning as a Video Detector and AGC Rectifier.

17HP4 Electrostatically Focused Picture Tube -

A type 17HP4A picture tube is employed in Arvin chassis TE 331. The tube is electrostatically focused and does not require external focusing adjustments. The focusing anode, connected to pin 6 of the picture tube, goes directly to the +130VDC line. The tube is designed to maintain focus under normal variations of the AC line.

In addition to an ion trap on the neck of the tube, a centering magnet ring is employed. To accomplish centering, the whole centering magnet unit may be rotated, or the magnet itself may be turned while the centering ring remains fixed.

BENDIX

Several interesting features are employed in Bendix Models 21K3, 21KD, 21T3, 21X3, & OAK3. Among these are voltage regulation circuits, noise inverter circuit, and anti-pincushioning magnets.

Tubes Connected for Voltage Regulation -

The manner in which several of the tubes in these models are connected provides good voltage regulation. This is accomplished by employing some of the tubes in such a manner as to form a voltage divider network between B+ and ground. To more clearly show how this is done, the simplified drawing

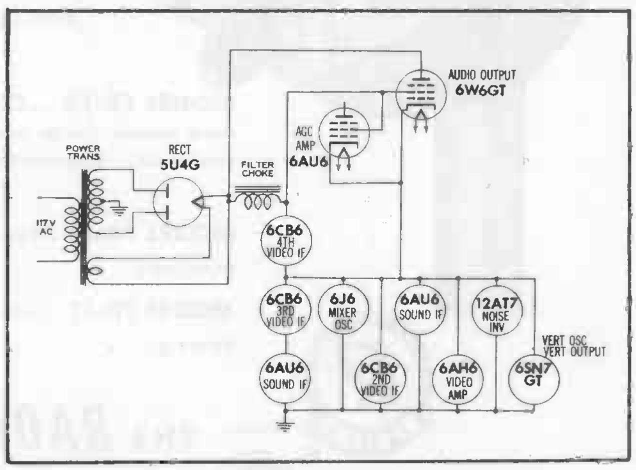

Figure 2. Arrangement of the Tube Circuitry in Bendix Receivers to Provide Voltage Regulation.

of Figure 2 indicates the B+ supplied to each tube. Note that the audio output tube and the AGC amplifier are in series with a group of amplifier tubes connected in parallel. Therefore, all the current flowing through the audio output and AGC tubes also flows through the parallel group of amplifier tubes.

If the current through the parallel group of tubes changes, the voltage on the cathode of the audio output and AGC amplifier also changes. This affects the impedance of these two tubes, tending to restore the same voltage drop across them that was present before the current changed.

Noise Inverter Circuit -

A method for effectively eliminating noise pulses to the sync circuits is employed in the Bendix receivers. This circuit is of the cancellation type in which out-of-phase noise pulses are made to cancel one another.

A schematic for this circuit is shown in Figure 3. This circuit may be understood more easily by noting that V2A provides screen regulation for the video amplifier during normal reception free of large amplitude noise pulses. When noise pulses of greater amplitude than the sync pulse are rectified by the video detector, they cut off tube current in V1, the video output tube. Instantly the plate and screen voltages increase sharply, giving rise to positive pulses at both the screen and plate, with the positive pulse in the plate circuit fed through coupling capacitor (C6) to the sync limiter.

The positive pulse from the screen of V1 is fed through C3 to the grid of the noise inverter. This grid is biased by the application of a negative potential resulting from the demodulated video signal in the detector output. Additional biasing in the cathode circuit is available by adjusting R9 to provide cutoff of V2B during normal reception.

The positive pulse applied to the grid overcomes this bias, is inverted in polarity at the plate of V2B and negative pulse is applied to C6. Cancellation of the resulting negative pulse is applied to C6. Cancellation of the noise pulse occurs because the two signals fed to C6 are of opposite polarity. This places the noise signal well below the amplitude of the normal sync pulses.

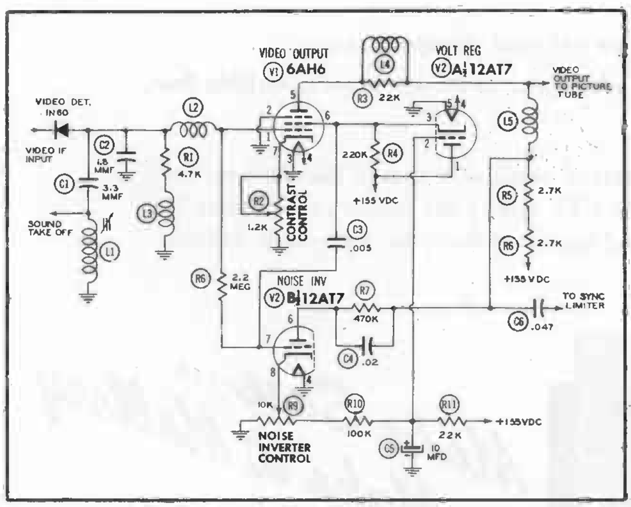

Figure 3. Noise Inverter Circuit Used by Bendix to Reduce Noise in Sync Circuits.

Anti-Pincushioning Magnets -

Two magnets are employed in conjunction with the 21FP4A picture tube to compensate for the bowing-in of the raster due to the use of a cosine deflection yoke. These magnets are mounted on the picture tube mounting brackets and are hinged at two places. This permits sufficient adjustment to pull the raster back to the desired straight side. To facilitate the adjustment of these magnets, move the raster to better observe the side of the raster being adjusted and move the magnets until each side is straight.

OLYMPIC

Variable Delay AGC -

Olympic Models 21C28, 21D29, 21K26, 21T27 employ a "local-distance" switch in the AGC circuit to accommodate a variable delay AGC voltage in "local" position and provide for a fixed delay voltage in "fringe" position. The purpose of this type of circuit is to provide a more uniform performance of the receiver over a wide range of input signal strength.

A schematic of the AGC circuit is shown in Figure 4. The video IF signal is coupled from the 4th video IF output through C1, a 100 mmf. capacitor, to the plate of the AGC diode (V1). The cathode of the AGC diode is connected to a voltage divider network. In "local" position the positive potential applied to the cathode as a delay voltage is variable. This is provided by connecting one end of the contrast control through the switch to the cathode while the arm of the control connects to ground. The delay voltage at the AGC diode cathode is fixed in "fringe" position.

When a strong signal is tuned by the receiver, the contrast control is adjusted to reduce the gain of the video amplifier V3. This reduces the amount of resistance in the leg of the voltage divider network between ground and the cathode of V2. For practical purposes the delay voltage is at a minimum permitting V3 to conduct immediately upon the application of a video IF signal. The negative charge produced upon C 4 remains essentially constant for a given signal strength and represents the difference between the peak swing of the applied signal and the amount of delay voltage present on the cathode.

Operation of the receiver in areas of medium strength applies an increased voltage to the cathode of V2 since the contrast control would be advanced to in-

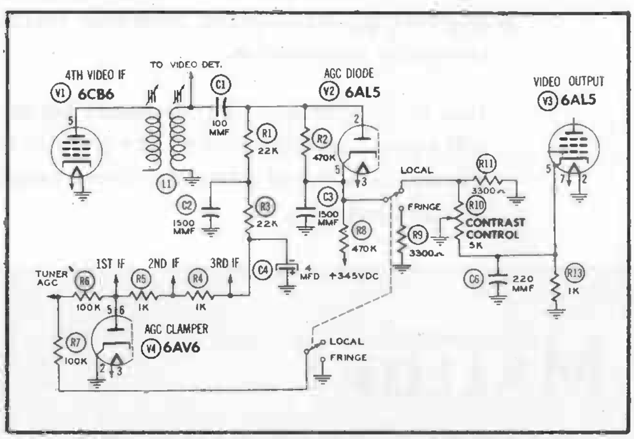

Figure 4. AGC Circuit Employing Fixed and Variable Delay Bias.

crease gain in the video amplifier. The AGC diode would not conduct until the peak swing of the applied signal drives the plate further positive than the cathode. The resultant charge or AGC bias would then be the difference between the peak of the applied voltage and the delay voltage present on the cathode.

For weak signal areas, the fringe position of the switch places a maximum delay voltage on the cathode. During the time the AGC diode is non-conductive, the bias on the tubes remain essentially zero by employing a clamper diode V4. Any tendency of the AGC bias line to go positive causes the AGC clamper to conduct, clamping the AGC line to practically zero potential.

An additional provision for insuring minimum bias in "fringe" position is the switching in of a 100K ohm resistor to ground from the point where the AGC bias is applied to the RF tuner.

Horizontal Retrace Blanking -

Visible horizontal retrace lines, which may degrade the picture, are effectively eliminated in the Olympic receivers through the use of a horizontal blanking circuit. One triode section of a 12AU7 tube functions as a horizontal blanking amplifier stage. (See Figure 5). This triode stage is designed to apply a negative pulse to the picture tube grid, during horizontal retrace time, for cutting off the picture tube beam current.

To insure that the blanking tube does not load down the picture tube grid during normal forward traces of the beam, the blanking circuit is designed to cut-off the blanking tube current except at retrace time.

The cathode bias circuit alone, consisting of C2 and R3, cannot effect tube current cutoff. However, when a positive pulse from the horizontal output transformer is fed through R1 and C1 to the grid of V1, the grid will be driven sufficiently positive to draw grid current. The charge thus developed on C1 returns to ground through R2. The time for the discharge of C1 through R2 is sufficiently long that a steady bias is maintained on the grid. When the positive pulse at the grid ceases during forward trace time of the beam, the the blanking tube V1 is cut off.

The next positive pulse applied to the grid of V1 is of sufficient amplitude to overcome the grid bias

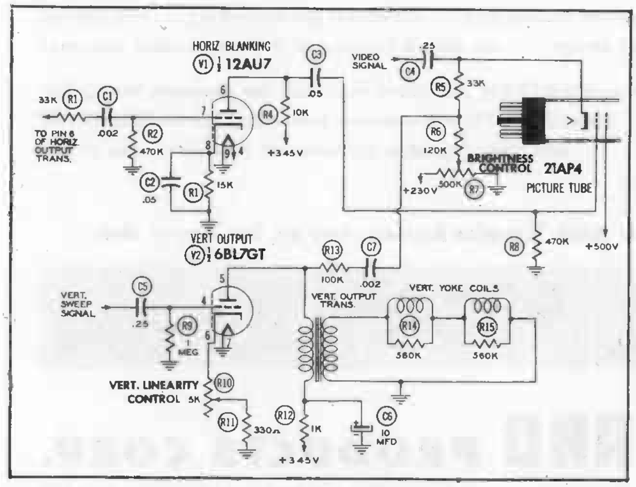

Figure 5. Horizontal and Vertical Retrace Blanking Circuits Used in Olympic Receivers.

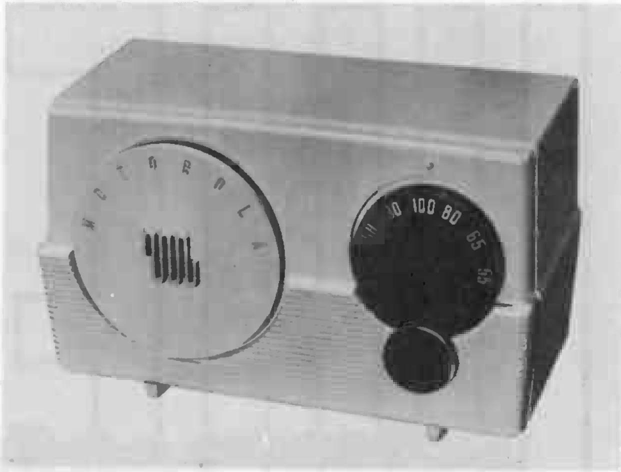

Figure 6. Cabinet Photo of Motorola Radio Receiver Model 52R Series.

and the cathode bias and effects tube current flow in V1. Polarity inversion at the plate of V1 gives a negative pulse across the plate load R4. C3, a .05 mfd. capacitor, couples the negative pulse to the picture tube grid cutting off the picture tube beam current.

Vertical Retrace Blanking -

Blanking of the picture tube beam during vertical retrace time is also accomplished in the Olympic receivers. A schematic for the vertical blanking circuit appears as a part of Figure 5. In this instance, a positive pulse present at the plate of the vertical output tube at retrace time, is fed to the cathode of the picture tube to cut off the beam. The path for the vertical pulse is from the plate of V2 through R13, C7 and R5 to the cathode of the picture tube.

PLATED CIRCUIT RADIO RECEIVER

A different approach to receiver design and construction is illustrated by the Motorola Model 52R Series radio receiver. The cabinet styling is conventional, see Figure 6, and the circuitry is typical of the AC/DC type of radio receiver. Here the similarity ends.

When the rear cover on the receiver cabinet is removed, the AC cord is also disconnected through the use of an interlock plug and connector as used with TV receivers. Looking inside the cabinet, the components are seen mounted on a plastic base posi-

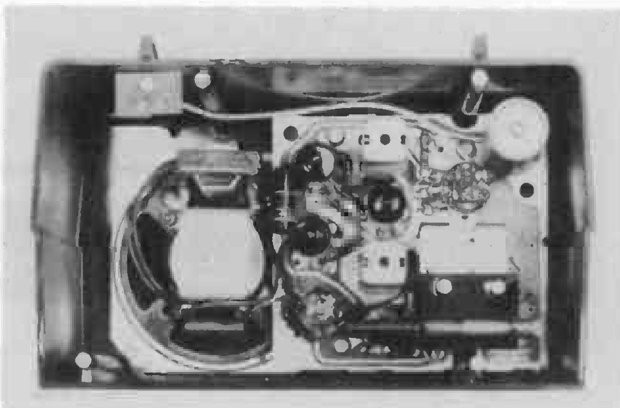

Figure 7. Rear View of Motorola Radio Showing Vertical Chassis Mounting and Plated Circuits.

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tioned vertically in the cabinet. (See Figure 7). Tube sockets are formed directly into the plastic base and are so designed that voltage and resistance measurements may be made on each tube socket without removing the chassis unit from the cabinet.

When the chassis unit is removed from the cabinet, it is observed that additional plated leads to additional components are formed on the bottom of the chassis as shown in Figure 8.

Further observation shows that several resistor and capacitor components are connected above chassis to various tube socket connections. In addition, wiring between sockets and between some other components is provided by silver plated strips on the plastic base which form lead connections.

The method of placing the silver plate on the plastic base was developed and put into practical application in electronic circuitry after years of research. Known as the "placir" process (the word is a contraction of plated circuit), it is not to be confused with printed circuit. The chief difference in the end product is that the plated circuit can carry very substantial currents. It is said that the plated circuit leads in the Motorola 52R Models could carry as much as 15 amperes of current.

As opposed to usual chassis design, the plated circuit chassis base consists of a thin plastic material on which the required components are mounted. Figure 9 is a side view of the Motorola 52R chassis illustrating the thinness of the chassis base.

An examination of the plated leads on the chassis base shows that several small holes are found at various points. The purpose of these holes is two fold. One purpose of the holes is to provide continuity between plated leads from one side of the plastic base to the other. This is accomplished by plating the sides of the holes during the plating process. The second purpose of the holes is to provide an anchor for the plated leads. The anchoring effect in conjunction with the normal adhesion of the plated silver and plastic base holds the plated material fixed in position.

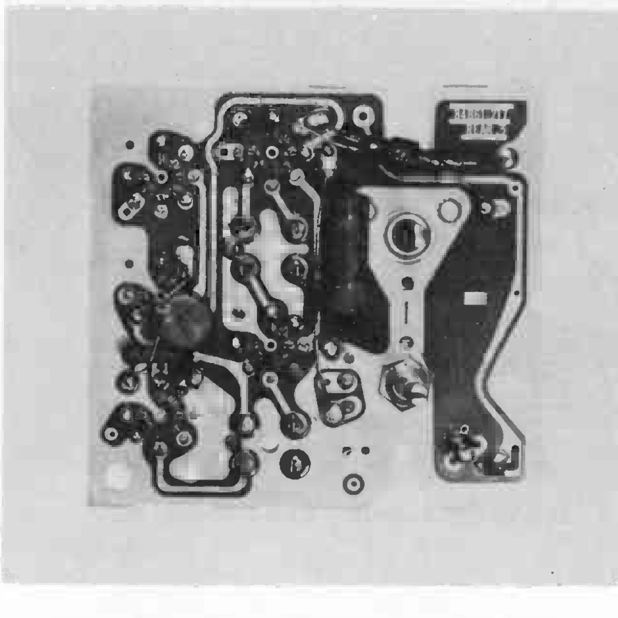

Figure 8. Bottom of Motorola Chassis Plate.

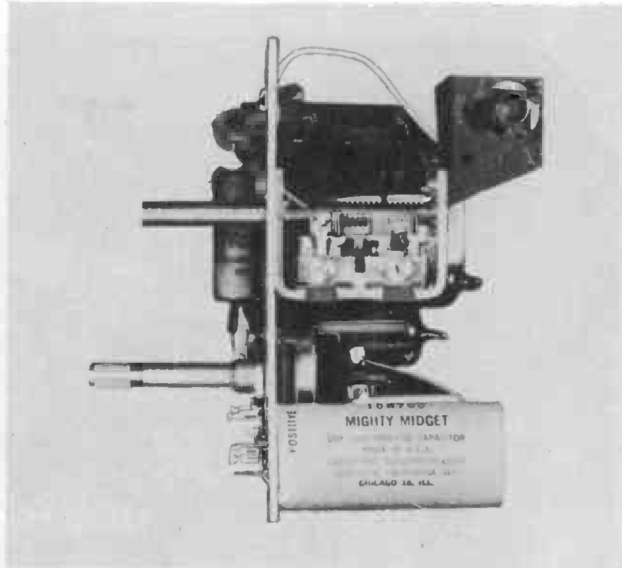

Figure 9. Side View of Motorola Radio Chassis Illustrating Thinness of Chassis Base.

After the plating process is completed, the unit is protected against moisture, RF leakage, and any corrosive effect of the elements by coating the entire unit with a thin film of quick drying substance. Subsequent soldering on the unit will not be impaired since the heat of the iron quickly removes the protective film.

Connecting the various components in the circuit is accomplished by soldering. Every connection is designed to be soldered on each side of the chassis. This process is facilitated by providing a plated hole at each connection. The natural affinity of silver and solder, together with the capillary attraction at the plated hole, insures a solder bond extending through the chassis.

If for any reason it is desired to remove a component from the chassis base, it is suggested that a small 60 watt iron be used. It is not recommended that a soldering gun be used in this application. A large iron may have sufficient heat to burn a plated lead in two. Should a plated lead be broken or burned in two, a wire lead may be soldered across the gap.

The IF transformers and the volume control have terminal lugs extending through, and soldered to, the chassis. To readily remove these components, the use of a small solder pot is suggested. All terminal lugs may be inserted in the pot simultaneously and the component then easily removed. If a soldering pot is not available, each lug terminal can be heated individually with a small iron and the melted solder removed by shaking the chassis unit. Alternate heating and loosening of each lug will free the lug from the solder bond. Care should be exercized in removing components that the printed connections are not pulled loose from the chassis.

Motorola produced the 52R Series radio receivers in two types. Some will be found with the plated circuit design, while others have the conventional chassis and wire lead arrangement.


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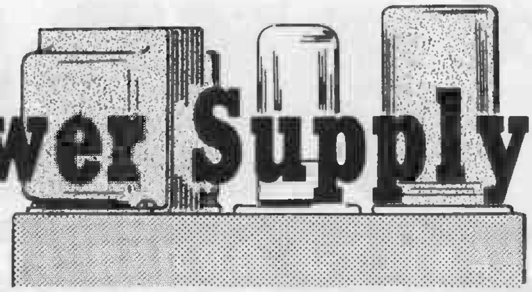
SERVICING THE Vibrator Power Supply



by Arthur Kozik

The outstanding difference between a home radio and an automobile radio is the type of power supply employed. A home radio uses the AC power lines for its source of power. The various voltages that are necessary to power the various circuits of the receiver are obtained through the use of an AC power supply. In the automobile, however, there is no alternating current available and it becomes necessary to incorporate a method of increasing the 6 volts, that is provided by the storage battery, to furnish the B+ for the plate and screen circuits of the radio.

In some mobile applications, where heavy current drain is encountered, a motor generator or dynamotor may be employed to effect this voltage step-up. However, the radios employed in pleasure cars use a vibrator type power supply. With this method, the direct current is changed to alternating current through the use of a vibrator.

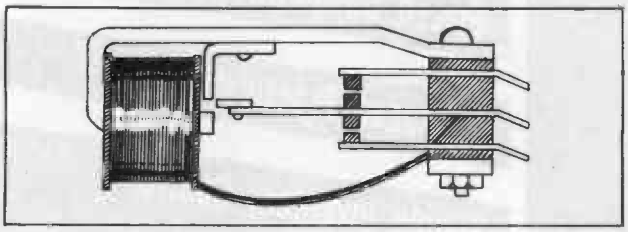


Figure 1. Construction Details of a Typical Vibrator.

The vibrator is a mechanical device that alternately reverses the current flow in the primary winding of a transformer. Figure 1 illustrates a typical vibrator. The heavy strap frame is so formed that one end passes through the driving coil and becomes the magnetic pole piece. A magnetic shunt is incorporated to complete the magnetic path. The vibrating reed, or armature, which has a contact point on both sides, and the side points are mounted on the opposite end of the frame by means of stacked insulators. During operation, the points on the reed engage with the side points in an alternating fashion. This entire unit is shock mounted in sponge rubber and completely enclosed in a metal container. A plug is normally incorporated to allow the unit to be placed into a polarized socket that is provided on the receiver chassis. In this manner, it is easily removed for test or replacement.

The electrical function of the vibrator can be understood by an examination of Figure 2. When used in conjunction with a transformer, the vibrator causes the direct current to be applied to the primary in an alternating manner. As the points on the reed (illustrated by the switch arm) makes contact with point A, current will flow in the bottom half of the transformer primary winding. When contact is broken at point A and made with point B, current flows in the top half of

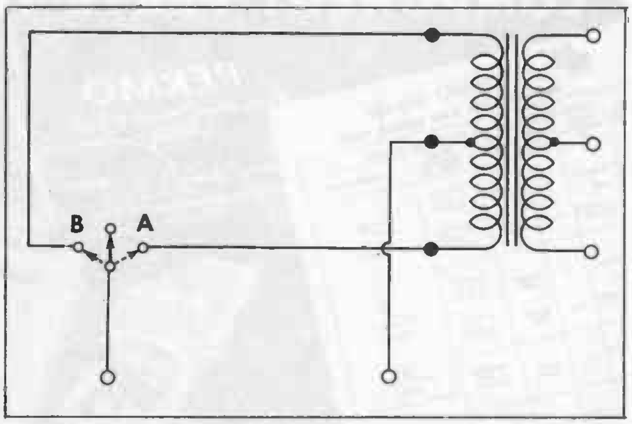


Figure 2. Simplified Schematic Showing Vibrator Action.

the winding in the opposite direction. Since the center tap remains at the same polarity at all times, and the ends are alternately placed at the opposite polarity, an alternating current flows through the primary winding. This current then induces a voltage in the secondary of the transformer. This voltage is AC, however, and the usual rectification and filtering is necessary before being applied to the receiver circuits.

In the shunt coil type, the driving coil of the vibrator is connected between the reed and one of the side points, as can be seen in Figure 3. When power is applied to the circuit, the magnetic field generated in the coil attracts the reed. When contact is made with the contact point "A", the coil is shorted out resulting in the collapse of the magnetic field. The reed then swings away and the contact at "A" is broken. The inertia causes the reed to effect closure of the points at "B". By this time the coil is again energized and the cycle repeats.

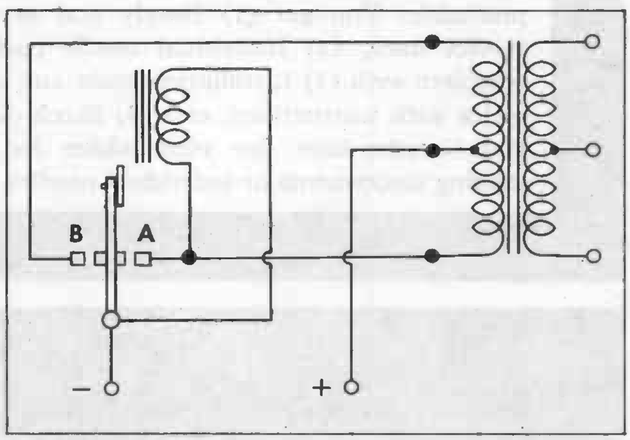


Figure 3. Shunt Coil Type Vibrator Circuit.

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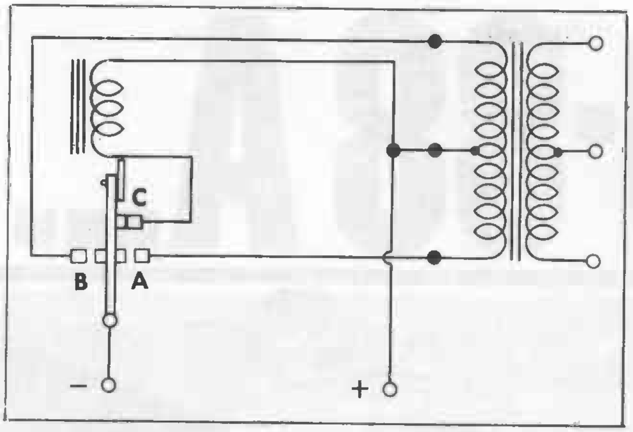

Figure 4. Driver Type Vibrator Circuit.

The driver contacts or series coil type is basically the same as the shunt coil type except that the driving coil is energized through a separate set of contact points ("C" in Figure 4). These points are normally closed. As current is applied to the driving coil, a magnetic field is built up attracting the reed. As the reed swings over, the points open and the magnetic field collapses, allowing the reed to swing over and again make contact.

One of the undesirable effects of a vibrator is arcing at the points, especially under heavy loads. A vibrator used in conjunction with an inductive load, such as a transformer, creates very high surges of voltage, at each closing and opening of the points. These surges create arcing at the points, and this arc in turn causes transient voltages of high values other than the initial surges. This arcing also creates a tremendous amount of heat on the points, causing them to become pitted and burned, and very effectively shortens the life of the vibrator. Since heat alone is more damaging to these points than any other factor, every effort should be made to reduce this arc as much as possible.

A resistor of 50 to 200 ohms is sometimes employed to minimize noise known as "pop hash". This resistor is connected across the points as shown in Figure 5A. Sometimes two resistors are used and are connected as shown in Figure 5B.

Another very important factor to be considered is the buffer, or timing capacitor. As was stated before, very high surges of voltage occur at each opening of the interrupter points. See Figure 6. These surges must be controlled to reduce arcing and to further increase the efficiency of the supply.

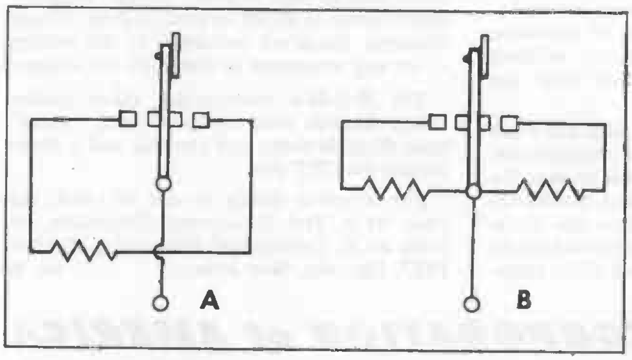

Figure 5. Typical Damping Resistor Connections.

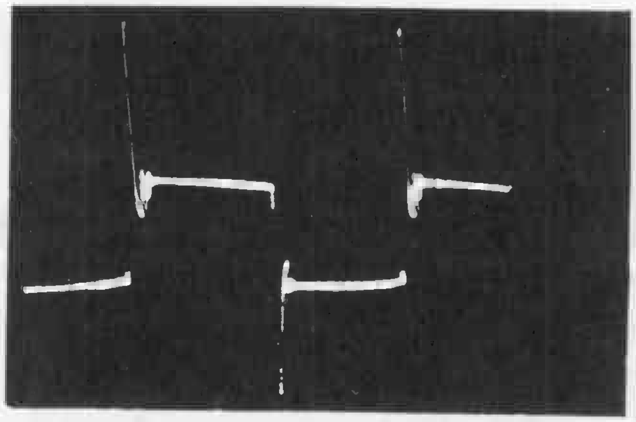

Figure 6. Waveform Showing Voltage Surges as Points Open.

An ideal waveform at the output of a vibrator would be a square wave. See Figure 7A. However, this is not the case since a time interval occurs during the swinging of the reed from one side to the other, during which time both points are open. This is known as "off contact time." A typical waveform illustrating this time interval can be seen in Figure 7B. Note the gap which occurs during the "off contact time."

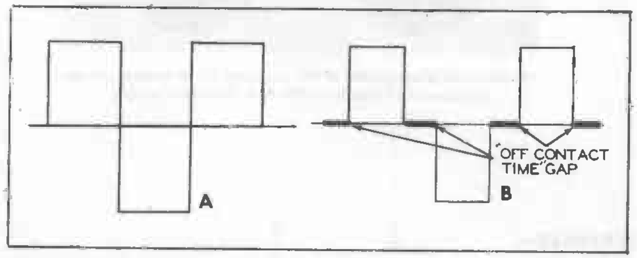

Figure 7A. Ideal Waveform.
Figure 7B. Typical Vibrator Waveform.

The buffer, or timing capacitor, may be connected across either the primary or the secondary winding of the transformer. A relatively small value across the secondary will function equally as well as a large value across the primary. Therefore, buffers will nearly always be encountered in the secondary circuit. The value of this capacitor and the inductance of the transformer form a tuned circuit that is set into shock oscillation, with each opening of the points. See Figure 8A.

The value of this capacitor and the inductance of the transformer control the frequency of this oscillation, and also the slope of the waveform. (Figure 8B). By selecting the proper value of buffer capacitor, the oscillation can be made to coincide with the closing of the opposite set of points, (Figure

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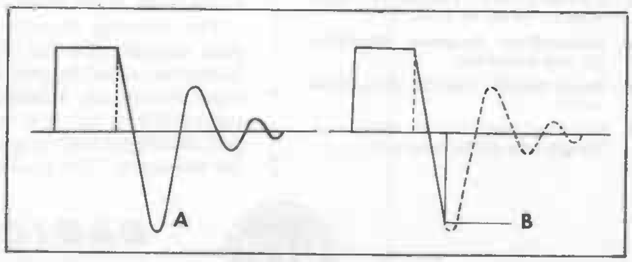

Figure 8. Waveforms Illustrating the Effect of the Oscillations on the Slope of the Waveform.

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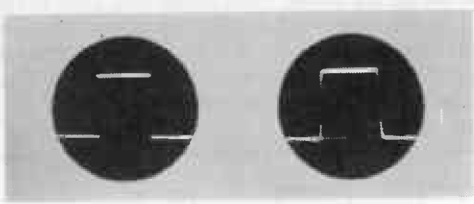

Unretouched photographs of 60-cycle and 50 Kc square waves reproduced on screen of WO-88A. Note fast retrace.

FEATURES—

- Direct-coupled, push-pull, two-stage vertical amplifier; push-pull horizontal amplifier.
- Frequency-compensated and voltage-calibrated attenuators.
- Front-panel source of 1-volt peak-to-peak calibrating voltage.
- Graph screen scaled directly in peak-to-peak voltage.
- Metal shield enclosing CRT gun to minimize hum-pickup from stray fields.
- Extra fast sweep-oscillator retrace.
- Built-in 60-cycle sweep with phasing control.

SPECIFICATIONS—

- Deflection Sensitivity: (vertical amplifier) 25 rms millivolts or better per inch.
- Vertical Amplifier Frequency Response: Flat from dc to 100 Kc; within −3 db at 500 Kc; within −10 db at 1 Mc.
- Input Resistance and Capacitance: 10 megohms and 9.5 uuf with WG-216B Low-Capacitance Probe.
- Sweep-Circuit Frequency (four ranges): 15 cps to 30 Kc.
- Square-Wave Response: Negligible tilt and overshoot.
- Power Supply: 105/125 volts, 50/60 cycles.
- Size 13½" high, 9" wide, 16½" deep. Weight only 25 lbs (approx.).

New WG-216B Low-Capacitance Probe gives the WO-88A an over-all input resistance of 10 megohms shunted by less than 10 uuf.

The WO-88A combines the features required for TV receiver servicing, and the high stability and ruggedness essential for continuous production-line duty.

The outstanding feature of the WO-88A is its remarkably true square-wave response, obtained by adequate band-width, negligible phase shift, and a complete absence of peaking circuits. Vertical and horizontal sync pulses, as well as other complex wave forms, are reproduced with fidelity characteristic of expensive laboratory instruments. Furthermore, uniform frequency response is maintained over the entire range of the attenuators.

The two-stage dc vertical amplifier has more than enough gain for all usual applications. Moreover, all of the gain is useable because the input circuits are shielded against extraneous noise and hum right out to the probe tips. Push-pull circuitry in both stages of the vertical amplifier minimizes "line bounce"; and direct coupling provides instantaneous "recovery" time.

For operating convenience, the controls for push-pull balance, astigmatism adjustment, and interstage dc coupling are accessible from outside the cabinet.

Voltage measurements and waveshape observations can be made simultaneously with the WO-88A. A front-panel terminal provides a 1-volt peak-to-peak reference voltage; the green graph screen is scaled in peak-to-peak voltage divisions, which are multiplied by the settings of the step attenuator to determine the voltage.

The WO-88A incorporates other quality 'scope features such as "plus" and "minus" sync, 60-cycle sweep and phasing, and a shield around the CRT gun.

For complete details on the WO-88A, see your RCA Test Equipment Distributor, or write RCA, Commercial Engineering, Section IX67, Harrison, New Jersey. TMK. ®

RADIO CORPORATION of AMERICA
TEST EQUIPMENT — HARRISON, N. J.

John Markus — Editor-in-Chief, McGraw-Hill Radio Servicing Library

Dollar and Sense Servicing

BIRDIES. Musical accompaniment for impressive press show in IBM's new electronic calculator manufacturing plant in Poughkeepsie, New York was provided by birds flitting about near the ceiling. They got in during construction of the huge building, and like it so well that they go out in shifts when windows are opened. Problem is how to get them all out at once so windows can be kept closed.

PERISCOPE. To see over heads of crowds at the political conventions, ABC TV cameras were equipped with periscopes that brought down a picture from a height of nearly 10 feet. Judging from personal experience with war-surplus tank periscopes, the gadgets would be used only when absolutely necessary, because they narrow down the field of vision so much.

PHONE PICKUP. For recording telephone conversations, Permoflux has brought out a compact coil that fits over the earpiece of any cradle or upright phone. It picks up the audio signal by induction, for feeding to any tape, wire, or disc recorder. Cost is around $10, and it's apparently legal since there are no connections to the telephone. Chief use envisioned by the manufacturer is for recording long and complicated instructions, lists, and data exactly as heard, plus the conversation of the person who is operating the recorder. (Legality may also involve proper notification that recording is being made. - Ed.)

ROLLING RADIO. Two out of three automobiles rolling along the highways of this country have auto radios, according to Broadcast Advertising Bureau figures. This means that there are some 24.5 million auto radios, as compared to about 88 million radios of other types. That's a lot of auto radios for today's 90,000 servicemen to work on, especially when about half of them are in TV and many of the rest refuse to get stiff necks working under dashboards.

On the other side of the picture, the auto sets are being made so well today that they're running for years without going bad. Chief reason is that there's no pressure on manufacturers to cut auto radio prices. Another fifty or hundred dollars added to the price of a new car is hardly noticed. How many other tie-in sales are there that click as well as this auto-and-radio team?

SMORGASBORD. When all the TV stations in the new FCC allocation plan are in operation with maximum permissible power and antenna height, viewers in San Francisco will have a choice of 30 different stations. Those in Wilmington, Delaware can choose from 31, while Indianapolis TV fans will have 27 and Atlanta 25 within reliable reception range. But what a nightmare it'll be for the antenna installation boys when a customer insists on getting every single one, unless someone comes out with a high-gain omnidirectional broadband UHF antenna.

MICROWAVES. Television network mileage today is 2/3 microwave relay and 1/3 coax, with more and more new links using the hilltop microwave towers.

LIFTING. With weight of a 27-inch all-glass picture tube running around 40 pounds, and the chassis adding another 40 pounds or more, removing a TV chassis in a home becomes a two-man job. In many factories already, two men are being used to install sets of this size in cabinets.

As more 27-inchers get into the field, service organizations will have to choose between sending out two men on every call or using one man, as now, and letting him call for help if the chassis needs yanking. Metal-wall 27-inchers weigh only about 29 lbs., which eases the weight situation a bit, but still leaves a wide, awkward 70 lb. chassis for one man to handle.

NARCOM. For an estimated expenditure of around fifty million dollars, a combination microwave and VHF relay system can be run across the top of the world to link U.S. and British television networks. The proposed North Atlantic Relay COMmunications system, called NARCOM for short, would also provide badly needed sites for early-warning radar. Longest hop, 290 miles from Iceland to the Faroe Islands, would be achieved by using a lower relay frequency in conjunction with better propagation characteristics of atmosphere in colder regions and over salt water. The system could be used for telephone, wirephoto, and facsimile when not needed for trans-Atlantic television. Though considered some time ago for military use, Narcom was turned down then because of the enormous installation and maintenance cost. Television has revived interest in the project, and groundwork for financing it is now under way, according to Television Digest.

SEATING. Servicemen weary of sitting cross-legged or kneeling on the floor while working on a set will appreciate Sylvania's latest premium-offer gadget, called Sit-N-Fixit. It's a folding aluminum stool, with side pockets for tools, coming in a zippered cloth case that serves as a drop cloth when opened on the floor.

AMMUNITION. Facts make the best sales arguments, so here are a few. Rectangular picture tubes, 16 inches and larger, represented 98 percent of picture tube sales to set manufacturers in the first quarter of this year, according to RTMA. This means that round tubes are pretty much dropping out of the picture, along with tubes smaller than 16 inches. Since tube price varies with demand, the large rectangular tube will very likely be much cheaper than smaller or round tubes in the future--an argument for trading in a small set on a new large-screen job.

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INDEX TO PHOTOFACT

RADIO AND TELEVISION SERVICE DATA FOLDERS

No. 34

Covering Folder Sets Nos. 1 thru 182

HOW TO USE THIS INDEX

To find the PHOTOFACT Folder you need, first look for the name of the receiver (listed alphabetically below), and then find the required model number. Opposite the model, you will find the number of the PHOTOFACT Set in which the required Folder appears, and the number of that Folder. The PHOTOFACT Set number is shown in bold-face type; the Folder number is in the regular light-face type.

IMPORTANT—1. The letter "A" following a Set number in the Index listing, indicates a "Preliminary Data Folder." These Folders are designed to provide you *immediately* with preliminary basic data on TV receivers pending their complete coverage in the standard, uniform PHOTOFACT Folder Set presentation.

2. Models marked by an asterisk (*) have not yet been covered in a standard Folder. However, regular PHOTOFACT Subscribers may obtain Schematic, Alignment Data or other required information on these models without charge. (When requesting such data, mention the name of the Parts Distributor who supplies you with your PHOTOFACT Folder Sets.)

3. Production Change Bulletins contain data supplementary to certain models covered in previously issued PHOTOFACT Folders, and are listed in this Index immediately following the listing of the original coverage of the model or chassis. These Bulletins should be filed with the Folders covering the models to which the changes apply.

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Chassis 5G2	**137**	2
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Chassis 5J2	**136**	2
Chassis 5K1	**30**	1
Chassis 5L2	**160**	1
Chassis 5M2	**157**	2
Chassis 5N1	**31**	1
Chassis 5R1	**59**	1
Chassis 5R2	**165**	3
Chassis 5T1	**68**	1
Chassis 5W1	**79**	2
Chassis 5X1	**76**	3
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Chassis 6A2	**103**	1
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Chassis 6C1	**53**	1
Chassis 6E1, 6E1N	**6**	1
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Chassis 6L1	**26**	2
Chassis 6M1	**25**	1
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Chassis 6R1	**54**	1
Chassis 6S1	**107**	1
Chassis 6V1	**62**	1
Chassis 6W1	**71**	1
Chassis 6Y1	**75**	1
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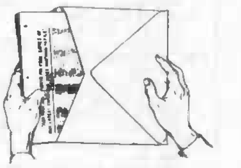
IMPORTANT

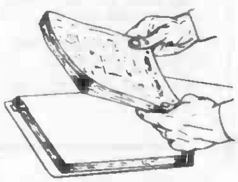
Quick, Easy PHOTOFACT Filing Method

The preferred 30-Second method for filing PHOTOFACT Folders

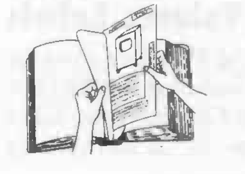
Your PHOTOFACT Folder Sets come to you in convenient envelopes. When you remove a Set from its envelope, you will find the Folders already arranged in proper filing order, and preceded by an Index Separator. This Separator lists each receiver covered in the Set, and has an index tab showing the Set number. To file, here's all you do:



1. Remove the Index Separator and the Folders from the envelope. The Folders and manila TV Jackets are already arranged in proper numerical filing order except the TV folders, which are placed last in the Set.



2. Open your binder and place the entire contents, taken from the envelope, behind the preceding Set of folders, laying aside the TV folders.



3. Now, insert the TV folders in their respective manila jackets and your filing is complete.

To locate the folder you want, refer to instructions on the first page of this index listing.

ALWAYS REFER TO THE PHOTOFACT INDEX

IMPORTANT

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"SHOP TALK" (Cont'd. from Page 5)

on hand, the mistake might never have been found. (And even with a schematic, changes in component values during different production runs are a frequent occurrence.)

Another example of a "factory-based" trouble is again not a defective component but poor or improper routing of wiring in a set. The vertical system in one receiver had a tendency to roll on the slightest electrical disturbance. The usual remedy of tube changing failed to help and all of the voltages and resistance measurements revealed nothing was amiss. Only by accident was it discovered that the filament lead of a nearby tube was passing sufficiently close to the grid of the vertical blocking oscillator to disrupt the oscillator triggering cycle sufficiently to cause it to lose sync quite easily.

In another set, horizontal weaving and pulling was noted. Positioning of the contrast, horizontal lock, and horizontal hold controls had no effect. The trouble here also stemmed from 60-cycle power leads running too close to the grid of a video amplifier tube.

The development of leakage paths may not be "factory-based" but then neither are they defective components that the service man usually seeks. A leakage path between filament and grid terminals of a tube socket can give you exactly the same symptoms as a grid-to-heater short in the tube. Only changing tubes here won't help. Further complications can arise if this grid terminal is connected into the AGC system because now all controlled tubes become affected.

In the high-voltage system, leakage paths due to dust accumulation are quite frequent. If the leakage path has a relatively low resistance, the arcing or corona may be sufficiently intense to be readily visible. But when the leakage resistance is quite high, the drain-off of energy may be small enough to impair the efficiency of operation without being noticeable to the unaided eye or ear. Whenever you suspect corona or arcing in the high-voltage system, place the set in operation and then put out all other lights in the room. The faint bluish flow of the discharge may then become visible. Sometimes a straw held with one end close to the ear and the other end extending into the high-voltage system will help to locate the seat of any corona or arcing. Also useful is careful probing with a blunt rod of a non-conducting material. When the blunt instrument contacts the corona source, the hissing sound will change pitch or be interrupted.

The foregoing are representative of troubles which are not defects in the commonly accepted sense of the word or in the way that most service men approach a television set. But they are specific disturbances that prevent the set from functioning properly. Keep them and others of their sort in the "usual" methods and you are at your wit's end.

* * *

REVIEW. The article selected for review this month concerns the application of the various types of meter, oscilloscope, and signal tracer probes used with associated test equipment. Proper understanding of probe use effectively multiplies the number and range of test instruments available in the service shop. For this reason, as well as those of getting a

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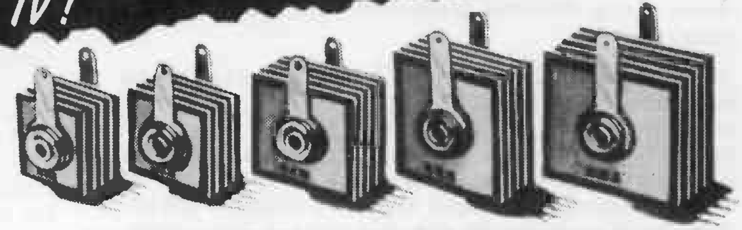

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16Y1	1/2" sq.	15/16"	260	760	20 MA*
8J1	11/16" sq.	9/16"	130	380	65 MA
5M4	1" sq.	11/16"	130	380	75 MA
5M1	1" sq.	7/8"	130	380	100 MA
5P1	1 3/16" sq.	7/8"	130	380	150 MA
6P2	1 3/16" sq.	1 3/16"	156	456	150 MA
5R1	1 1/2" x 1 1/4"	7/8"	130	380	200 MA
5Q1	1 1/2" sq.	1 1/8"	130	380	250 MA
6Q1	1 1/2" sq.	1 1/8"	156	456	250 MA
6Q2	1 1/2" sq.	1 3/8"	156	456	250 MA
6Q4 (†)	1 1/2" sq.		130	380	300 MA
5QS1	1 1/2" x 2"	1 1/8"	130	380	350 MA
6QS2	1 1/2" x 2"	1 1/4"	156	456	350 MA
5S1	2" sq.	1 1/8"	130	380	500 MA
6S2	2" sq.	1 3/8"	156	456	500 MA

* This rectifier is rated at 25 MA when used with a 47 ohm series resistor.
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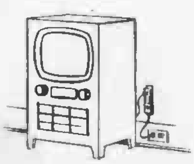

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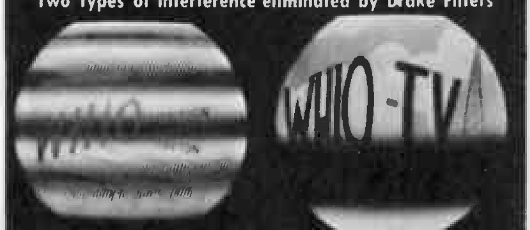

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job done rapidly and accurately, the subject of probes assumes a major importance to the service technician.

The article, entitled "Probes for Radio - TV Troubleshooting," appeared in the April issue of "The Capacitor" a monthly publication of the Cornell-Dubilier Electric Corporation, at Hamilton Blvd., South Plainfield, New Jersey. This publication is available free of charge to those who request it.

In preparing the review, this writer has taken the liberty of including some hints and thoughts from his own experience in the hope that they may be of assistance.

* * *

A probe is a piece of equipment which extends the usefulness of a particular test instrument. Compared to the cost of the instrument itself, the additional outlay for the probe is quite nominal. Yet, frequently, by the addition of a probe, the service man avoids the expense of another instrument. An excellent example is the high-voltage probe that technicians use so frequently in television receiver servicing. Special meters for measuring high voltage are available and can be purchased at any parts jobber. Still, if a 20,000-ohm volt-ohmeter or a VTVM is already possessed, a simple probe costing in the neighborhood of $6 or $7 will enable the service man to make whatever high-voltage measurements he may need in the course of his work.

Over a period of years, a number of special probes have been developed for use with conventional instruments. The majority of these probes have been designed for use with such instruments as the VTVM and the oscilloscope. This would be true of the RF probe, the peak-to-peak probe, the low-capacity probe, and the demodulator probe. Other probes, such as the signal tracer probe and the injector probe are not specifically designed to be used with any particular instrument although in some instances they may be.

* * *

METER PROBES

1. DC - VTVM Probe. Best known to the radio service man is the isolating probe used with a DC vacuum-tube voltmeter. In its conventional form, the unit consists of a regular shielded test prod containing a built-in 1-megohm resistor. See Figure 1. The purpose of the resistor is to isolate the test-prod tip from capacitance effects due to the operator's hand and the test-lead cable.

It will be noted that the resistor is in series with the other resistors that form the voltage dividing network across the meter input. Consequently, a portion of the applied voltage will be dropped across this isolating resistor and this must be taken into account when the meter is calibrated. Usually this is of little concern to the service man because he buys the VTVM with the isolating probe as standard equipment. It is important, however, if you are going to add an isolating resistor to a meter (which now does not have one) or

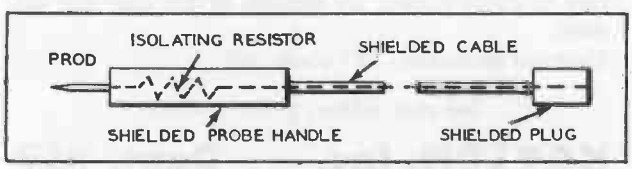

Figure 1. D-C VTVM Probe.

if you are going to increase the value of the resistor now in the probe. Improved isolation is afforded by higher values of resistance.

2. Television High-Voltage Probe. The top DC voltage range of 1000 volts found on most VTVM's is more than sufficient for the measurement of any of the low DC voltages ordinarily encountered in television receivers. However, the picture tube operates at an accelerating potential of from 9,000 volts to 25,000 volts (the latter for projection tubes) and some means should be available to the technician for measuring these high potentials. A very high resistance in series with the input of a VTVM or high resistance volt-ohm-milliameter will adapt the instrument for the measurement of high voltages.

The physical construction of such a high-voltage probe is shown in Figure 2. The probe body is made quite long, with three or four safety flanges placed up near the front end. These serve to protect the service man from coming in contact with the high voltage and also to protect him from arcing or corona. A burn from arcing or corona can be just as harmful as a burn from direct contact.

Within the probe there is a very large series resistor across which the bulk of the applied voltage is dropped. For example, if a probe is designed to measure 25,000 volts, then 24,000 volts would be dropped across the probe resistor and only 1,000 volts actually applied to the VTVM itself.

To employ the high-voltage probe, its connector cable is connected to the DC volt terminal at the VTVM. The common lead of the meter is securely fastened to the television receiver chassis. The next step is to set the VTVM selector switch to the proper setting. In most instances this is the highest DC voltage range, say 1,000 volts. Just how much each reading on this range must be multiplied (say 10, 15, or 30 times) depends upon the resistance of the high-voltage multiplier.

Which brings up a very important point. The high voltage multiplier which is to be used with a specific meter should be designed expressly for that meter. The multiplication factor required for a certain scale when the high-voltage probe is attached will depend upon, (a) the internal resistance of the meter and, (b) the resistance of the dropping resistor in the body of the probe. Any change in the resistance at any point (probe or meter) will alter the voltage division and, with it, the value indicated by the meter.

PRECAUTIONS: It is not safe to assume that two different model VTVM's marketed by the same manufacturer utilize the same high-voltage probe. If the internal resistances of the meters differ, so will their probe resistances. Also, it is a good rule to keep one hand in your pocket when making high-voltage measurements. And, the other hand, which holds the probe, should be kept well behind the safety flanges.

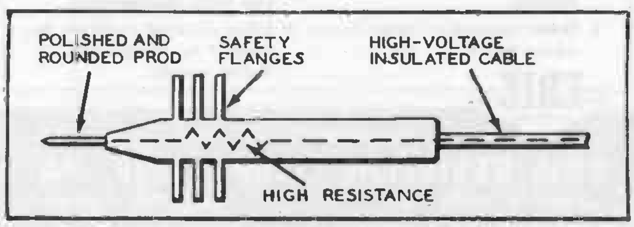

Figure 2. High - Voltage Probe.

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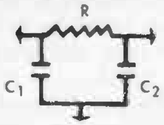

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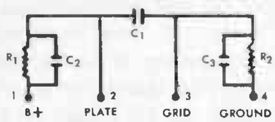
1403-03

TRIODE PLATE COUPLER



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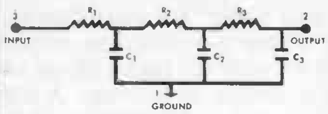
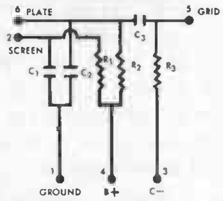
1404-02 1406-02

VERTICAL INTEGRATOR



1405-01

PENTODE PLATE COUPLER



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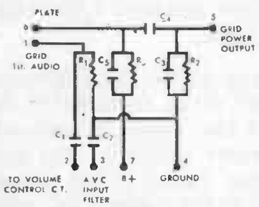
1407-03

AUDIO OUTPUT CIRCUIT



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RF Probes. As the circuit frequency of operation rises, we know that the capacitance and inductance in that circuit decrease. Another way of looking at this is to say that with frequency increase, a circuit becomes more sensitive to capacitance and inductance changes. Moving a wire only one-quarter of an inch in a 200-mc circuit will cause more disturbance than moving a wire several inches in a low frequency circuit.

Because of this sensitivity, measurement in high-frequency circuits must be made with an instrument which introduces as little additional capacitance and inductance of its own as possible. Toward that end, special RF probe attachments are available wherein the rectifying element of the alternating voltage is brought as close to the point of measurement as feasible. This reduces shunting capacitance to a minimum and, at the same time, keeps the lead inductance low, too.

Two types of rectifiers are employed in RF probes: miniature diodes and crystal rectifiers.

The diode is advantageous because it can be used to measure fairly high voltages. Its disadvantage lies in the fact that it requires filament voltage and this must be brought up to the probe through the connecting leads. Crystal probe construction is simpler and, in consequence, its cost is less. However, it should not be operated in circuits containing AC voltages in excess of 20 volts.

A suitable RF probe circuit is shown in Figure 3. The value of R1 in the diagram is equal to 1.414 times the input resistance of the meter plus whatever normal value of isolating resistor is used by the DC probe. Thus, for a 10-megohm-input instrument, R1- 1.414 (10 + 1) = 15.554 megohms. We are assuming here that the DC probe contains a 1-megohm resistor.

When using the RF probe, know the safe maximum voltage which can be applied and be familiar with the frequency range throughout which its indications can be relied upon.

In use, place the probe end directly on the point where the RF potential is to be measured. The grounding lead should be connected to the chassis as close to the measuring point as possible. Disturb the circuit components as little as possible when making measurements. Keep your hands and other parts of the body away from the circuit. Above all, do not indiscriminately push leads and components aside in order to get at the point where the voltage is to be measured. Pick your way through the circuit carefully.

3. AC Peak-to-Peak Probe. This type of probe, shown in Figure 4, is useful for measuring the peak-to-peak value of complex, non-sinusoidal waveforms in television circuits. The circuit is seen to consist of two separate shunt-diode peak rectifiers with their inputs in parallel and their outputs in series.

Diode V1 conducts when the upper AC input terminal is positive and charges capacitor C1 to the

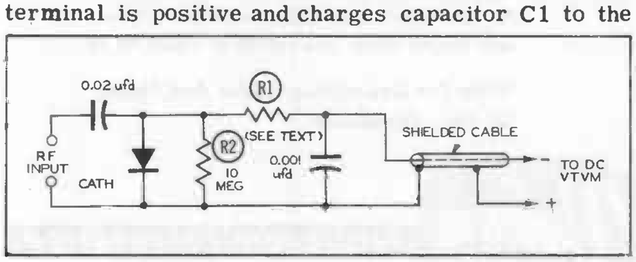


Figure 3. R.F. Probe.

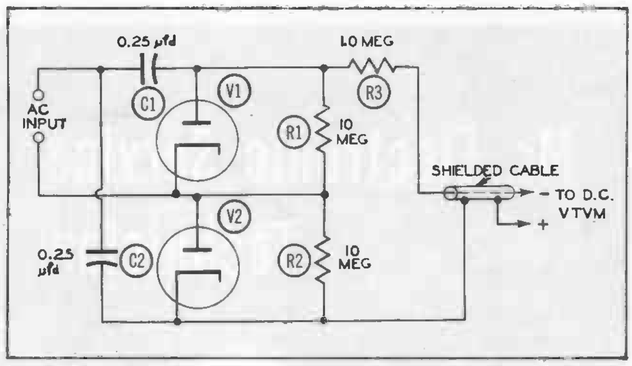


Figure 4. Peak-to-Peak Probe.

peak value of the applied AC voltage. A DC voltage equal to this peak value appears across load resistor R1. When the lower AC input terminal is positive, diode V2 conducts and charges capacitor C2 to the peak value of the applied AC. A DC voltage equal to this peak value appears across resistor R2. Since R1 and R2 are connected in series, the DC voltage across each will add. The voltage applied to the VTVM is this sum which is equal to the peak-to-peak value of the applied AC voltage.

The DC scales of the meter may be used directly except on ranges lower than 0-10 volts where a special calibration will be required. The 1-megohm resistor, R3, replaces the isolating resistor normally found in the DC probe of the VTVM.

There are a number of VTVM's on the market which contain a separate peak-to-peak voltage scale yet these units will not give a true indication of the peak-to-peak value of any wave except sine waves. Actually, if you examine these instruments carefully you will see that no special provision has been made for obtaining the peak-to-peak value of a wave by a circuit similar to that shown in Figure 4. All these manufacturers have done is simply add another scale to the meter face, labeled it peak-to-peak voltage, and then multiplied each value on the normal rms scale by 2.83. In a sine wave, 2.83 times the rms value will equal the peak-to-peak value. Unfortunately, this relationship does not hold when the wave shape changes.

When a VTVM is capable of accurately measuring the peak-to-peak value of any wave, it will frequently have a separate selector switch position for it or a separate probe.

OSCILLOSCOPE PROBES

1. The Low-Capacity Probe. The vertical input circuit of an oscilloscope contains a certain amount of capacitance-- on the order of 30 to 50 mmf. To this we can add, on the average, another 25 to 50 mmf. of capacitance arising from the test leads.* Thus, when you place your test prod or probe at some point in a circuit to observe the waveforms present there, you are automatically shunting this point with 55 to 100 mmf. of additional capacity. In some circuits, this additional capacity will have virtually no effect; in other circuits, especially where the waveforms contain relatively high frequencies (such as square sync

* A pair of plain leads will shunt less capacitance across a circuit than a section of coaxial cable. However, the cable is shielded, reducing or eliminating spurious signal pickup and because of this, is more desirable.

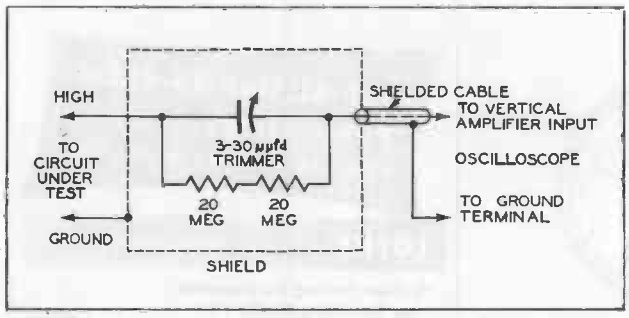


Figure 5. Low - Capacity Probe for Oscilloscopes.

pulses), the additional capacitance will alter the shape of the wave present there.

To minimize the disturbing effect of the oscilloscope test leads, a special low-capacity probe can be designed. See Figure 5. A small, semi-variable padder capacitor and a shunt resistor are encased in a special housing to form a low-capacity probe. The reduction in shunting capacity occurs because the padder capacitor is actually being placed in series with the 80 to 100 mmf. of combined capacity present in the connecting cable and across the vertical amplifier input. And since capacitances in series produce a total value which is less than the lowest capacitor, the addition of perhaps 10-15 mmf. of series capacitance reduces the effective overall capacitance to a value somewhat less than the 10-15 mmf. This is a decided improvement over the 80 mmf. or so present before the addition.

There is one disadvantage to this arrangement and that is that the voltage actually reaching the vertical amplifiers of the scope is reduced in the same proportion as the input capacitance. Thus, if the total capacitance is decreased by 1/10, so is the voltage reaching the scope. In television service work, the observation of waveforms using the low-capacity probe usually is done in the video amplifier and sweep systems and in these stages sufficient voltage is available for the probe.

Any one not possessing a low-capacity probe may build the unit shown in Figure 5. To adjust it, connect probe to the oscilloscope it is to be used with and apply a square wave input to the probe. Use a square wave whose frequency is between 1000 and 10,000 cycles.* Adjust the padder capacitor until a square wave is obtained on the oscilloscope screen.

In the absence of a square wave generator, Philco recommends that the probe be applied to the video detector stage of a TV set known to be in good working order. Set oscilloscope for composite video signal, and adjust padder capacitor so that the amplitude of the vertical and horizontal sync pulses are equal.

* Apply square wave first to oscilloscope directly (without using probe) to make sure that a square wave is obtained on the scope screen. Choose a frequency where this condition will hold true.

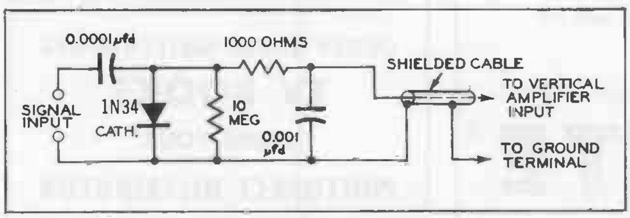


Figure 6. Detector Probe.

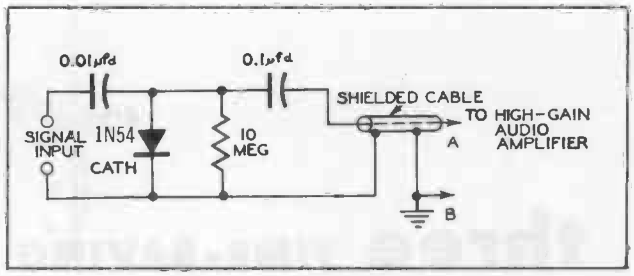


Figure 7. Signal Tracer Probe.

Once these probes are adjusted for a certain oscilloscope, they should be used only with that instrument. Use with any other oscilloscope should not be attempted unless the probe is reset. It is also well to keep in mind that the probe cannot compensate for limitations in the frequency response of the vertical amplifier system of the oscilloscope.

2. Demodulator Probe. A demodulator probe is required when the oscilloscope is used for visual alignment of individual IF stages, in a TV receiver or for the observation of the signal in any stage preceding the video detector. A crystal-type demodulator probe circuit is shown in Figure 6. The components may be attached to a small bakelite board, and the probe input leads soldered temporarily to the circuit under test. In this way, long connecting leads and the necessity for handling the probe are eliminated. No shield-can will be required.

SIGNAL TRACER PROBES

1. Signal-Tracer Demodulator Probe. The conventional aperiodic signal tracer employed for trouble-shooting radio receivers consists of a high-gain audio amplifier preceded by a demodulator probe. An amplitude-modulated RF test signal is applied to the input terminals of the receiver under test. The demodulator is used to pick this signal up at various test points in the circuit and to deliver the audio modulation component to the amplifier portion of the signal tracer. The demodulator, in essence, is a detector.

The circuit of an efficient signal tracing probe is shown in Figure 7. This arrangement is similar to Figure 6, except that the rectified DC component is not used in this instance. Instead, the audio component resulting from the demodulation process is extracted by the 0.1 mfd. capacitor and presented by the amplifier portion of the signal tracer. For increased demodulation efficiency, a type 1N54 high back-resistance germanium diode is used.

An extremely simple aural signal tracer for use with an amplitude-modulated signal may be made by connecting a pair of high-resistance headphones to output terminals A and B. This arrangement will not have the high sensitivity provided by the amplifier, but will be useful when simplicity and the elimination of all power supply equipment are factors to be considered. This setup often is referred to as a radio stethoscope.

2. Capacitive-Type Signal Tracer Probe. A signal tracer of the "analyzer" type employs a tuned RF receiver circuit to tune sharply to an unmodulated RF test signal picked up at various points in a receiver under test. The signal must be coupled into the tracer circuit by means of a capacitance small enough not to detune the circuit under test.

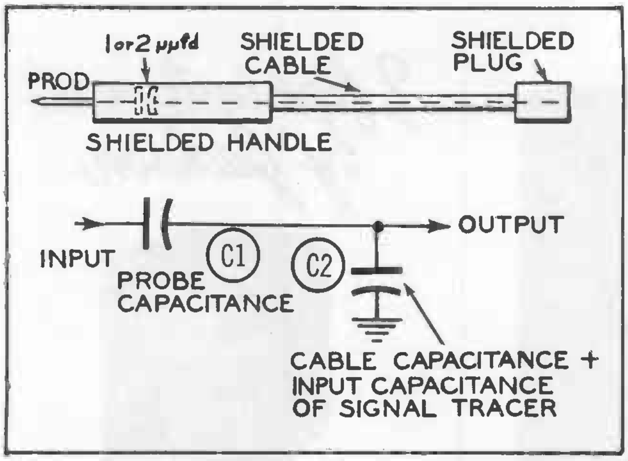


Figure 8. Capacitive - Type Signal Tracer Probe.

Figure 8 shows a capacitive probe suitable for this purpose. The coupling unit is a 1- or 2-mmf., miniature ceramic capacitor mounted inside the shielded handle of the test probe as close as possible to the metallic prod tip.

Some signal attenuation takes place as a result of voltage divider action between the small input capacitor and the combined capacitance of the shielded cable and the input capacitance of the tuned signal tracer. The equivalent circuit, also shown in Figure 8, illustrates the relationship between these two capacitances.

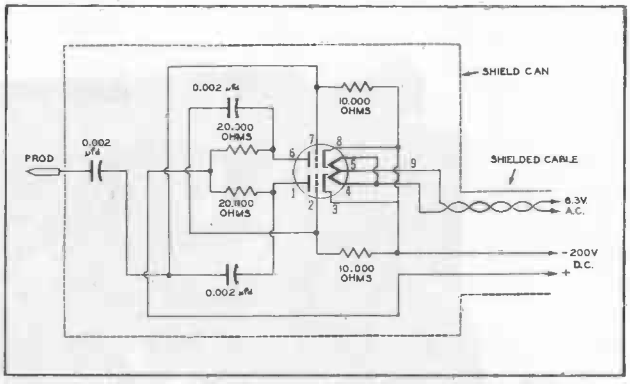


Figure 9. Signal Injector Probe.

3. Signal Injector Probe. A handy method of checking radio and audio equipment consists of injecting a signal at various test points and noting the presence or absence of operation. In a radio receiver, the signal is injected first at the loudspeaker, and then successively at the output and input of each stage back to the antenna input terminals. A dead stage is spotted by loss of the signal as the injection is transferred from output to input of the stage.

Figure 9 shows a combination radio-audio injector which may be built in the form of a probe. A 12AX7 twin triode is employed in a multivibrator operated at approximately 10 kc. The output is rich in harmonics, producing a rough signal which may be applied to either audio or radio circuits up to several megacycles. No tuning is required.

"VIB. POWER SUPPLY" (Cont'd. from Page 45)

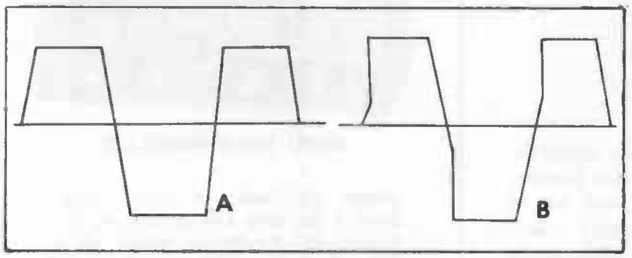
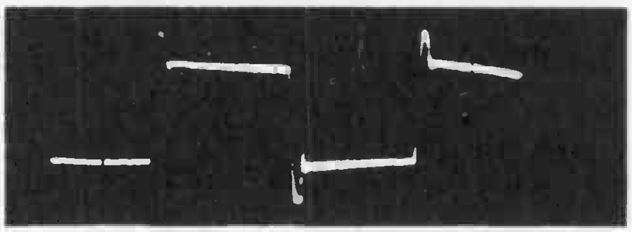


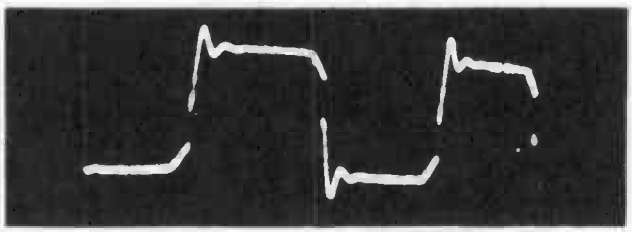
Figure 9. Buffer Operating Linearly at 100% (A) and 65% (B) of "Off Contact" Time.

8B). In this manner a part of the load has been removed from the points and arcing has been reduced to a minimum. Figure 9A illustrates an ideal waveform with the buffer operating in a linear fashion for 100% of the "off contact time."

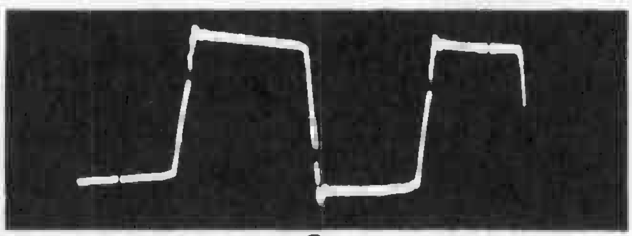
However, due to changes of the input voltage, the value of the capacitor is selected to close the "off contact time" gap at about 65%, (Figure 9B) with 6 volts input. An increase of the input voltage to a level of 8 volts will close this gap at 100%. If the gap were closed at 100% at 6 volts, the effects of the capacitor would be lost if the voltage increased. Figure 10 shows the effects of buffer capacitors of different values in the same power supply. Figure 10A illustrates the effect of too small buffer capacitor value. The frequency of the damped oscillation is too high and therefore causes "overclosure," (gap closed at over 100%). Figure 10B illustrates the effect of too large buffer capacitor value. This results in "underclosure." Figure 10C shows the



A



B



C

Figure 10. Effects of Various Values of Buffer Capacitors; Too small (A), Too large (B), and Correct Value (C).

waveform with the proper buffer capacitor value in the circuit. These waveforms were taken with the scope connected across the primary of the transformer. The rectifier tube was removed to better illustrate the various conditions in Figure 10.

In some cases, a resistor may be found in series with the buffer capacitor. This resistor usually runs from 10,000 ohms to 50,000 ohms and is primarily a protective resistor. In the event of a shorted buffer capacitor, the load is placed upon this resistor rather than across the points of the vibrator. If this resistor were not used, a shorted buffer capacitor would damage the vibrator points. Some of the various buffer capacitor hookups are shown in Figure 11.

Figure 11D and 11E are used in conjunction with synchronous vibrators, which are discussed later.

After the desired voltage has been developed in the secondary winding of the transformer, it is necessary to rectify this AC and pass it through a filter network. An ordinary full wave rectifier, having a separate cathode and a 6 volt filament is sometimes employed. Tubes such as a 6X5 or 6X4 are used, and full-wave rectification is accomplished in the normal manner.

Gaseous rectifiers, such as the OZ4, are sometimes encountered. This type of tube has an ionically heated cathode, thus requiring no filament voltage. As the voltage on one of the plates of this tube builds up to a certain level, the gas within the tube ionizes and current flows in that respective half of the tube. As the voltage decreases to a certain value, conduction ceases. Then the voltage on the other plate builds up and that half of the tube passes current. These gaseous tubes must have a certain amount of peak voltage for firing the tube. In the case of the OZ4, this firing voltage is 300 volts, minimum. Another requirement for operation is the current drain. If the current drain is less than 30 ma., which is stated as a minimum value for the OZ4, the tube will fail to operate. The maximum current drain must also fall within the limits of the tube.

Another type vibrator supply employs a synchronous vibrator. This vibrator is essentially the

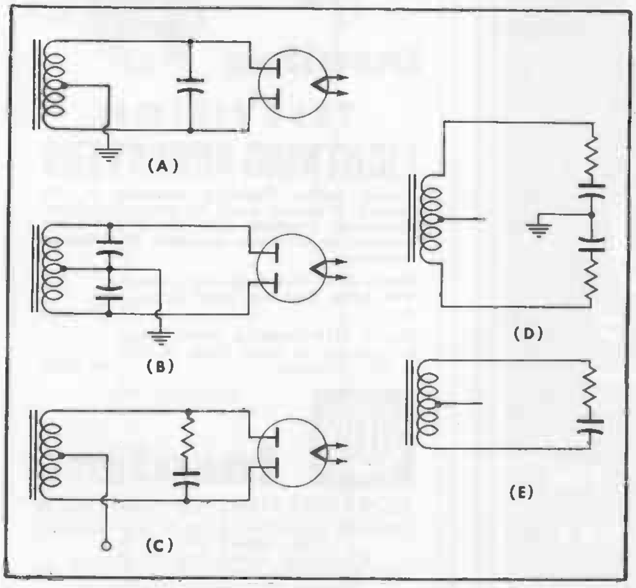


Figure 11. Typical Buffer Capacitor Connections.

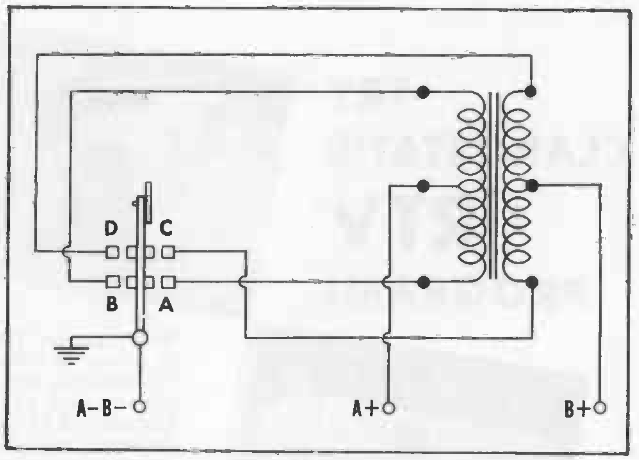


Figure 12. Circuitry of the Synchronous Vibrator.

same as the ones discussed earlier, with the exception that two extra sets of points are added, one set on either side of the reed. It will be noted that in this type of circuit the secondary center tap is always B+. Rectification with the use of a synchronous vibrator is accomplished through mechanical means, thus requiring no tubes. Figure 12 will illustrate the operation of a synchronous vibrator.

As the reed swings to the right, the interrupter point A makes contact, thus causing a voltage to be induced into the secondary with a negative potential at point C. The rectifier point C also makes contact

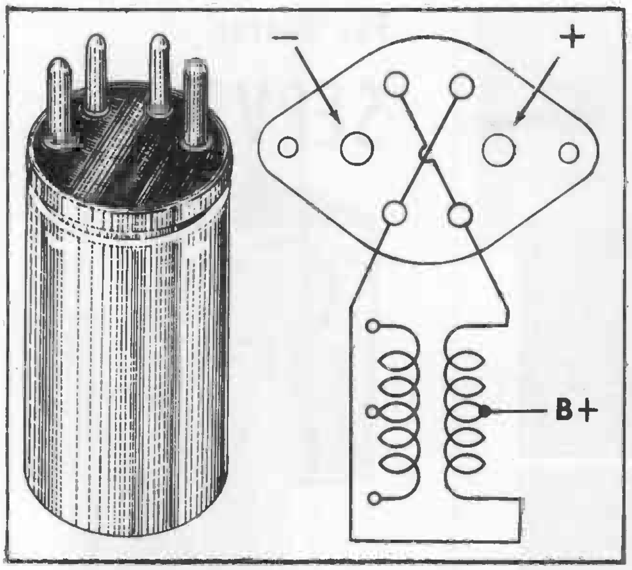


Figure 13. Synchronous Vibrator with Polarity Reversing Feature.

with the reed, connecting the negative end of the secondary to ground.

Thus the center tap of the secondary is positive with respect to ground. The reed then swings to the left and the induced voltage has changed polarity placing the negative potential on point D. This point is now in contact with the reed which places this potential to ground. Once again the center tap is positive in respect to ground. Therefore the center tap is always positive and the ends of the winding are alternately negative and so synchronized to always place this negative potential to ground. In this manner rectification has taken place through mechanical means.

In actual operation, the points are so adjusted that the interrupter points close before the rectifier points, and the rectifier points open before the interrupter points. This removes part of the load from the primary before the opening of the interrupter points. In this manner, arcing of the points has been reduced resulting in cooler operation and longer vibrator life.

An important fact to remember is that a reversal of the input polarity causes a reversal of the output polarity when a synchronous vibrator is employed. Since the ground polarity varies with different cars, a check should be made to determine the correct input polarity. Figure 13 shows a vibrator designed so that it can be turned 180° in the socket allowing operation with either polarity.

The vibrator will function regardless of the polarity of the input voltage, however, the receiver will not operate since the output voltage will be of reversed polarity. This may result in damage to the receiver (such as the electrolytic filters) or to vibrator. It is therefore necessary to observe proper polarity when replacing a unit of this type.

The condition of a vibrator power supply can also be observed by connecting the scope across the 6 volts at the input of the receiver. The condition of the points can be determined by examining that part of the pattern during the "on contact time" of the points. Figure 14A indicates a properly operating supply. Figure 14B indicates poor point contact in the vibrator as shown by the jagged line during "on contact time." The variation between the pulse sizes in Figures 14A and B during "off contact time" are merely the result of using two different supplies in obtaining the waveforms and are not an indication of improper functioning.

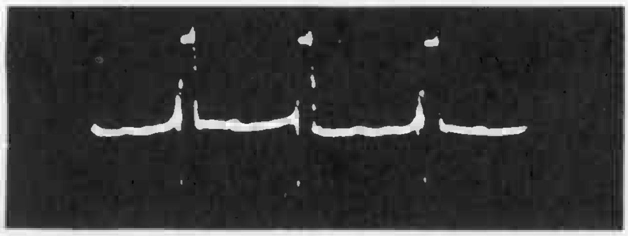


Figure 14A. Input Waveform with Normal Points.

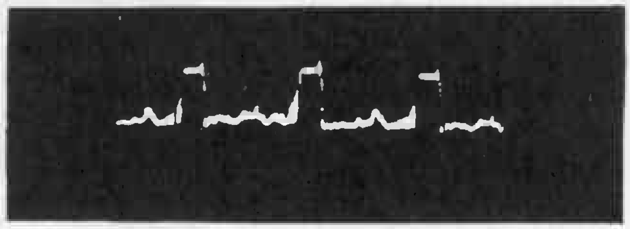


Figure 14B. Input Waveform with Bad Points.

The rectifier tube too, can be checked for operation with the scope connected across the 6 volt input. Should one section fail to operate, a pattern such as seen in Figure 15B would result. Figure 15A is the pattern obtained with both sections of the rectifier tube inoperative. The sharp negative pulse observed in Figure 15B indicates no load during that "on contact time." In the case of a cold cathode rectifier, such as a type 0Z4, this pulse might occur at irregular intervals if the tube were not "firing" properly.

The necessity of proper part replacement cannot be stressed too greatly, since the efficiency of the supply and perhaps the life of the part may be at stake. Whenever a transformer is replaced in an automobile receiver, a check of the waveform across the primary should be made since the buffer capacitor may not be of proper value for the inductance of the new transformer. This waveform is quite important, and is controlled by the vibrator, the buffer capacitor and the transformer. A change in any one of these components may alter this waveform.

It is apparent that an oscilliscope can be quite useful in servicing vibrator power supplies. This article is intended to provide a basic understanding of the circuits and waveforms encountered.

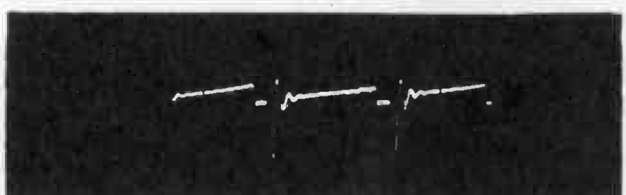


Figure 15A. Input Waveform with Inoperative Rectifier.

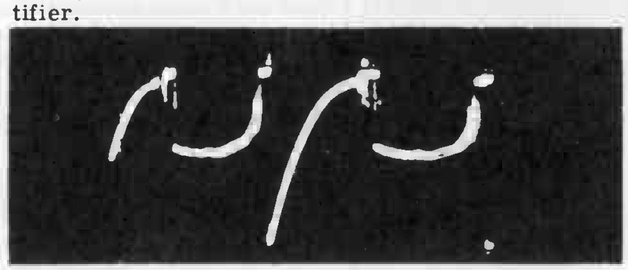
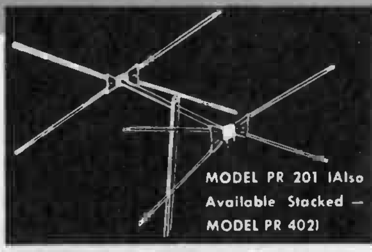
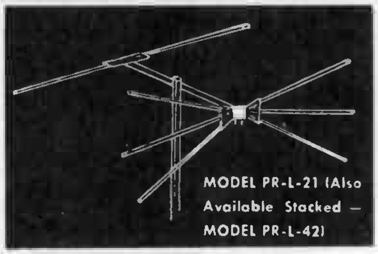


Figure 15B. Input Waveform with 1/2 of Rectifier Operating.



MODEL PR 201 (Also Available Stacked — MODEL PR 402)



MODEL PR-L-21 (Also Available Stacked — MODEL PR-L-42)

DC to AC Converters

Dynamotors

Genemotors

Recorder Converters

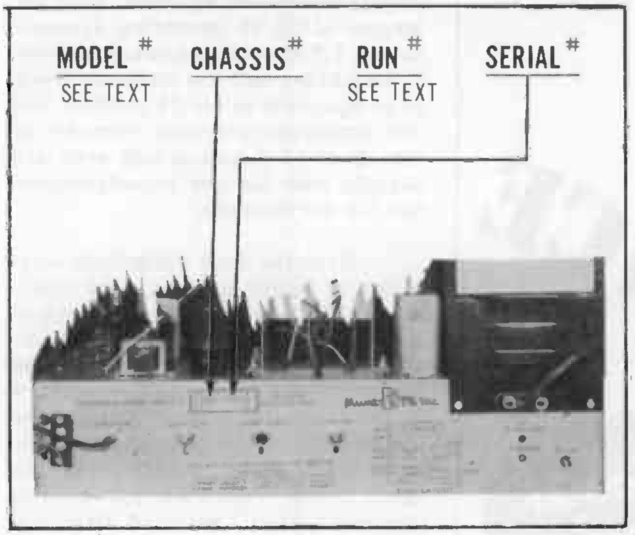
Inductor Alternators

Magmotors

"TV MODEL IDENT." (Cont'd. from Page 17)

MUNTZ (Continued)

SERIAL NUMBER: The serial number is found printed on a sticker on the rear apron of the chassis.



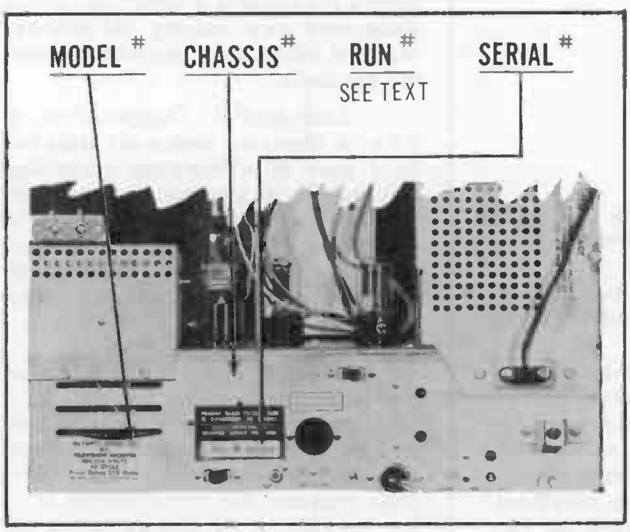
OLYMPIC

MODEL NUMBER: The present system of identifying all models is as follows: The size of the picture tube is designated by the first two numbers while the type of set is indicated by a letter which follows. The next digits simply identify the model to avoid confusion with other models which are identical in the two previous categories. By this method a 17T20 would be a 17-inch table model, as compared to a 21C28 which is a 21-inch console type open face receiver.

Prior to the latter part of 1951 there was no definite system of model numbering.

The model number is found printed on the tube layout chart attached to the inside of the cabinet and printed on the label attached to the rear apron of the chassis.

CHASSIS NUMBER: At present, chassis numbers run in alphabetical series prefixed by the letter



OLYMPIC (Continued)

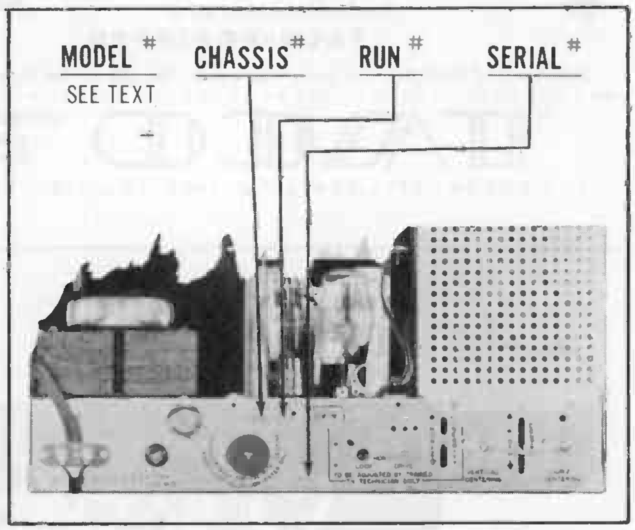
"T". Thus, the first of these chassis was TA, the second TB, etc. At the present time, the 17-inch chassis is designated as TG and the 21-inch chassis as TH. Before the latter part of 1951 no definite system of chassis marking was employed.

The chassis number is found ink-stamped on the rear apron of the chassis.

RUN NUMBER: No run number or code markings are used since all serial numbers run consecutively and any variations in chassis are indicated by designating the serial number at which any given change was made.

SERIAL NUMBER: Serial numbers are found printed on a sticker placed on the rear apron of the chassis, and on a label on the picture tube.

SENTINEL



MODEL NUMBER: The model number is found printed on the tube layout chart which is attached to the inside of the cabinet or on the outside of the back cover of the cabinet.

CHASSIS NUMBER: The chassis number is a series number that is ink-stamped on the rear apron of the chassis. It is distinguished by the words, "Series No."

RUN NUMBER: The letters that follow the series number identify the particular run of the chassis.

SERIAL NUMBER: The serial number is metal-stamped into the rear apron of the chassis.

* * *

The next PF INDEX and Technical Digest will contain data pertaining to TV model identification of the following manufacturers: Philco, RCA Victor, Sparton, Stewart-Warner, Stromberg-Carlson, Sylvania, Westinghouse, and Zenith.

"DOLLAR AND SENSE"

(Cont'd. from Page 47)

PEANUTS. Latest nosecount gives 13,750 subscribers to community television systems, with the largest of the 94 operating systems having 1,500 sets connected by coax to the master antenna and amplifiers. In comparison to the 18 million sets now receiving programs directly by air, these 14 thousand odd sets are peanuts both for set manufacturers and for servicemen.

Even the most optimistic estimates of future growth for community TV are not high enough to mean more than supplementary income for servicemen out beyond the super-fringes. It's the operators of these systems who take in the big money. Some have spent up to $300,000 in a town and got it all back again in less than two years. The operators aren't worried about the future of community TV--at least not until every little hamlet is served by at least one UHF station.

OBLONG. An auxiliary focus coil that makes the spot on a TV picture-tube screen oblong in the vertical direction is claimed to improve horizontal definition and contrast, and also to eliminate the horizontal-line pattern seen on most sets. The new method, described in June Wireless World (London) by G. N. Patchett, can be added to most receivers in a few minutes. Needed parts are said to cost "only a few shillings", or about a dollar.

NIGHT OWLS. All-night TV programs, said to have been put on first by Pittsburgh's WDTV, are now also on New York's WOR-TV. It's not 24-hour service, though, as the signoff is around sunrise. This leaves a few hours for routine maintenance of the transmitter each day, before the breakfast programs go on. Programs are mostly old movies, many of which are excellent cures for insomnia.

LIBRARIES. Competition of TV with libraries wears off after the first year of televiewing, according to speakers at a recent American Library Association convention. The prediction of one speaker, was that TV, when settled down, will prove no more of a threat to reading than did radio.

UKACO. That's the name of a 4-tube gadget, about the size of a table radio, which is supposed to put an electronic hex on crop-destroying insects. According to an article in June Fortune, the name comes from the initials of the last names of the three inventors and owners. Instructions specify that an aerial photo of the farmer's cotton field be placed face down on a copper plate, with an eucalyptus leaf and a sprig of hemlock alongside (boll weevils are alleged to dislike both). The plate is connected to the gadget by two heavy wires. The switch is turned on for 5 to 10 minutes, during which a pilot lamp glows green; all boll weevils in the area covered by the aerial photo are then supposed to be dead.

UKACO services, according to the magazine, are sold by Pennsylvania Farm Bureau Co-operative Association at $5 an acre on a no-charge-if-not-satisfied basis. Conventional treatment with insecticides presently costs around $8 an acre. Tests by University of Miami graduate students with the machine proved unsuccessful; the explanation by one of the inventors for this was that the machine was not infallible and needed perfecting.

How does it work? The radiurgic and homeotronic explanation offered by the inventors is that every living thing develops its own electromagnetic aura. The machine sends out a stress by radio that disrupts the insects' metabolism and turns the plant's aura into an anti-insect atmosphere. This explanation is remiscent of that offered by quack doctors who used so-called radio devices to tune in on diseases of gullible patients and cure them.

A word of advice: Be extremely tactful in warning people against wasting money on such devices, as people can be quite fanatical in their faith in a contraption. A young radio engineer once lost his girl friend by deprecating the "radiurgic and hometronic" treatments she was getting for a goiter.

UHF. Maganavox service manager Ray J. Yeranko states that UHF will make the present shortage of servicemen still more acute, and declares that in-training in UHF circuitry is a must. This means going back to school for a few days or even weeks, as soon as manufacturers open up classes in their plants or in offices of their distributors.

AGE. Still running and giving good picture quality is one of the first DuMont receivers, made in 1939. It's in the home of Dr. T.T. Goldsmith, Jr., DuMont's director of research, though, so we wonder how many of the original parts are still in it.