ELECTRONIC SERVICING

AUGUST
1957
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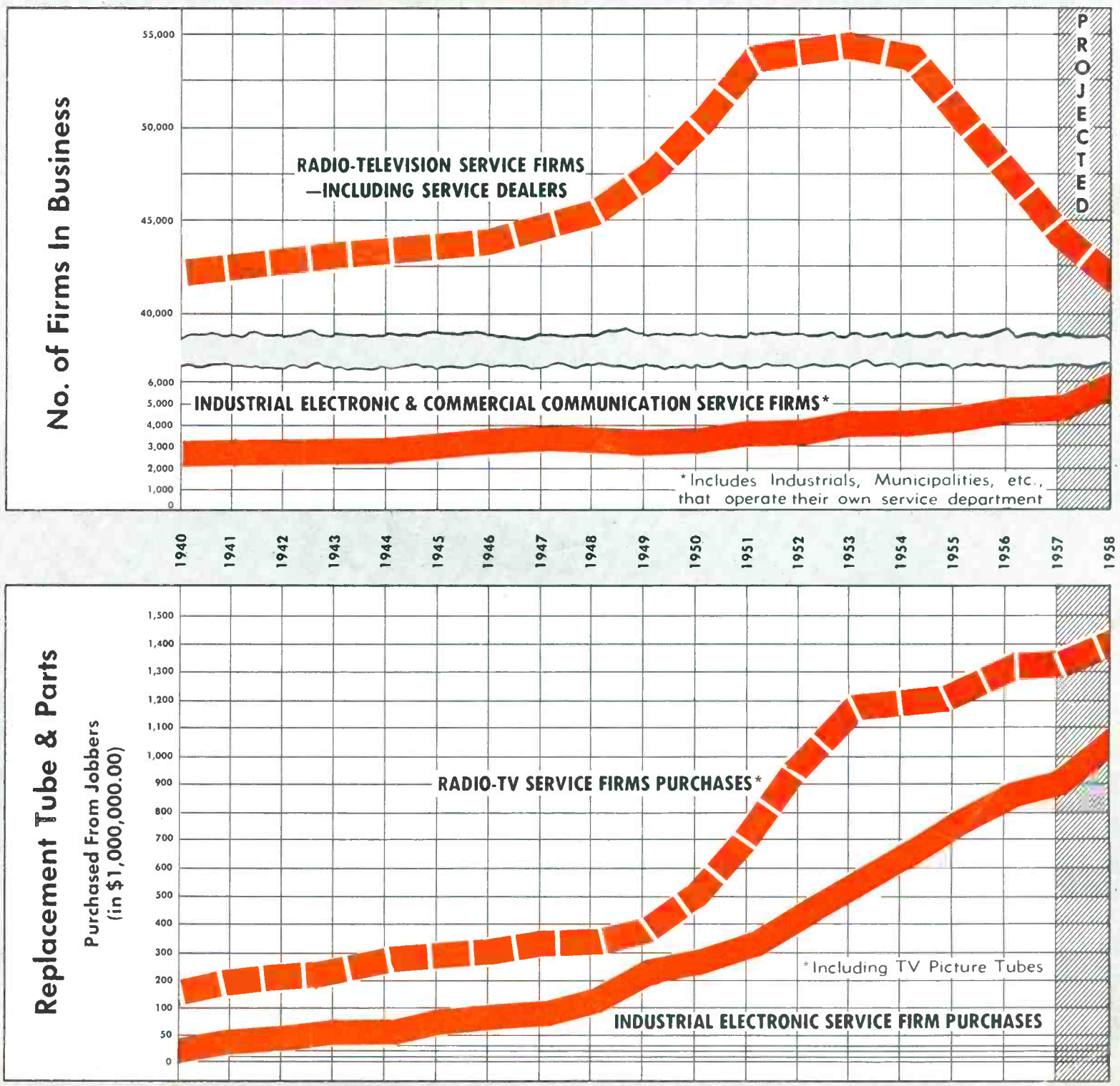

all figures from U.S. Gov't Bureau of Statistics (Feb. 1957) and the RETMA "1957 Fact Book"

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FEATURE ARTICLES

CIRCUIT AND SERVICE FORUM

DEPARTMENTS

THIS MONTH'S FRONT COVER

Facts and Figures Chart of Industrial and Commercial Radio and TV firms compiled from U. S. Government Bureau of Statistics (Feb. 1957) and the RETMA "1957 Fact Book."

ACKNOWLEDGMENT

The photograph on last month's front cover illustrating a stage in transistor fabrication was supplied by the General Transistor Company of Jamaica, New York.

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NEW 1958 HOTPOINT TV TUBE LOCATION CHARTS

Hotpoint's new 1958 TV line is now in the stores—featuring 110° Picture Tubes in every model.

Note that two 21″ models (21S405 and 21S505) use the M3 chassis.

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Complete service information on this new line is now available from your Hotpoint Distributor, and you are invited to contact him and order Hotpoint TV Service Data today.

Published as a service to servicemen by

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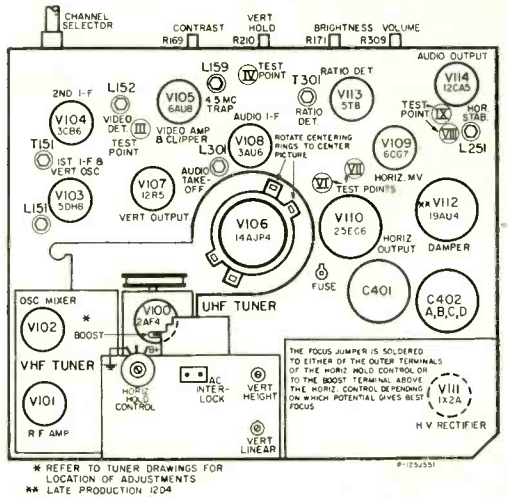
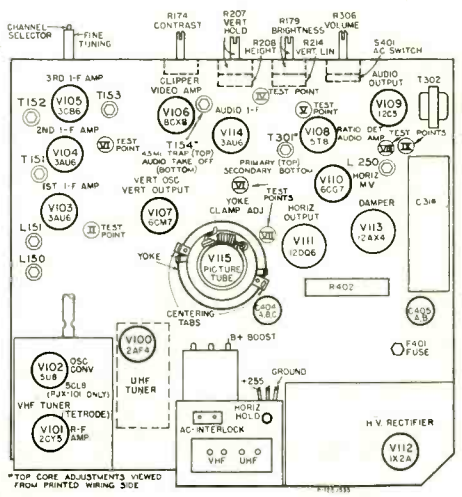
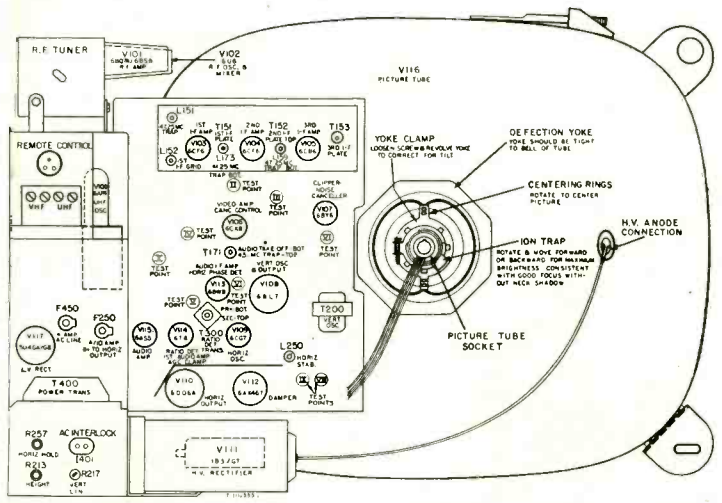


CHASSIS Q2—Covers models 14S206 and 14S207 in VHF and UHF versions.



CHASSIS M3—Covers models 17S305, 17S306, 21S405, and 21S505 in VHF and UHF versions.



CHASSIS U2—Covers models 21S406, 21S455, 21S456, 21S507, 21S508, 21S555, 21S556, 24S805, 24S806, 21S605 and 21S606 in VHF and UHF versions.

Ad Libs

by S. R. COWAN

Facts and Figures Worth Analyzing

ALTHOUGH it has been said, "There is no such thing as an average man" I believe there are "average businesses." If, in a town, there are two Five & Dime stores grossing a half-million dollars each annually and two other such stores each grossing one hundred thousand dollars per annum, then the *"average"* Five & Dime store in that town grosses $300 thousand and obviously two of the stores are well above average while two are obviously well below average. Using this basic and fundamental information as a gauge, the operators of the two smaller establishments could logically deem it expedient to try to get a proportionately larger share of business so that their respective firms could be more close-to-average rather than remain in a below-average status. Usually an average (or normal) store earns average profits while most sub-normal or below-average stores earn less than average or normal profits. That business truism is the underlying reason why statisticians compile statistics which serve as guides for interested parties.

We've done that! We've compiled statistics about radio-TV service firms and about firms that specialize in industrial electronic servicing. Then by striking "averages" we show our readers how they may gauge their relative position in the competitive scheme of things. Our readers can then decide for themselves whether or not they wish to concentrate on some phase of business

which might elevate their earning-power. Or, they might decide that because their test equipment is over-age, as compared to the "average," that it would be worth their while to trade it in now for newer, more efficient instruments that will enable them to work faster and earn more. You must judge for yourself just how you want to utilize the information given in the article "Electronic Firms Analysis" which appears on page 12 of this issue. And, to the nearly 600 ELECTRONIC SERVICING subscribers who helped us compile this data, may we express our thanks and appreciation.

Licensing

Occasionally a subscriber writes me a letter expressing vehement objection to any type of legislation in regard to municipal, or other, licensing of radio/TV technicians. (We have editorialized often that we believe that properly planned and policed licensing will, in the long run, assuredly benefit everyone in the radio/TV service industry as well as the set-owning public.)

Of late, practically every objector to licensing, who has written me, is a part-time independent serviceman. Undoubtedly there are still some professional full-timers who have not yet been "sold" on the licensing idea. Just now we cannot call to mind a single Serviceman's Association which has gone on record that its membership opposes licensing, provided that Associaiton is permitted to collaborate in the promulgation of the legislation itself.

In mail (June 20th) we find a letter from Joe Driscoll, Secretary of TESA, St. Paul, Minnesota and with it a clipping taken from the St. Paul Sunday Pioneer Press of June 16th. This excerpt under the byline of feature writer Carl G. Langland, is quite illuminating and effectively supports proponents of licensing. Here's the Langland article, quoted verbatim:

"The value of a city ordinance to license individuals and firms in the television service industry—or any other service which sends men into private homes—was illustrated forcefully in a recent City Council session.

"In that instance, a man made appli-

[Continued on page 23]

Fig. 1—The faint white line at the left may be due to a defect in the damping circuit. *Courtesy G.E.*

Horizontal Retrace Blanking

by Irving Tepper

Too long a horizontal retrace time causes a type of trouble with specific symptoms. These symptoms, their causes, and remedial measures are discussed here.

Fig. 2—Horizontal fold-over usually caused by too long a horizontal retrace time. *Courtesy G.E.*

Few servicemen are aware of the problem of faulty horizontal retrace and its effect upon the picture, although most are familiar with the appearance and elimination of vertical retrace lines. Defective horizontal retrace may be recognized by the following symptoms:

1—The presence of a hazy vertical line superimposed on the picture, left of center as shown in *Fig. 1,* or foldover from left to right as shown in *Fig. 2.*

2—The hazy line moves in a direction opposite to that of the picture as the horizontal hold control is rotated.

3—People or objects, when leaving the scene on the left side, reappear momentarily and then disappear towards the center of the screen.

4—The haze may be moved off the screen by rotation of the horizontal hold control, but the point at which the haze is off the screen leaves the horizontal in a very unstable state, where a camera shift or any other momentary interruption of sync will throw the set out of hold.

Cause of the Trouble

This defect is caused by too long a horizontal retrace period. A comparison between normal and abnormal waveforms is shown in *Fig. 3.* The retrace of the normal sawtooth occurs within the blanking pulse period of 10 microseconds, having an approximate duration of 7 microseconds. Since the entire retrace period is blanked out, no defect will be observed in the set's performance. The sawtooth illustrated at the bottom of *Fig. 3* has a retrace that starts during the blanking pulse but is still active after the blanking pulse has ended. This means that portion AB of the retrace will be seen on the screen and this retrace portion corresponds to the video information shown above from A′ to B′. It can also be seen that the picture information between B′ and C′ will be presented on the screen in the same area as the information between A′ and B′. This overlapping of course, is what the term foldover refers to.

Thus, the video content of area AB, instead of being swept normally from left to right, starts at left of center and sweeps from right to left as shown by the arrows in *Fig. 4.* Since the retrace is very rapid, the video has low intensity in area AB and has a hazy appearance.

Cause of Foldover

The cause of excessive retrace time may usually be isolated to the area of the flyback transformer. The problem first appeared when large screen conversions were in vogue. In order to increase width many servicemen wired a paper tubular condenser in parallel with the width coil. Although this invariably increased the width, a simultaneous occurrence was the lengthening of the retrace time.

This may be explained as follows. When retrace occurs, a shock excited oscillation is produced in the flyback secondary circuit. It is the purpose of the damper tube to suppress this oscillation and use its energy for the initial portion of the sweep. The first half cycle of oscillation produces retrace. Since this must take place in about 7 microseconds, the full cycle of oscillation would require about 14 microseconds. This corresponds to a frequency of about 70 *kc.* As the resonant frequency of the output circuit is lowered, the time taken by the first half cycle of oscillation (retrace) is increased. When its duration exceeds 10 microseconds we have horizontal foldover. The additional condenser across the width coil has the effect of lowering the resonant frequency, thus not only increasing the transfer of energy to the

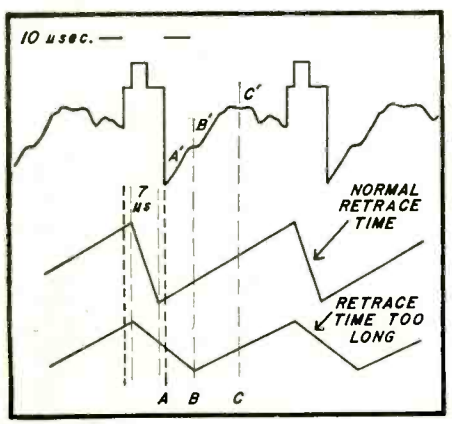


Fig. 3—Graphical illustration of the effect of too slow a horizontal retrace on picture presentation.

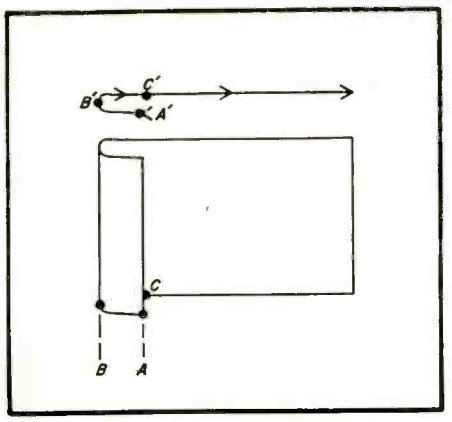


Fig. 4—Three dimensional illustration of the manner in which foldover occurs because of long retrace.

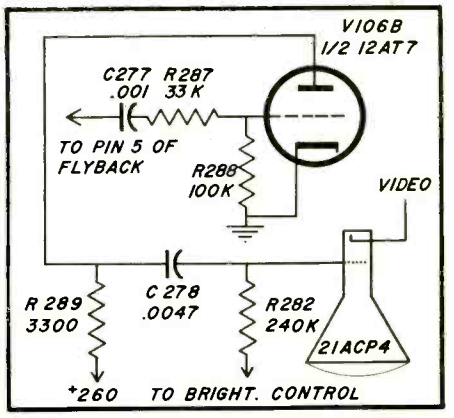


Fig. 5—The horizontal blanking circuit used in the General Electric model 21 C 350 chassis.

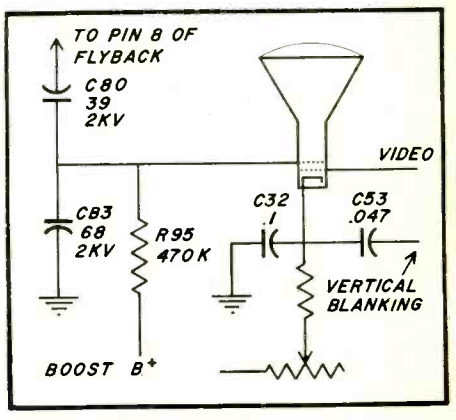


Fig. 6—A variation of horizontal blanking circuitry used by Majestic in their Model 123.

yoke but also increasing the retrace time.

Blanking the Retrace

The basic principle involved in blanking the horizontal retrace is to make the blanking period as long as the actual retrace time. The blanking pulse is generated by taking a portion of the output of the flyback transformer and properly attenuating and shaping it. It is then applied to an appropriate element of the CRT to blank the screen during retrace. The element to which the blanking pulse is applied is determined by the polarity of the blanking pulse.

Typical Circuits

Three typical blanking circuits are shown in *Figs. 5, 6,* and *7.* The General Electric circuit shown in *Fig. 5* makes use of one half of a 12AT7, V106B, as a blanking tube. When horizontal retrace occurs a positive pulse, taken from the flyback, is applied to the grid of V106B. In the process of amplification the pulse is inverted 180 degrees by V106B, thus producing a negative pulse suitable for application to the control grid of the picture tube. The negative pulse will cut the picture tube off during retrace and the period of cut off is determined by the duration of this negative pulse and not by the blanking pulse contained in the composite video signal.

The circuit illustrated in *Fig. 6* makes use of a capacitive voltage divider (*C80* and *C83*) to reduce the amplitude of the pulse taken from the flyback. During

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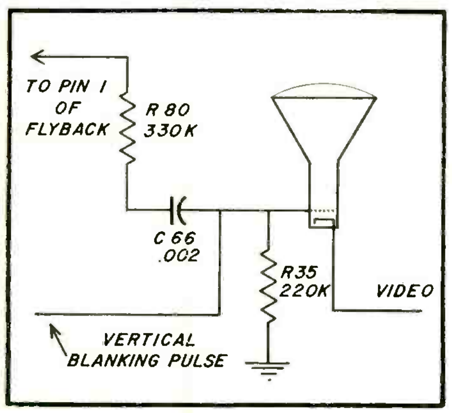


Fig. 7—The Olympic model 21CV16 uses the horizontal blanking circuit illustrated above.

Production Line Fugitives

by Allan Kinckiner

Missing components, wrong values, unsoldered connections, and other "built in" troubles cause headaches to set owners and T.V. servicemen alike.

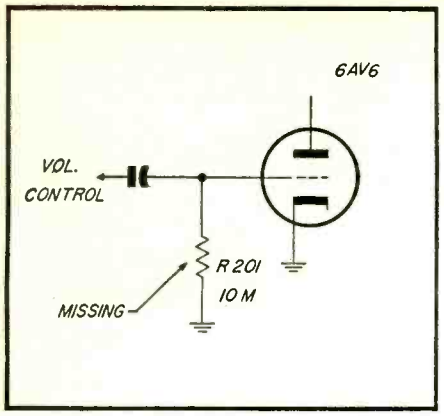


Fig. 1—Trouble caused by missing part.

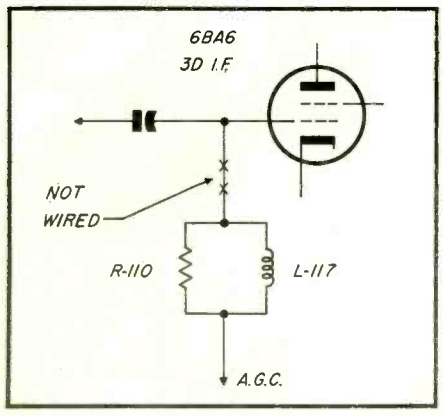


Fig. 2—The agc line was left unwired.

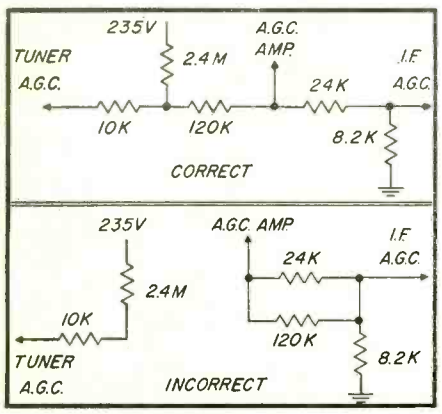


Fig. 3—Wiring error was culprit here.

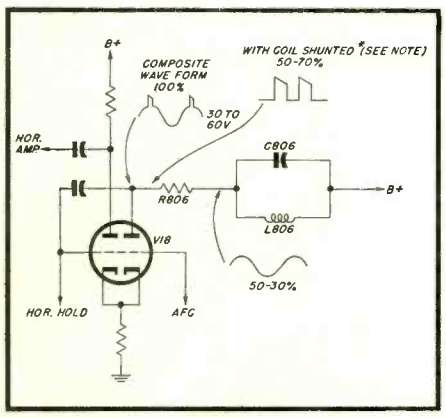


Fig. 4—Incorrect value of plate resistor caused poor horizontal sync.

ACROSS the service bench of every TV service dealer, must eventually pass the receiver which was faulty when it left the factory. The fault may be due to an incorrect component, a missing component, faulty wiring, or poor soldering. The fact that the fault had not been detected during factory inspection indicates that the set must have been near standard to have thus evaded detection, and it is because of this near standard condition that these jobs are more difficult to service.

Oftimes the owner recognizes a defective condition in his new receiver by comparing it with a neighbor's. This is a valuable clue, if brought to the attention of the serviceman, that something is wrong, and rather than brush it aside, the serviceman would do well to investigate it further.

The following notes are on sets in the category of "Production Line Fugitives" with four specific instances cited and several other generalized conditions found.

RCA TA129, KSC 41A Chassis With Low Volume

This set, according to the owner, had had intermittent sound, and while another service shop had apparently corrected that condition, it had been returned with a "low volume" condition. When tube substitution proved ineffective it was decided that an alignment was in order. After carefully aligning the sound *if's,* which considerably improved the condition, the set was tuned to a station. The set played at good volume but the cutting out returned. On closer observation it was noted that the audio would cut out following an unusually loud passage of voice or music. A scope reading showed a signal at the 6AV6 grid (see *Fig. 1*) but none at the plate, and with a new tube the condition was the same. Further examination revealed the absence of *R201,* and from the looks of things, the resistor had never been wired into the set. The trouble was traceable to grid-blocking of the 6AV6 by the contact bias built up on the grid condenser. Normally, if *R201* were present, it would have kept down this bias to the correct voltage.

RCA KCS40 Delayed Video

The picture came on anywhere from 2 to 10 minutes after the raster, the latter appearing in the normal time, Measurements with a probe and scope proved that the signal came through the first and second *if* the stages in *normal* time, but was *delayed* in the third *if* stage. Voltages and parts were checked, but revealed no apparent defect. The set was then turned off and allowed to cool. Putting a fixed bias on the *agc* line and turning the set on again resulted in normal operation. Close scrutiny of the wiring of the third *if* stage revealed that the resistor and choke *(Fig. 2)*, supposed to be connected from the *agc* line to the grid of the third *if* tube, had never been wired to the tube socket, missing its mark by a full one quarter of an inch. Dressing the wire to the socket and then soldering the connection completed the repair on this set.

Analyzing the action here the following explanation is given: With the signal failing to get through, no *agc* was developed. Thus, the first and second *if* tubes were at full gain, which was enough to block the third *if* grid. After a slight delay the charge on this grid leaked off internally, passing enough signal to develop *agc,* which decreased the gain through the first and second stages allowing for further reduction of charge and a return to normal operation. In this case the customer was not even aware of a fault, thinking the delay was normal as the set had always worked that way.

Capehart CX33A, M or K

This set had many faults. First, the set had considerable snow, which was

Fig. 5A—Oscilloscope photo of wave form at the plate of the horizontal mutivibrator. (Fig. 4)

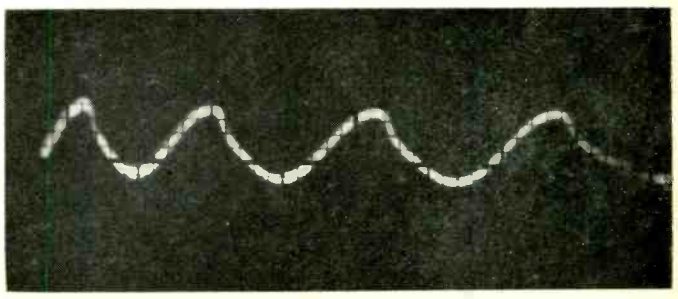


Fig. 5B—Oscilloscope photo of wave form at the B end of R806. (See Figure 4)

traced to a shorted condenser and burnt out resistor in B+ line of the *rf* tube. After the defective parts were replaced it was found that the set still was not right—it had more snow than normal, and there was a tendency for sound bars to interfere with the picture. A voltage check of the *rf* stage revealed a very slight positive voltage on the 6CB6 grid. Further circuit checking indicated the wiring mistake as shown in *Fig. 3*. The customer was not aware of the fault in this set either, but when the set was returned he could not help but notice the improvement.

Philco D-201-Poor Horizontal Lock-In

While the horizontal would sync and hold with the hold control, it would not lock in when turning from one channel to another. The scope revealed proper pulses present on the 6AL5 tube; and the *afc* voltage developed normally. Scope tracing on the horizontal tube itself was another story. The combined sine wave and horizontal multivibrator spike pulse were considerably out of proportion. Ordinarily, the spike and the sine wave are of equal amplitudes, or at least in a 60-40 ratio. In this set the ratio was about 80-20 with the spike being larger. An ohmmeter check proved the plate resistor to be 47K, the manufacturer's schematic calling for 15K. Finally, a 47K color coded resistor was found, buried under some other parts. (See *Fig. 4*). Replacing it with a 15K unit resulted in a complete cure. For this successful solution the credit goes to scope tracing. The 60-40 ratio value given is not to be considered absolute, but is average with most sets made with this type of horizontal *afc*. Some manufacturers use a 50-50 ratio

[*Continued on page 33*]

Fig. 5C—Normal pulses observed at input to the 6AL5 phase detector.

Servicing Intermittents

by George Kravitz
Westinghouse Elec. Corp.
Metuchen, N. J.

Helpful hints for finding and repairing anoying, intermittent troubles in TV sets are given in this article.

ONE of the most difficult types of repair involves the intermittent —the TV set or radio that works, then quits, then works again. When the receiver becomes defective, tapping the cabinet, or turning the set off and on, may temporarily result in normal operation. Or, the receiver may return to normal by itself. The receiver may fade slowly or cut off sharply. Its return to normal may be gradual or sudden, all of which leads to the question: How do we fix this type of dog? Unfortunately, there is no simple answer. This article provides suggestions, however, based on methods used by experienced servicemen.

Causing the Trouble

To find the cause of intermittent receive failure, the defective part must break down when the receiver is being serviced. When the breakdown occurs, voltages can be measured, or oscilloscope patterns can be observed to isolate the defective stage. Because most receivers are "uncooperative" (they perform perfectly when you want them to fail), a number of methods are used to cause breakdown of the intermittent part. Commonly used methods are: probing and tapping suspected parts, applying heat, and increasing operating voltages.

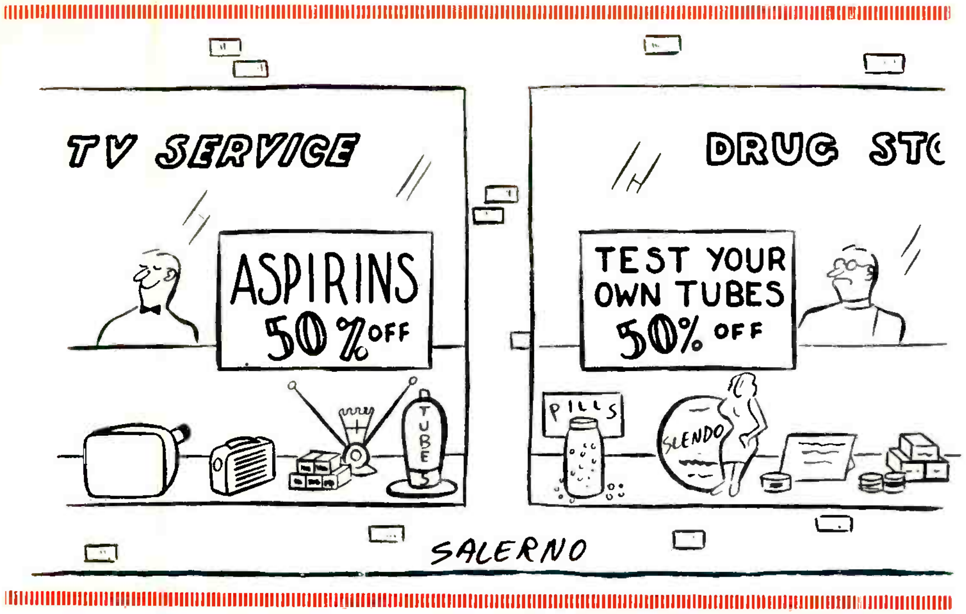
Probing and Tapping

Tapping suspected parts to cause the faulty condition requires skill, care, and patience. Your objective is to cause only the suspected part to vibrate. This type of test may be deceptive because many parts may vibrate, leading to suspicion of the wrong part. Parts should be tapped carefully, with a pencil eraser, in an effort to vibrate only one suspected part at a time. This topic is discussed later in this article in connection with specific parts.

Frequently, one strand in an insulated wire may protrude to cause an intermittent short. Or, where a wire is dressed around a tube socket lug, or other terminal, the insulation may be worn; the wire may short intermittently to the lug or terminal. Probing, with an insulated rod, may lead to the detection of this type of trouble. It is advisable to suspect any insulated wire which presses against a terminal. Tapping a terminal strip may reveal a broken terminal; tapping a variable tuning capacitor may reveal a loose or intermtttently shorting capacitor plate.

Applying Heat

When a receiver is bench-tested, its normal operating conditions are *not* being simulated. The ventilation is too good. For this reason, a common practice is to apply heat externally in an effort to bring about the defect. A heating lamp, directed at suspected parts, is frequently used. To apply heat to one part, a funnel can be placed over the



heating lamp with the wide opening covering the bulb, the narrow opening directed at the part under suspicion. Another method of localizing trouble, via the heat treatment, is to hold a hot soldering iron near the part. Where heat is transferred to a suspicious part, remember that the attempt is to cause electrical breakdown under operating conditions, and not to demolish the part with heat.

Increasing Operating Voltages

An intermittent or border-line part will often break down when it receives a higher than normal voltage. A variable line transformer may be used to raise the *ac* input voltage to about 130 volts. To prevent damage to good components, this method should be tried only for a brief interval. In parallel filament receivers, a tube can be pulled out to increase voltage in a plate circuit. In series filament receivers, a dummy tube (one with only filament prongs) may be substituted to produce the same (high plate voltage) condition.

Tubes

A tube, capacitor, resistor, coil, or transformer may be the culprit causing intermittent operation. Each potential offender is discussed below.

Tube filaments may open intermittently. Where filaments are in parallel, the trouble can be seen in glass tubes. With metal tubes, the trouble may show up in a tube tester. Intermittent shorts within the tube is another trouble source. Careful tapping of the tube with a pencil eraser may bring about failure. If the trouble can be caused by tapping, but tapping almost *anything* causes trouble, it may be advisable to test each tube. In the tube tester, each tube can be tapped gently, then clunked a little harder to see if it acts up. A picture tube, of course, should never be handled roughly. It can be tapped gently, however, to look for arcing within the tube or an intermittent filament.

Capacitors

Capacitors often open intermittently at a point inside the capacitor where the lead is connected to the foil. This type of defect can frequently be located by gently pulling and nudging the capacitor lead with an insulated probe.

A capacitor may change value when warm. This type of defect should be suspected in frequency drift problems.

Resistors

Wire wound resistors tend to open; carbon resistors tend to change value. The application of heat may cause resistor trouble. Nudging the resistor with an insulated probe may also bring about the defect.

Coils and Transformers

A common cause of trouble is an intermittent open at the point where

[*Continued on page* 33]

Outboard Motorboat Electronics

Basic principles in the operation of outboard motor ignition systems, generators, and starting systems are treated in this installment

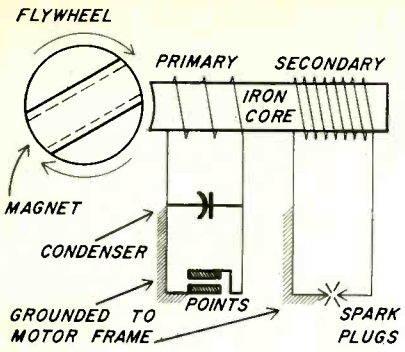


Fig. 1—Basic ignition circuit for magneto fired outboard motor.

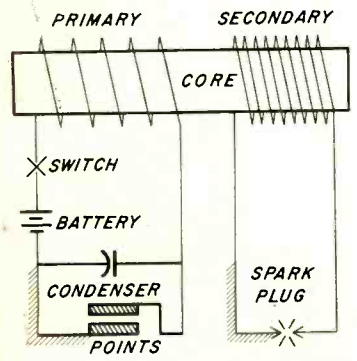


Fig. 2—Ignition system shown here is similar to that used in autos.

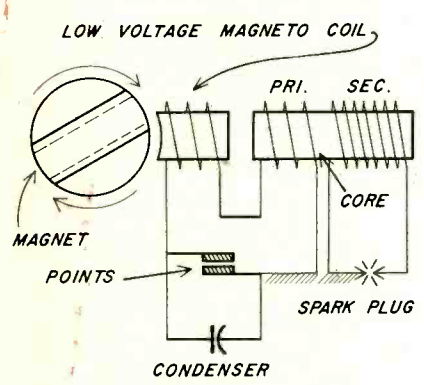
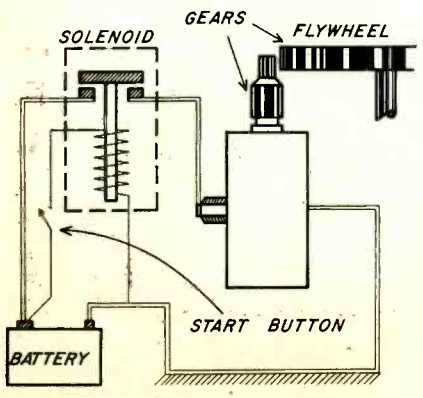


Fig. 3—The new Oliver motors use this variation of the basic system.



A FEW years ago an outboard motorboat was simply an open skiff with a "kicker" on the stern and fish scales on the seats. But today, outboard motorboats are capable of cruising with the entire family aboard, and of travelling great distances, even far offshore. The recent development of motors with electric starting batteries and charging generators has brought a new era to outboarding, by making it possible to install almost any kind of electrical or electronic gear manufactured for pleasure-boat use. Since outboarders outnumber inboard boats by about ten to one and represent the fastest growing form of marine life today, they represent a market for which the alert marine electronics agency must soon be fully prepared. Already, a number of outboard boats have been fitted with radiotelephones, direction finders, and depth sounders, and their number is sure to increase rapidly in the near future. A knowledge of outboard electrical systems is a coming necessity in the marine electronics business.

The outboard-motor electrical system is divided into three separate parts, each of which varies considerably among motors of different manufacture. Circuits are classified as ignition, starting, and battery-charging. These will be taken up in turn.

Ignition Systems

Figure 1 shows the basic ignition circuit of the usual magneto-fired outboard motor. A primary and secondary coil are wound concentrically on a laminated iron core and are excited by a rotating field magnet. The system is timed so that at the moment of desired ignition, maximum current flows through the primary winding and the breaker points. At the instant of engine firing, the points open (any arc being absorbed by the shunt capacitor) and the resultant rapid collapse of the magnetic field through the secondary winding induces the necessary high voltage to jump the gap in the spark plug. Note that one side of both the primary and the secondary circuits are, as in automobile ignition systems, grounded, the circuit being completed through the engine frame itself.

Fig. 4—The basic starting system is also similar to that of autos.

As a matter of mechanical convenience and economy, the magneto coils and points assembly are located under the flywheel of the engine, and the field magnet is an integral part of, or attached to, the flywheel.

The circuit shown in *Fig. 1* is for a single-cylinder motor, and since most outboard motors use a two-stroke cycle, the magneto furnishes a burst of high voltage once for every revolution of the engine. Two-cylinder engines have two complete magnetos and sets of points under the flywheel, and the cylinders are fired alternately.

Multi-cylinder engines, such as the Mercury four-cylinder models, may have external magnetos driven by gears or a notched belt, with a distributor to route the high tension to the proper cylinders in their firing order.

The first Evinrude put on the market, almost fifty-years ago, had an ignition system using principles somewhat similar to those of our automobiles, as shown in *Fig. 2*. Here, a conventional type of high-tension coil is excited by an ignition battery. At the time of firing, the points open, again causing a rapid collapse of the magnetic field through the multi-turned secondary winding and generating high voltage for the spark plug. For many years this system was in discard, but the last couple of years have seen its return in motors such as the *Fageol* and the largest *Mercury* motor. Distributors are used to route the high-tension to the cylinders in firing sequence.

The circuit of *Fig. 3*, which is used in the new *Oliver* motors, is a variation on the battery system where an external high-tension coil is excited by current induced in a low-voltage magneto winding under the flywheel. The purpose here is to keep the high-voltage circuits to the minimum possible length and out in the open where they can be easily serviced.

These, then, are the basic circuits used for ignition in all of our modern motors. However, individual designs have, of course, a number of variations. For example, motors such as the Scott-Atwater, Evinrude, and Johnson have idling cut-out switches, which disable one of their two cylinders at idling speed so that the motor will slow down satisfactorily. The cut-off switch is actuated by crank-case pressure, and when this drops to a predetermined level, one of the primary coils is grounded. A sidelight on this particular form of switch is that the terminal is a convenient one to use for the installation of an electric tachometer, which must be connected to the primary of the ignition circuit.

Other cut-out switches are used to prevent the motor from being started

by Elbert Robberson

with the transmission in gear, or at high speed throttle settings. This is to safeguard the operator and make it impossible for him to start the engine and have the boat race away from under him. These switches may be either of the mercury or mechanical types.

Starters

The principles of the basic starting circuit are shown in *Fig. 4,* and are quite similar to those in automotive use. A heavy lead connects from the battery to the motor-starting solenoid, which is physically located on the starter motor itself. The ground return is through the motor block and a heavy cable back to the battery. A relatively low current, flowing when the start button is depressed, actuates the solenoid, closing the starting contacts. A Bendix-type gear engages the starting motor with the flywheel only while the motor is actuated. The choke lever is also actuated by a solenoid, energized by a push-button switch.

Generators

Two systems of battery charging are used. That shown in *Fig. 5* is the generator and regulator scheme used on *Evinrude* and *Johnson* motors. Here, a miniature automotive type *dc* generator, which is driven by a belt from the flywheel, supplies battery-charging current through a miniature voltage regulator and a dashboard ammeter. On these particular motors there are power-take-off terminals, supplied on a terminal box, for the connection of low-drain external circuits, such as lights, etc.

[*Continued on page 26*]

ELECTRONIC SERVICE FIRMS ANALYSIS

by San D'Arcy

NOWADAYS there are 5 basic types of Electronic Service Firm, to wit: 1) the firm that does Radio-TV servicing exclusively; 2) the firm that does *some* Industrial Electronic servicing as well as Radio-TV servicing; 3) the firm that does Industrial Electronic servicing exclusively; 4) the Industrial Electronic service specialists who also do *some* Radio-TV servicing; 5) the service departments of industrials, or municipalities, or utilities, which use electronics devices and which only service their own equipments whether it be closed-circuit TV or Counters or 2-way mobile radio.

During April 1957 we sent to every tenth service firm name on our list a questionnaire relating to their present and planned future activities, etc. Exactly 4,998 questionnaires were sent out, and within one month 582 replies were received. Our records indicate there are 44,500 radio-TV service firms and 4,750 Industrial Electronic and/or Commercial Communications service firms in the USA. Thus our survey was rather comprehensive and reached a representative cross-section of servicers in each category in all 48 states, the District of Columbia and US Territories.

For the edification of you subscribers who did not receive a questionnaire, here it is in detail.

You'll note that we did not ask participants to give their name or company affiliation, nor did we ask "loaded or trick" questions because we sought optimum accuracy.

In analyzing and evaluating the replies we broke them into two distinct groups comprising those service firms whose gross income (55% or more) is derived from radio-TV servicing, and those service firms, who because less than 50% of their income is derived from radio-TV servicing, must be categorized as being Industrial Electronic servicers.

TABLE 1

Type of Servicing Done by Radio TV Service Dealers

In this classification only service firms reporting that 53% or more of their annual volume accrued from repairing radios and/or television are included. Firms reporting that over 50% of their service volume accrued from Industrial Electronics and/or Commercial Communications servicing are covered under the Industrial Service classification analysis.

23.4% or 9,945 shops do Radio/TV servicing exclusively

42.1% or 17,892 shops say Radio/TV servicing is 90-100% of their gross

28.1% or 11,942 shops say Radio/TV servicing is 80-90% of their gross

1.6% or 724 shops say Radio/TV servicing is 70-80% of their gross

4.8% or 1,997 shops say Radio/TV servicing is 53-70% of their gross

Analysis of $ Service Volume In % of Average Service Shop

Radio-TV Service %	*Mobile 2-Way Radio Service %*	*Hi-Fi - P.A Intercom Service %*	*Teletype & Office Mach. Service %*	*Industrial Electronics Prod. Equip. %*	*Industrial Electronics Research Equipment %*
100 %	—	—	—	—	—
95.5%	1. %	3. %	.06%	.38%	.04%
85.6%	3.4%	6.5%	1. %	3.4 %	—
53.3%	9.9%	19.7%	1.5 %	8.6 %	7. %

An outstanding fact brought to light by our survey, and it should be stressed strongly, is this: Only a small percentage of the Industrial Electronic Service Firms purport to do any radio/television servicing now—and in the main they make it very clear that they do not intend to go after any additional radio-TV service business in the foreseeable future. By the same token, a relatively high percentage of the firms that now are primarily engaged in radio-TV servicing state that they do intend to extend their activities into Industrial Electronic Servicing at some future date. At present, 93% of the nation's radio-TV service firms derive 70% or more of their gross from radio-TV servicing, whereas only 7% derive as much as 30% of their income from Industrial Electronic servicing. Yet the survey indicated that in the near future upwards of 25% of the radio-TV service firms anticipate that their gross from Industrial Electronic Service activities will increase anywhere from 10% to 30% over present levels.

Stated another way, radio-TV service firms need not expect any great competition from Industrial Electronic Service firms insofar as the home market is concerned, but by the same token industrial electronic service firms can expect more and more competition from their radio-TV service contemporaries. In truth, the Industrial Electronic Service firms will not "feel" this competition because they can hardly handle the volume of business currently available. There's a very serious manpower shortage of technicians competent to service the myriad of industrial installations now extant.

Getting back to the survey itself—you can see that in effect it allowed us to differentiate between firms that specialize in radio-TV servicing as contrasted to firms that basically are engaged in doing industrial electronics or commercial communications servicing. For example, if any reply to the second sentence in question "IV—SPECIAL" indicated that over 53% of the replier's business is radio/TV repairing, we automatically knew that that particular firm was *not* to be classified as an Industrial Electronic Service Firm.

Now if you are a radio/TV service shop owner you can evaluate your status against "average" by referring to the adjacent *Table 1* which breaks down the "types of servicing done." For example, you know whether 90 to 100% of your income is derived from radio/TV servicing or whether 80 to 90% comes from radio/TV servicing. If, for example, 90 to 100% comes from radio/TV work, then, if yours is an "average shop"—1% of your income is from servicing mobile 2-way radios, 3% from servicing Hi-Fi and P.A., .06% from servicing electronic office machines, etc.

Likewise, if 80 to 90% of your volume is from radio/TV, then 3.4% of your business probably is derived from Mobile 2-way work and 6.5% from Hi-Fi-P.A. if your operation is "average." You can use our other statistical findings as a guide should your operations be dissimilar to an "average" shop.

Of the 9,945 shops now engaged solely in radio/TV servicing, 71% say they do not expect to broaden out into industrial electronic servicing in the near future while 21% report that they are contemplating that move and 8%

are still indecisive. Of the 17,892 shops who report that at present over 90% of their business is now derived from radio/TV servicing, 80% report that they intend to expand and make a stronger effort to obtain Industrial Electronic servicing business soon, while 20% report, in effect, that they will go along on their present basis. Of the 11,942 shops reporting that radio-TV servicing now constitutes over 80% of their income, almost 94% report that they intend to concentrate more and more intensely on Industrial servicing while 6% will hold to the status quo. Almost every one of the 724 shops who now do 70%-80% in radio/TV servicing and almost every one of the 1,997 shops who now do from 53% to 70% of their volume in radio/TV servicing report that they plan much more aggressive efforts to obtain Industrial service work. In fact, 12% of the latter group report that they are gradually giving up radio/TV servicing in order to concentrate 100% in the Industrial service business.

Years In Business

The average Radio-TV Service Dealer has been in business 11 years 2 months.

2,975 or 7% in business 1 year or less
850 or 2% in business 1 to 2 years
13,175 or 31% in business 3 to 5 years
9,350 or 22% in business 5 to 10 years
4,250 or 10% in business 10 to 20 years
11,900 or 28% in business 20 years or more
42,500 or 100% (total)

Recapitulation of the 42,500 firms engaged in Radio/TV servicing

44.8% or 19,040 shops are operated as 1 man shops
29.2% or 12,410 shops have 1 employed technician besides owner
8.7% or 3,697 shops have 2 employed technician besides owner
13.8% or 5,865 shops have 3 employed technician besides owner
3.5% or 1,488 shops have 5 employed technician besides owner

The average (of the 42,500 service shops), has 1.55 employed technicians in addition to the owner-serviceman.

$ Investment

44,500 Radio-TV Service Firms have $162,-169,550 invested in stock consisting of tubes, components, instruments and fixtures, but not including receivers, Hi-Fi, etc.

Shops have investments ranging from a low of $250 to highs exceeding $20,000. The average shop investment is $4,273.

3% or 1,275 shops have $ 500 or less invested
11% or 4,675 shops have $500-1000 invested
40% or 17,000 shops have $1000-3000 invested
24% or 10,200 shops have $3000-5000 invested
13% or 5,525 shops have $5000-10,000 invested
9% or 3,825 shops have $10,000 or more invested

What test equipment is owned and used by the average Radio-TV service shop?

(To simplify this analysis—the following figures show approximately how many of the respective instruments are in use per 100 service shops.)

Tube Testers	109.9	Yoke-Flyback Tester	11.3
VTVM	102.2	Dot-Bar Generator	11.3
'Scopes	88.8	Wheat Bridge	7.6
VOM's	73.7	Audio Generator	5.7
Signal Generators	54.8	Color-Bar Generator	5.6
Alignment & Sweep Generators	49.1	Square Wave Gen.	5.6
Condenser Checkers	35.9	Variac	5.5
Power Supplies & Batt. Eliminators	35.9	Isolating Transf.	5.4
CRT-Tester-Rejuv.	22.7	Field Strength Int. Meter	5.4
Signal Tracer	17.0	Grid Dip Meter	3.8
Frequency Meter	13.2	Transformer Checker	2.2
Marker-Generator	13.2	Vibrator Tester	2.0

Now let us review the data provided by Industrial Electronic Service Firms.

Industrial Electronics Service Firms Years in Business

The average Industrial Electronic Service Firm has been in business 15 years 6 months.

910 or 20% have been in business 3 years or less
636 or 14% have been in business 3 to 5 years
1000 or 22% have been in business 5 to 10 years
1136 or 25% have been in business 10 to 20 years
865 or 19% have been in business 20 years or more
4547 100%

7% or 318 shops are operated as 1 man shops
20% or 909 shops have 1 empl. tech. bes. owner
27% or 1227 shops have 3 empl. tech. bes. owner
26% or 1582 shops have 5 empl. tech. bes. owner
19% or 864 shops have 10 empl. tech. bes. owner
1% or 37 shops have 20 empl. tech. bes. owner
100% 4547

The average Industrial Electronic Service Firm has 4.9 technicians employed.

* Of the 222 replies received (from 498 questionnaires sent) 110 were from public utilities, city, state police; airlines, etc., who indicated that their prime service activities relate to servicing their own mobile 2-way radio-communications systems. 86 replies were from Independent Industrial Electronic service firms, many of which report that they are also engaged in servicing mobile, aviation and marine 2-way radio besides servicing Industrial Production and Industrial Electronic Research Equipment.

TABLE II

Analysis of Servicing Done By Industrial Electronics & Commercial Communications Service Firms

The classification "Industrial Electronics Service Firm" has been used in its broadest terms. For example, a Railroad's electronics service department is responsible for servicing: the electronic safety devices along the right-of-way; the 2-way and 3-way radio-phone equipment from caboose to engineer, or engineer to signal tower; the 2-way radio phone gear used on trucks by line-maintenance crews; the closed circuit TV installations at main ticket reservation branches; the public address installations at railroad stations; the radio and TV systems aboard trains, etc., etc. In like manner the electronics serviceman working for an industrial manufacturing plant maintains the firm's 2-way radio-phone equipment; the electronic counters, checkers or sorters; the automation or "systems" devices; office machinery, etc.

39% are engaged in Indus. Com. Serv. 100%
20% are engaged in Indus. Com. Serv. 90-99%
18% are engaged in Indus. Com. Serv. 70-89%
12% are engaged in Indus. Com. Serv. 50-69%
11% are engaged in Indus. Com. Serv. 30-49%
0% are eng. in Ind. Prod. Equip. Serv. 100%
1% are eng. in Ind. Prod. Equip. Serv. 90-99%
1% are eng. in Ind. Prod. Equip. Serv. 70-89%
1% are eng. in Ind. Prod. Equip. Serv. 50-69%
6% are eng. in Ind. Prod. Equip. Serv. 30-49%
91% are eng. in Ind. Prod. Equip. Serv. under 30%

[Continued on page 23]

1957 Philco TV-part 2.

by H. S. King
Supervisor, Electronic Training Dept.
Philco Corporation

This second installment deals with the Philco chassis 7L40 series with emphasis placed on automatic and remote control tuning, UHF adapters, and circuitry.

7L40 Chassis Series

The 7L40 chassis series are all vertically mounted types designed for installation to one side of the picture tube as shown in *Fig. 5.* Variations in the chassis of this series include facilities for *uhf*, phonograph connections, automatic tuning with remote control, and changes in the output deflection circuits for various size picture tubes.

All of the chassis that are equipped for automatic tuning also contain provisions for connecting one of the two remote control units available, the RC-10A and RC-30. A 12-contact receptacle is provided on the back of the receiver cabinet for remote control connections.

Top-Touch-Tuning System

The automatic tuning system, known as "Top-Touch-Tuning" consists of a 12 volt motor driven stepper assembly mounted on the rear of the *vhf* tuner. A momentary contact switch, mounted on the top of the cabinet activates the system permitting consecutive channel selection or selection of only those channels receivable. A selector rod on the cabinet rear provides the means of adjusting the system to select only those channels that can be received in the area or to stop on every channel consecutively.

The RC-10A remote control is a small plastic-case hand unit with a push-button switch and 30 feet of two-conductor control cable and plug. When the plug is inserted into the receptacle on the cabinet rear, the switch of the remote control is in parallel with the top-touch-tuning switch on the receiver and activates the automatic channel selector system in the same manner.

The RC-30 is a deluxe remote control unit. It consists of the hand control, a 30-foot, five-conductor, flat-ribbon cable and a sub-chassis, illustrated *Fig 6.* This unit permits remote selection of the desired channel, control of volume and also turns the receiver power on and off. The hand unit contains a volume control, an on-off contact switch and the automatic tuning contact switch. The sub-chassis contains a step-down transformer (117*v*-12*v*), a relay, relay switch and connecting plug. The sub-chassis plugs directly into the receiver's 12-contact receptacle on the cabinet rear.

Circuitwise, the automatic-tuning contact switch on the remote control unit connects in parallel with the top-touch-tuning button on the receiver and permits remote channel selection automatically. The volume control is connected in series with the B-plus voltage applied to the sound *if* stage to control audio volume. It is independent of the receiver's volume control in operation but its maximum range is dependent upon the level to which the receiver's volume control is adjusted. The step-down transformer is continuously powered as long as the receiver is connected to the power line. The remote unit activates the relay switch through the step-down transformer. The relay switch alternately opens or closes each time the on-off button is depressed and the relay is energized, thus opening or closing the power line circuit. The RC-30 remote control circuits are illustrated in *Fig. 7.*

7L40 Chassis Circuitry

The tuners in the 7L40 chassis series are either 12 position or 13 position incremental types. The 13 position tuner has facilities for the installation of a *uhf* tuner adapter. The output of these tuners is a 45.75 *mc if* signal. The *if* printed wire panel contains 3 stagger tuned *if* amplifiers and the video detector. Maximum interference rejection is obtained in this system by the use of three traps in the input stage, two of which are tuneable to 47.25 *mc* while

[*Continued on page* 35]

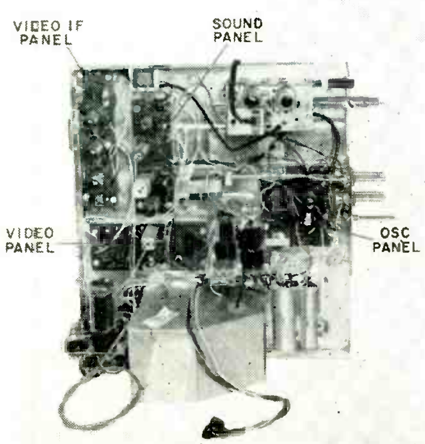


Fig. 5—View of 7L40 vertically mounted chassis.

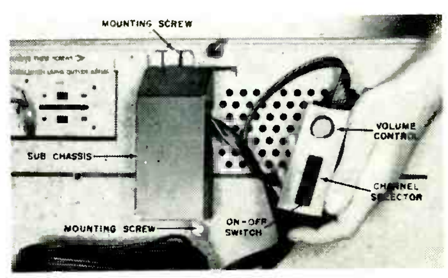


Fig. 6—Photo of RC-30 remote control tuning assembly.

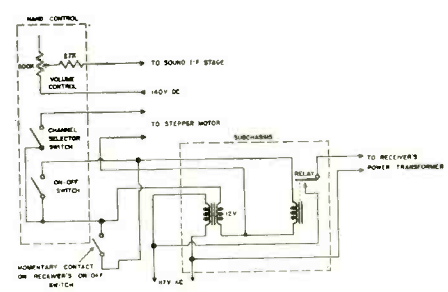
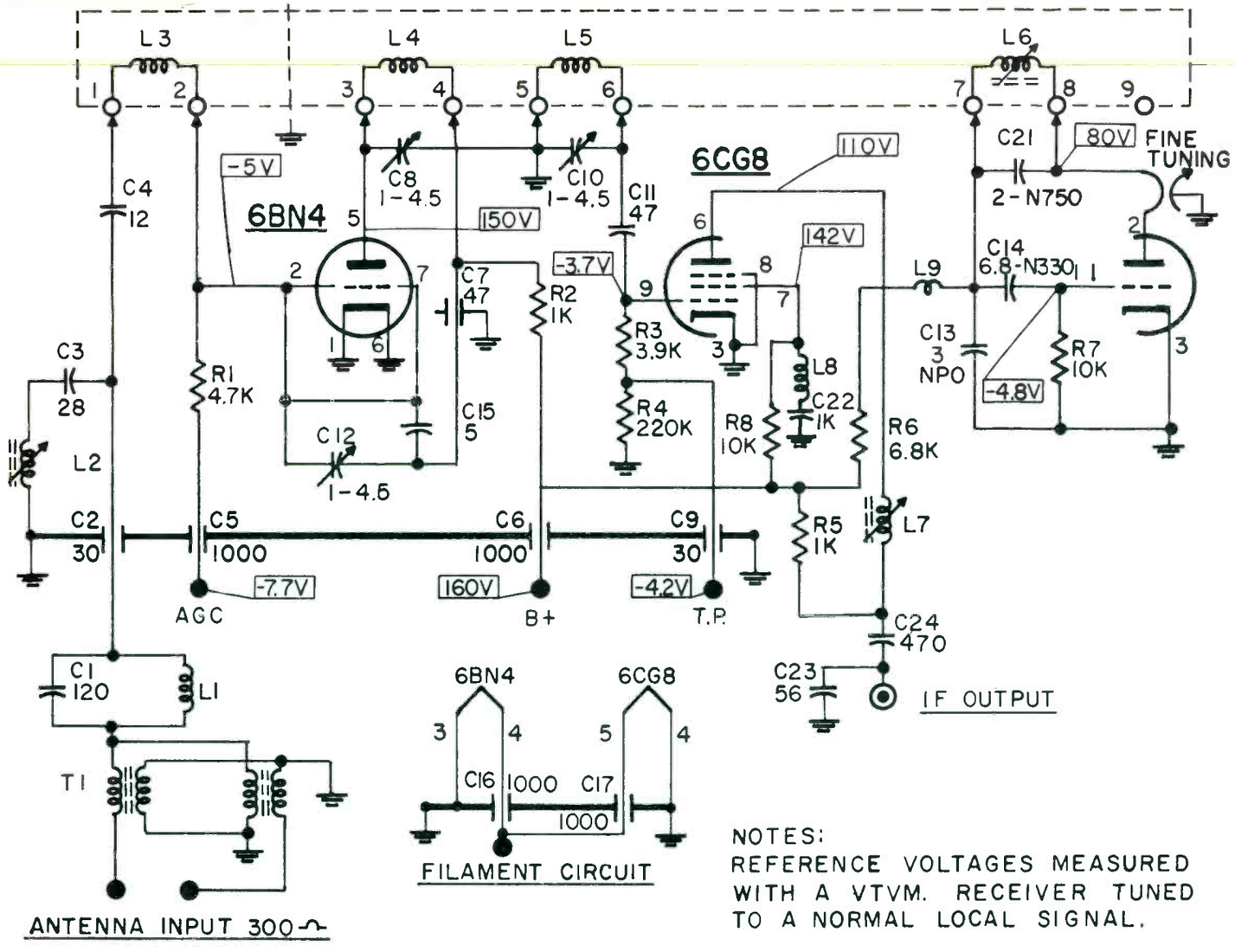


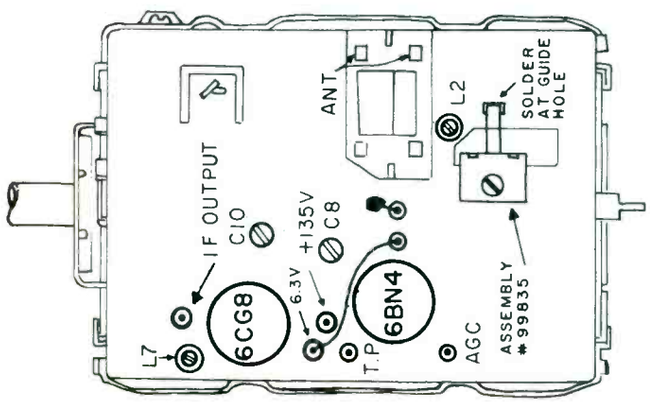
Fig. 7—RC-30 remote control tuning assembly circuitry.

CHASSIS 329, 329U, 330

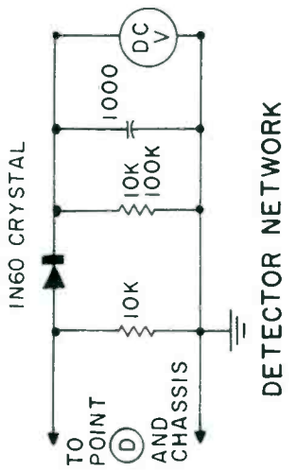


NOTES:
REFERENCE VOLTAGES MEASURED WITH A VTVM. RECEIVER TUNED TO A NORMAL LOCAL SIGNAL.

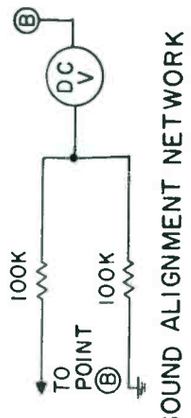
SCHEMATIC DIAGRAM FOR TUNERS 710001 & 710003



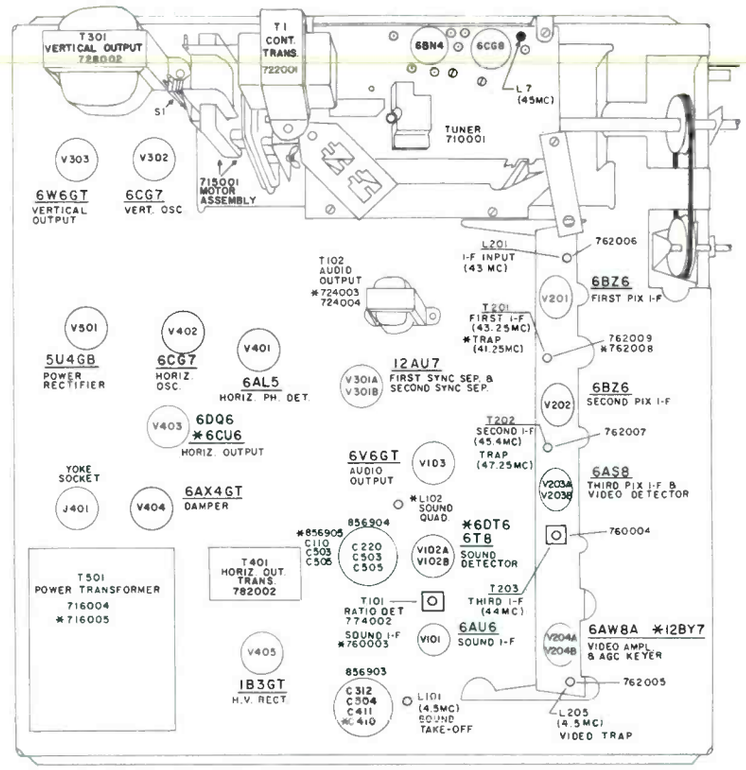
TOP VIEW TUNERS 710001 & 710003



DETECTOR NETWORK

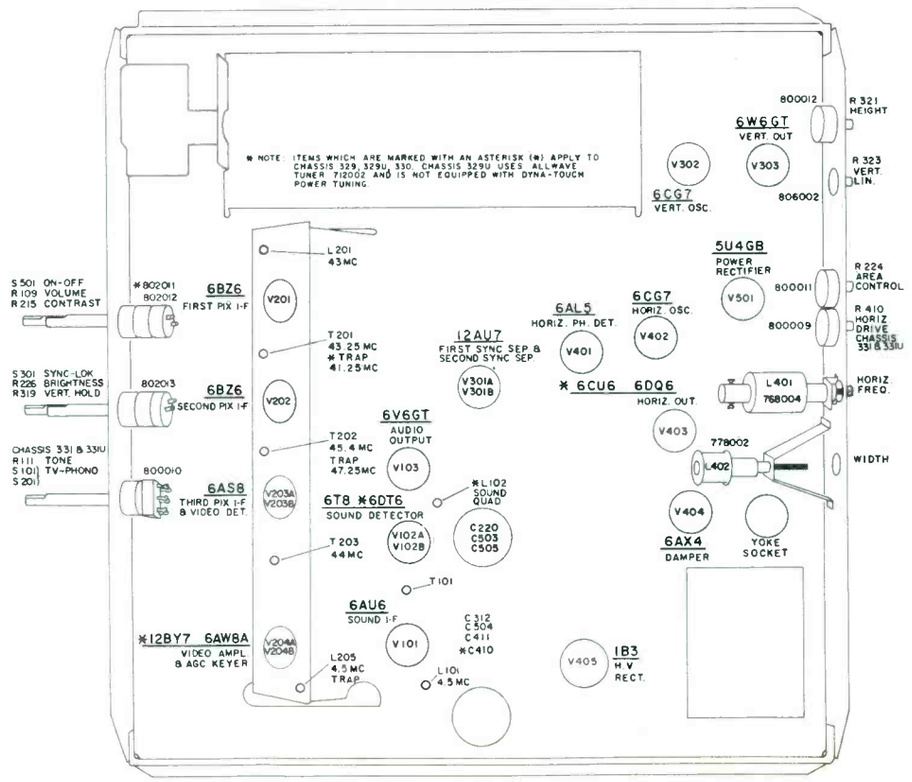


SOUND ALIGNMENT NETWORK

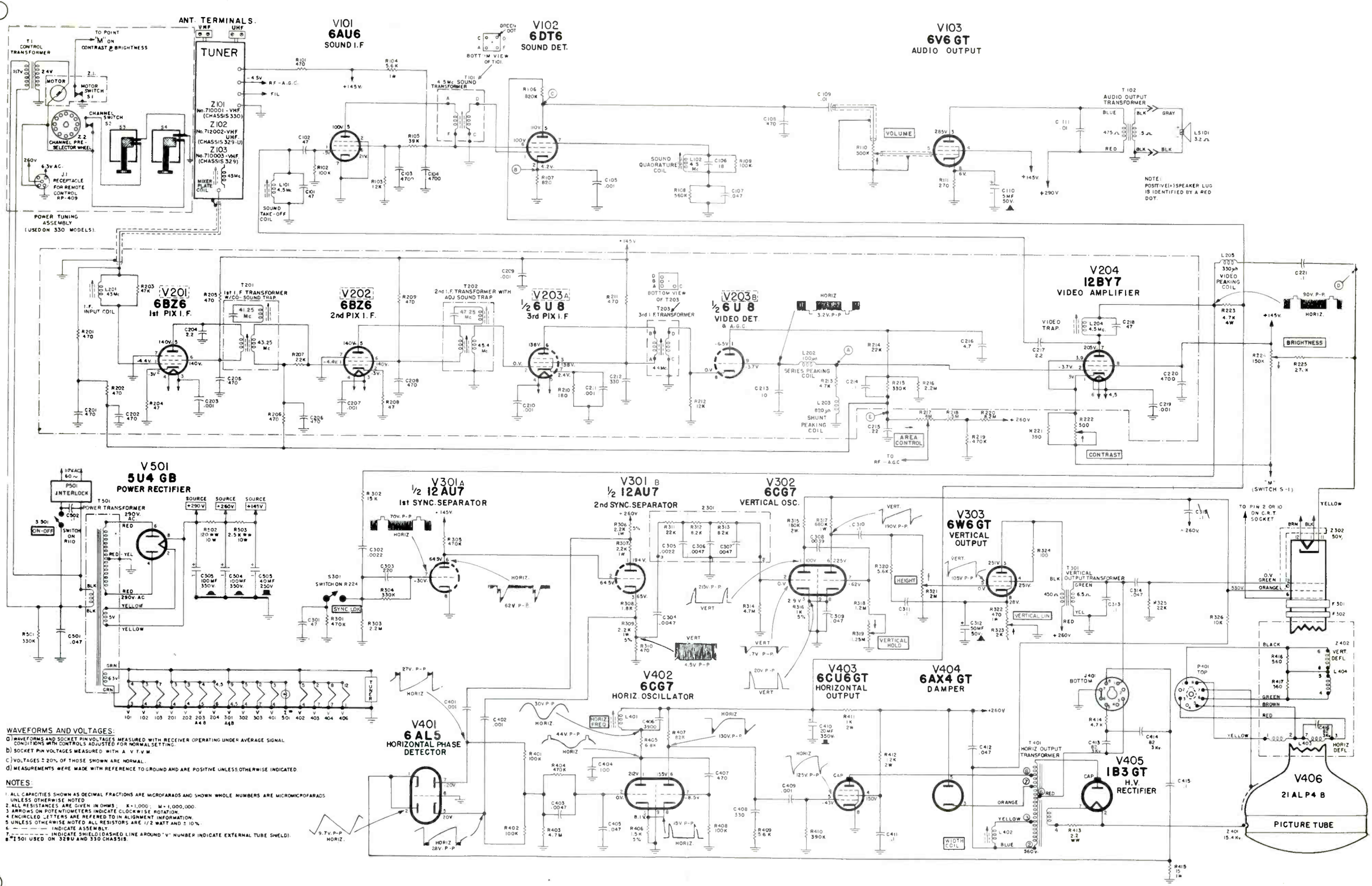


*NOTE: ITEMS WHICH ARE MARKED WITH AN ASTERISK (*) APPLY TO CHASSIS 329, 329U, 330. CHASSIS 329U USES ALLWAVE TUNER 712002 AND IS NOT EQUIPPED WITH DYNA-TOUCH POWER TUNING.

TOP VIEW OF CHASSIS 329, 329U, 330, 331, 331U



BOTTOM VIEW OF CHASSIS 329, 329U, 330, 331, 331U



WAVEFORMS AND VOLTAGES:

a) WAVEFORMS AND SOCKET PIN VOLTAGES MEASURED WITH RECEIVER OPERATING UNDER AVERAGE SIGNAL CONDITIONS WITH CONTROLS ADJUSTED FOR NORMAL SETTING.

b) SOCKET PIN VOLTAGES MEASURED WITH A.V.T.V.M.

c) VOLTAGES ± 20% OF THOSE SHOWN ARE NORMAL.

d) MEASUREMENTS WERE MADE WITH REFERENCE TO GROUND AND ARE POSITIVE UNLESS OTHERWISE INDICATED.

NOTES:

1. ALL CAPACITIES SHOWN AS DECIMAL FRACTIONS ARE MICROFARADS AND SHOWN WHOLE NUMBERS ARE MICROMICROFARADS UNLESS OTHERWISE NOTED.
2. ALL RESISTANCES ARE GIVEN IN OHMS; K = 1,000; M = 1,000,000.
3. ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION.
4. ENCIRCLED LETTERS ARE REFERED TO IN ALIGNMENT INFORMATION.
5. UNLESS OTHERWISE NOTED ALL RESISTORS ARE 1/2 WATT AND ± 10%.
6. — — — — INDICATE ASSEMBLY.
7. - - - - - - INDICATE SHIELD (DASHED LINE AROUND "V" NUMBER INDICATE EXTERNAL TUBE SHIELD).
8. *T501 USED ON 329U AND 330 CHASSIS.

SCHEMATIC DIAGRAM FOR HOFFMAN MARK 10 CHASSIS 329, 329U, 330

GENERAL ELECTRIC

"T" LINE

V108 4.5 MC AMP 6AU6A

V109A AUDIO AMP 1/2 10C8

V109B AUDIO OUTPUT 1/2 10C8

V104 2ND I-F 6CB6A

V103 1ST I-F 6CB6A

V105A CLIPPER 1/212CT8

V105B VIDEO AMP 1/2 12CT8

V106 9QP4

V110 HORZ. M.V. 7AU7

V111 HORZ. SWEEP OUTPUT 18A5

V112 H.V. RECT. 1V2

V113 DAMPER 17H3

UNLESS OTHERWISE NOTED

K = 1000 M = 1,000,000
CAPACITORS MORE THAN 1 = MMF
CAPACITORS LESS THAN 1 = MF
RESISTORS ARE 1/2 WATT

VOLTAGE MEASUREMENTS ARE IN RESPECT TO CHASSIS WITH A 20,000 Ω VOLT METER, WITH CONTROLS SET FOR NORMAL OPERATION, NO SIGNAL APPLIED.

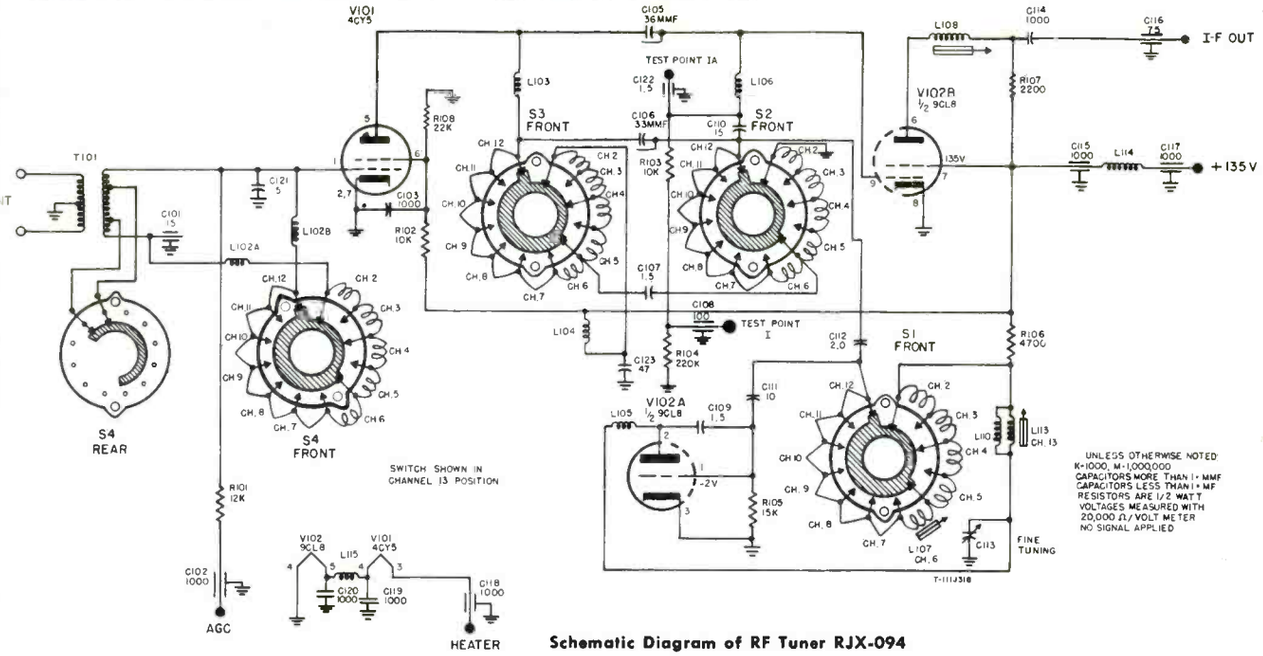
* SCOPE SYNCED AT 1/2 VERT. FREQUENCY.
** SCOPE SYNCED AT 1/2 HORIZ. FREQUENCY.
WAVE SHAPES TAKEN WITH NORMAL CONTROL SETTINGS & NORMAL SIGNAL APPLIED.

▲ MEASURED WITH VTVM
● VARIES WITH CONTROL SETTINGS

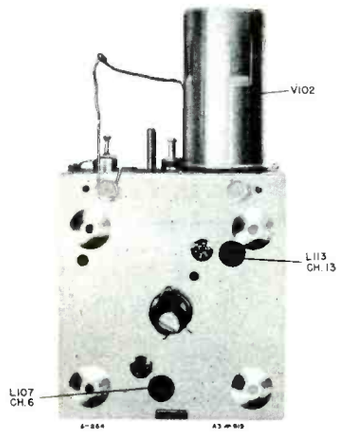
CIRCUIT FOR SELENIUM RECTIFIER

CIRCUIT FOR GERMANIUM RECTIFIER

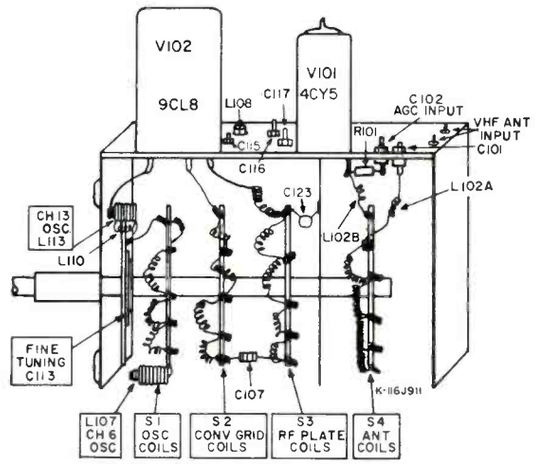
BOOST +265V



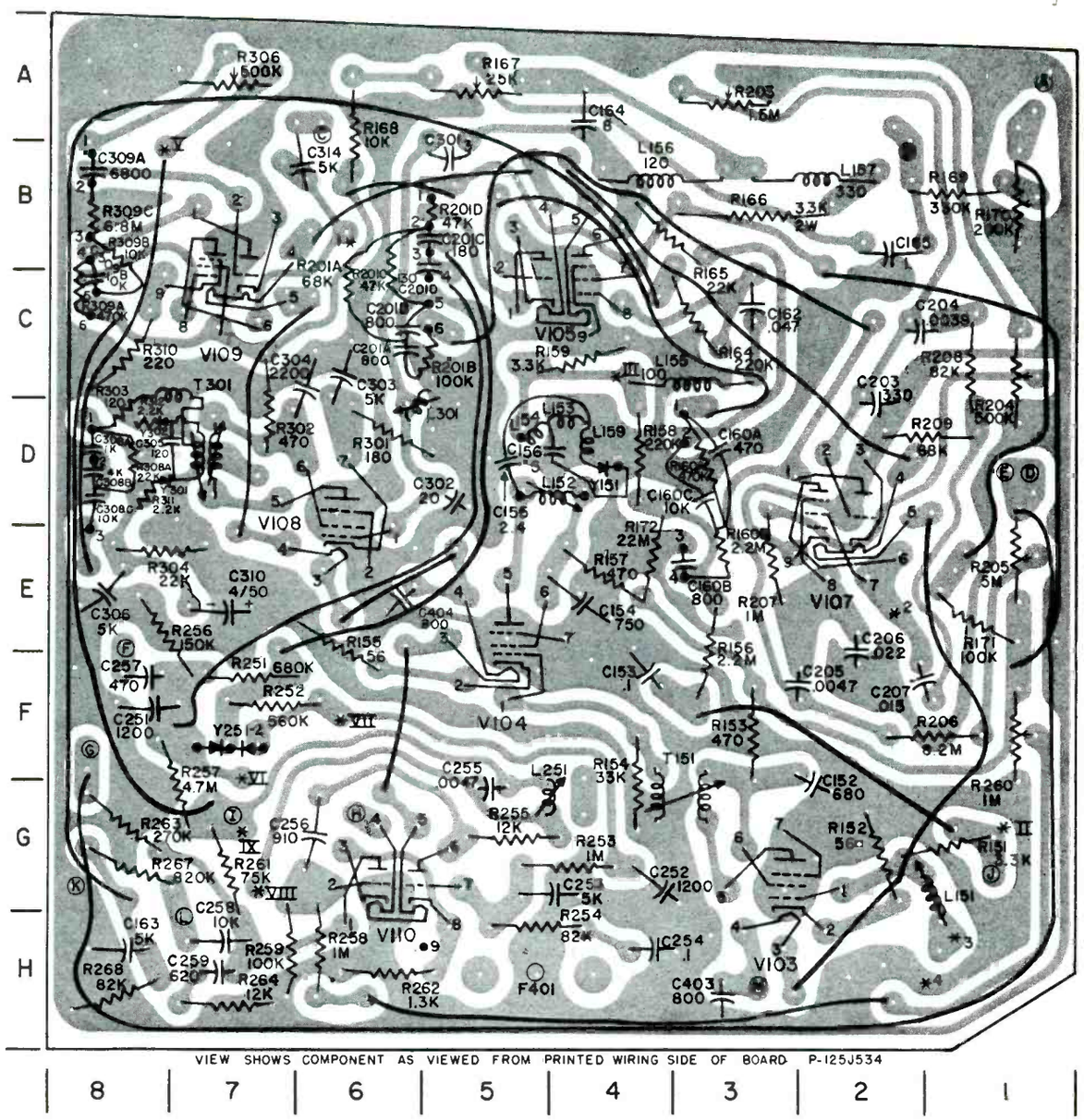
Schematic Diagram of RF Tuner RJX-094

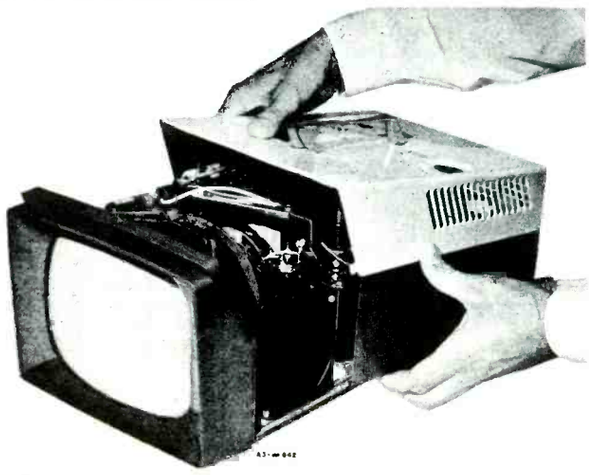


Oscillator Adjustments (RJX-094)

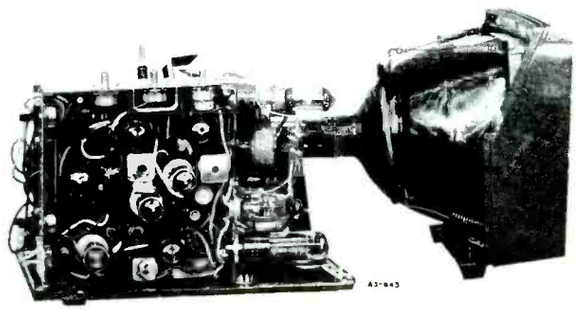


RJX-094 Adjustments





Removing the Cabinet



Removing Cabinet Front and Picture Tube

CIRCLED Ⓐ LETTERS

REPRESENTS INTERCONNECTING WIRES FROM OTHER COMPONENTS.

- A PIN 2 OF V106
- B PIN 11 OF V106
- C TO Y401
- D PIN 10 OF V106
- E PIN 3 OF V106
- F TO R265
- G TO PIN 6 OF T251
- H TO PIN 2 OF V111
- I TO PIN 8 OF V111
- J TO VHF TUNER-AGC
- K TO PIN 3 OF V111
- L TO R266
- M TO PIN 1 OF V106

ASTERISKED ⊛ NUMBERS

REPRESENT WIRE WRAP TERMINALS MOUNTED ON COMPONENT BOARD FOR CONNECTING WIRES FROM OTHER COMPONENTS

- *1 TO T302
- *2 TO T201
- *3 FROM VHF TUNER-IF OUTPUT
- *4 GRD FOR I-F INPUT CABLE SHIELD

UNLESS OTHERWISE NOTED

K=1000 M=1,000,000
CAPACITORS MORE THAN 1 = MMF
CAPACITORS LESS THAN 1 = MF
RESISTORS ARE 1/2 WATT
INDUCTANCES IN μh

ASTERISKED ⊛ ROMAN NUMBERS

REPRESENT TEST POINTS ON COMPONENT BOARD

AD LIBS

[*from page 3*]

cation for a license as a television serviceman and tendered a $33 check in payment. Preliminary to acting upon the application, the city license department asked for a police report, a formality which usually brings a statement of 'no police record.' In this case, however, the report said: 'In 1946, drunk, 15 days in the workhouse; 1947, disorderly conduct, 15 days in workhouse; disorderly conduct again, 30 days suspended; suspected forgery and suspected auto theft, released; 1948, second degree forgery, sentenced to St. Cloud reformatory; 1949 (and apparently out again) indecent assault and placed on probation; 1955, leaving the scene of an auto accident, 5 days in the workhouse; 1956, disorderly conduct, 10 days suspended; driving after suspension of his driver's license, 30 days; 1957, once again, driving after suspension of his driver's license, 30 days.'

"To add to the insult, the $33 check which accompanied his request for a city permit bounced for lack of funds. The license committee recommended and the City Council promptly voted to deny the application. Without such a restrictive ordinance, this man might have gone his merry way as a self-styled television repairman, entering homes where women were alone or where only children were present, or where opportunities were wide open for theft or more serious crimes. Some time back when the City Council gave consideration to this type of ordinance, it was agreed that a tight ordinance should be adopted as a safeguard for all in St. Paul. Obviously, that viewpoint is paying off.

"It shouldn't be necessary to point out that persons at home would do well to insist upon proper identification from any person arriving with a tale of offering service. Reputable servicemen welcome such queries and are willing to show their credentials; they know that such questions and evidence of their reliability are protection against the no-goods and the fly-by-nights."

In every walk of life, in every industry or profession there are "sinners" who have on occasion run afoul of the law. (I've paid fines for overtime parking. My physician tells me that last month he was arrested for speeding. A neighbor of mine recently was hauled into court for burning grass clippings on the street). The mere fact that one has broken some law does not make him a hardened criminal, nor does it justify depriving him of the right to earn a living in his chosen profession. But, there are chronic offenders of law whose past records, like in the case cited by Mr. Langland, justify and require that they be barred from free access to homes where temptation can, and undoubtedly will, induce them to take advantage of the unwary. If licensing of radio/TV servicemen (and other in-the-home servicemen) does nothing less than prevent scoundrels and hardened criminals from having easy access to homes, licensing is justifiable and warrants support of all parties concerned. Servicemen, situated where licensing is required, can hold their heads erect and say with pride, "I have been tried. My record has been scrutinized. I have not been found wanting." This would be a giant-step forward—one in which we would all take enviable pride.

Our Format Change Next Month

Early last year the majority of our subscribers, when asked whether or not they preferred to have ELECTRONIC SERVICING change its format to "King Size - 11 x 11 inches," voted for that change which was put into effect with our May 1956 issue. Since then many subscribers have reversed their opinion and now suggest that we revert to the "Standard Size" with text pages 7 x 10 inches. Many readers suggest that we sectionalize the magazine, too, keeping radio-TV articles apart from industrial service articles so that tear-outs and filing for future reference can be done more easily.

A magazine publisher must respect the wishes of his subscribers. Accordingly, next month ELECTRONIC SERVICING's format will be changed back to its former style. ■■

ELECTRONIC FIRMS ANALYSIS

[*from page 13*]

1% are eng. in ser. Ind. Elec. Res. Equip. 100%
1% are eng. in ser. Ind. Elec. Res. Equip. 90-99%
2% are eng. in ser. Ind. Elec. Res. Equip. 70-89%
3% are eng. in ser. Ind. Elec. Res. Equip. 50-69%
2% are eng. in ser. Ind. Elec. Res. Equip. 30-49%
91% are eng. in ser. Ind. Elec. Res. Equip. under 30%

Test Equipment Reported Owned & Used by Industrial Electronic Service Firms

The huge amount of various specialized instruments owned and used by Industrial Electronic Servicers in addition to the more popular types made it unfeasible to break this classification down.

Commonplace instruments used are: Tube Testers, VTVM's, VOM's, Signal Generators, Alignment and Sweep Generators, Power Supplies and Battery Eliminators, Condenser Checkers, Grid Dip Meters, etc., etc.

The specialized types of instruments include: Frog meters, Thruline and End Voltmeters, Modulation and Frequency Meters, Audio signal generators and analyzers, Microvolters, Microwave panoramic analyzers, distortion meters, sound level meters, engargicators, vibrotesters, wavemeters, radiation detectors, etc., etc.

$ Investment

4,547 Industrial Electronic Service Firms have $34,874,900 invested in stocks consisting of tubes, components, instruments, fixtures and accessories.

Shops have investments ranging from a low of $505 to highs approximating $200,000. The average shop investment is $7,672.

24% or 1094 shops have $1000 or less invested
10% or 455 shops have 1,000- 3,000 invested
10% or 454 shops have 3,000- 5,000 invested
23% or 1045 shops have 5,000-10,000 invested
29% or 1318 shops have 10,000-20,000 invested
4% or 181 shops have 20,000 or more invested
100% 4547

Analysis In % Showing Types of Industrial Electronic Equipment That Is Serviced

Industrial Communications			Industrial Production Equipments		
Mobile 2-Way Radio	*P.A. and Intercom.*	*Teletype & Office Mach.*	*Automation, sorting, counting, selection devices, etc.*	*Indust. Elect. Research*	*TV/Radio*
69.8%	4.5%	2.0%	14.4%	4.6%	4.7%

trade

Radio Receptor Co., Inc., a pioneer in electronics, is completing installation of imported equipment to manufacture a line of selenium rectifiers it claims will be smaller yet more efficient. The new rectifiers, to be trade named "Petti-Sel," represent an investment of more than $500,000 and more than a year of negotiations and planning. Production, under a process developed by the Siemens companies of West Germany, will get under way in about a month, according to Hugo Cohn, president of Radio Receptor.

• • •

Sprague Products Company, North Adams, Mass., recently received its fourth Friends of Service Management Award from the National Alliance of Television and Electronic Service Associations. Sidney L. Chertok, Sprague Sales Promotion Manager, left, is shown receiving the bronze and marble plaque from Harrol O. Eales, NATESA West Central Vice President, at the recent association conference in New Orleans. The plaque compliments Sprague for "outstanding service in creating better customer relations" between set owners and the Television-Radio Service industry.

• • •

Manufacturers' sales of receiving and TV picture tubes increased in May over the preceding month, RETMA reported. A decline was recorded, however, in cumulative sales this year compared with the first five months of 1956. Producers sold 32,836,000 receiving tubes worth $28,995,000 in May compared with 27,970,000 units valued at $25,384,000 sold in April and 33,015,000 worth $27,145,000 sold in May 1956. Cumulative receiving tube sales for the first five months of this year totaled 185,847,000 valued at $159,147,000 compared with 188,619,000 units worth $152,680,000 sold during the same period last year.

Philco distributors report "no difficulty "in getting dealers with service facilities and independent service shops to sign service agreements with Philco to provide free service to Philco radio and phonograph owners during the 90-day free warranty period, reported Henry T. Paiste, Jr., Vice President-Service of Philco Corpration. The program, announced at the Company's June distributor cnvention is designed to enroll 10,000 "Gold-plated" independent service operators and servicing-dealers to give broad national coverage.

• • •

A practical and timely Transistor Home-Study Course especially for electric service technicians has just been announced by the CBS tube division. Proclaimed to be an industry first, the course is designed to help the independent service-dealer take advantage of extra profits now available from servicing transistorized equipment. Profusely illustrated, the course is written in an easy "learn by using" manner. What the technician learns he remembers," a company spokesman said, "because he does it himself. . . by making several practical transistor devices he can keep and use."

• • •

Formation of a nine-man group of promotion specialists to concentrate solely on color television activities was announced recently by Joseph P, Bannon, General Sales Manager, RCA Victor Television Division, Radio Corporation of America. Heading the new group as Manager, Color Television Market Development, is Roger S. Drew who has had an extensive background in promotion and merchandising. Mr. Drew will have a representative in each of RCA's eight regions.

• • •

Two completely new and comprehensive promotion campaigns were announced recently to Raytheon Receiving and Industrial Tube Distributors by Raytheon's Distributor Sales Department. One, a personalized and sales stimulating promotion program for Raytheon Tube Distributors and the second, a business building program for service dealers. Continuance of the popular Raytheon Bonded Electronic Technician Program was also announced to Raytheon Sponsoring Bonded Distributors. The Raytheon Business Building Program for service dealers provide a collection of window displays and streamers, indoor and outdoor signs, sales helps, advertising aids, shop aids,

flashes

business supplies and service help. The Raytheon Business aids and service helps have been designed to assist service dealers in building business and boosting profits.

• • •

Transistor sales during the first five months of this year increased substantially over the corresponding 1956 period, RETMA announced. Sales of the semiconductor device during May also showed an increase over April and May of last year. Factory sales of transistors in May totaled 2,055,000 units with a dollar value of $5,636,000 compared with 1,774,000 transistors sold in April valued at $4,880,000. Cumulative sales of these devices during the first five months of this year totaled 8,954,300 valued at $25,128,000 as against 3,628,000 transistors worth $10,082,000 sold during the corresponding period of 1956.

• • •

The first comprehensive exposition covering every phase of the making and the reproducing of sound and pictures opens September 17, 1957 in Chicago's famed International Amphitheatre. Slated for a six day run, the show will unify, under one roof, all industries such as television, radio, hi-fidelity reproducers and recorders, tape, musical instruments, recordings, organs, sheet music, pianos, electronic parts and components, and other allied products.

• • •

The TV industry is a competitive morass of too many low-cost, poorly styled, stripped down receivers according to David T. Schultz, president of Allen B. DuMont Laboratories, Inc. He spoke recently before a group of editors and writers at the unveiling of the firm's new television receivers and high fidelity phonographs. "I think most executives in the industry agree," Mr. Schultz said, "that manufacturers have gone too far in trying to outdo each other price-wise in order to get volume. There is now considerable upgrading of merchandising in the new lines being introduced this spring, and I think it's a healthy trend which can and will return TV manufacturing to a profitable business."

• • •

Norman Ackerman, President of the Perma-Power Company, Chicago manufacturer, announces that the company has just completed a two week move to its own new and larger building which increases its production five times over its former headquarters. New equipment, extended assembly lines, better facilities to expedite orders more rapidly, plus additional key production personnel at the new plant assure continued high quality and service. This move marks the first step of the company's expansion program.

• • •

A state organization of independent radio-television service groups was created at a recent meeting held in Cambridge by delegates from six Massachusetts cities. The organization is chartered as the Electronic Technicians Guild Of Massachusetts. Among the more pressing problems of the industry

Seated: Nicholas A. Averinos. L-R: Remo DiNicola, Albert N. Giddis, Gilbert P. Clark, L. J. McEvoy.

has been the need of uniform service charges and standard business practices, and public recognition of the electronic service industry as a high skilled technical profession having a unique part to play in 20th century technological society.

• • •

Blonder-Tongue Laboratories is now offering to all its distributor's personnel and system installers a factory training course in the installation, operation and maintenance of Closed-Circuit TV and Master TV Systems. The courses are handled on an individual basis to permit consideration of actual wired systems and to concentrate on the major fields of each distributor or operator. Certificates are awarded upon completion of the two and three day courses.

• • •

Intensified plans for manufacturer participation in the promotion of National Television Week, Sept. 8-14, have been endorsed unanimously by the nation's leading TV set makers, RETMA announced recently.

OUTBOARD MOTORBOAT ELECTRONICS

[*from page 11*]

Figure 6 shows the circuit of the other battery-charging system, used on motors such as the *Scott-Atwater, Mercury, Oliver,* and *Fageol.* Here, alternator windings on a laminated core are installed under the flywheel which contains a magnet. On engines that also have under-the-flywheel ignition magnetos, these windings may be grouped around the ignition windings and excited by the same magnet. Current output from the alternator coils is fed to a bridge-connected selenium rectifier, providing the battery with full-wave rectified alternating current for charging.

The *dc* generators are rated for a current output of 10-amperes, while the alternators are nominally rated at from 4 to 8 or 9-amperes of *dc* output. Most outboard motors today employ a 12-volt system with the exception of the 4-cylinder Fageol, which has 6-volts. Contrary to automotive practice, where different manufacturers use a different ground polarity, the outboard motor people have apparently standardized on using a negative ground.

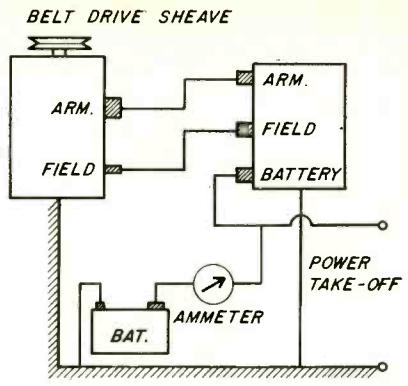


Fig. 5—Charging system used by Evinrude and Johnson motors.

Complete Electrical Systems

Details of the complete *Evinrude* battery and charging system are shown in *Fig. 7. Johnson* motors also use the same circuit. These motors have separate under-the-flywheel magnetos for ignition, which are not shown in this diagram. Although power-take-off terminals are supplied on the junction box, it should be noted that the current to these terminals passes through a rather lengthy cable up to the ammeter, and back to the battery. High-current or voltage-sensitive devices, such as a radiotelephone, might not be expected to do their best if connected to these terminals, especially where an additional long run of wire must be used to connect to the set. However, these terminals are convenient for connecting up any non-critical load circuits. In operating a radiotelephone, less voltage drop will be experienced if the telephone power circuits are connected to the solenoid switch "hot" terminal and the grounding stud, or bolt, on the motor. These connections are preferable to connecting to the battery directly, where wires might possibly become reversed, causing damage to the boat and/or equipment, and where they would possibly deteriorate from any stray acid.

Figure 8 shows the circuit used in the 4-cylinder *Fageol* outboard motor. Note here that battery, coil, and distributor type ignition is used, while the battery charger is an under-the-flywheel alternator and a rectifier.

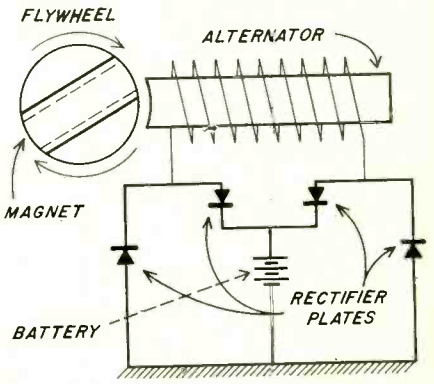


Fig. 6—Charging system used on Scott-Atwater, Mercury, and others.

The circuit of the *Mercury* "Mark 75" 6-cylinder motor is shown in *Fig. 9.* This motor uses battery, coil, and distributor-type ignition, but with a varia-

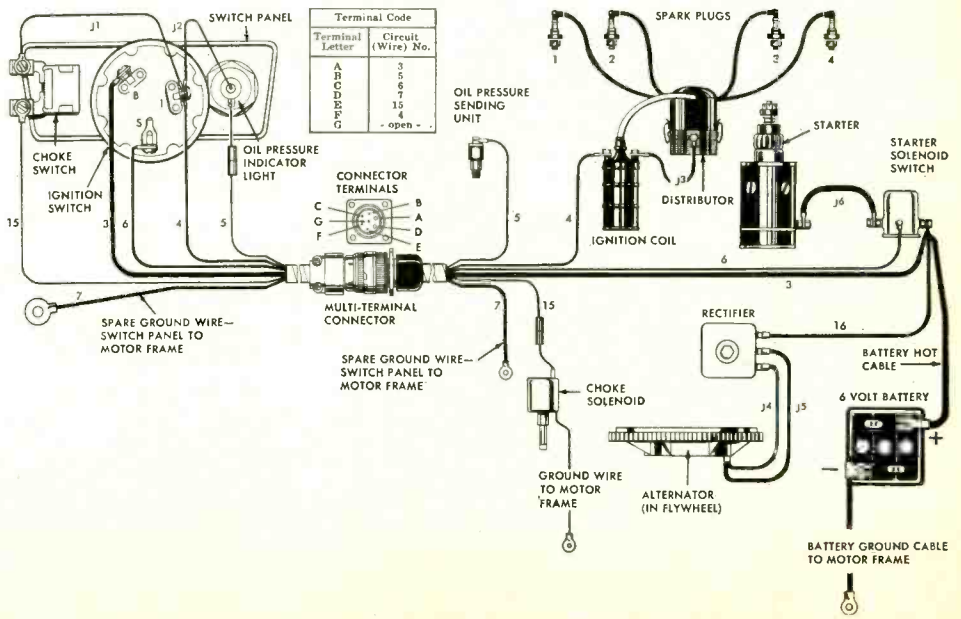


Fig. 8—Wiring diagram for the 4-cylinder Fageol outboard motor.

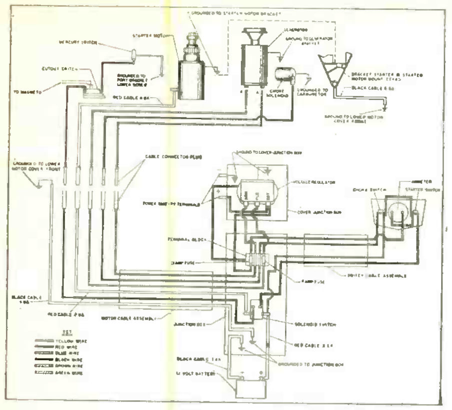


Fig. 7—Wiring diagram of the Johnson and Evinrude electrical systems.

tion from usual practice, in that two coils and sets of points are used. This is due to the fact that at its rated operating speed of 5800-rpm., a single coil and set of points would be called upon to deliver 580 sparks per-second to feed the 6 cylinders—too much to expect. So the job is therefore given to two separate coils and sets of points which fire alternately. A single distributor routes the output from both coils to the cylinders in firing sequence.

The battery-charging system uses an under-the-flywheel alternator and an external rectifier, bridge-connected, giving full-wave rectified *ac* to the 12-volt battery.

The starting circuit of the *Mercury* "Mark 75" is also a little out of the ordinary. This is due to the fact that that "Mark 75" has no reverse gears. Instead, the motor itself is designed to run either backward or forward at the will of the operator. So, naturally, the starter motor must be able to run in either direction to start the engine going ahead or going astern. To accomplish this, a special generator is required with ahead and astern connections which are fed current by one of two solenoids, actuated by switches in the operator's control handle.

The *Mercury* people recommend the connection of external circuits directly to the battery terminals.

Figure 10 shows the under-the-flywheel circuits of the *Oliver* ignition and alternator system. One coil with two pairs of "point" contacts is used to supply primary current to either of the two external high-tension coils in sequence. Additional under-the-flywheel coils generate alternating current which is fed to the external selenium rectifier.

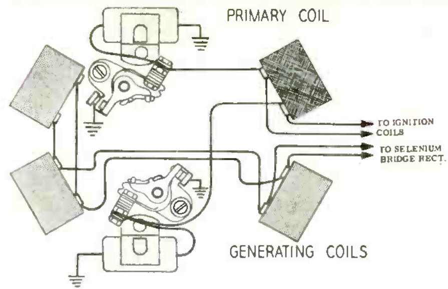


Fig. 10—A single coil and two sets of points are used in this system.

Installation of Accessories

In installing electronic gear on outboard boats, the same cautions regarding current consumption that apply to inboard boats should be followed. Since power availability from the battery charger may rate from an approximate low of about 24 watts for one motor to 120 watts for others, care should be taken before selling or attempting to

[*Continued on page 31*]

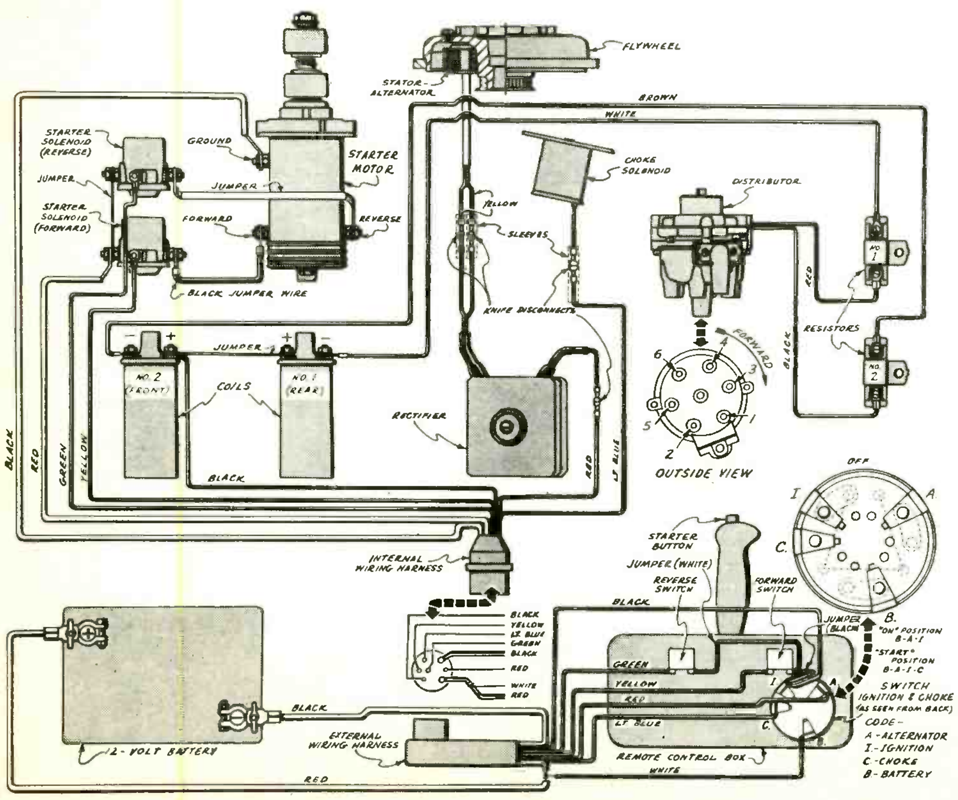


Fig. 9—Electrical sytem of the Mercury, "Mark 75" 6-cylinder motor.

"There's nothing wrong with you, doctor, that a new JENSEN NEEDLE won't fix up."

THE WORK BENCH

Service Problems And Their Solutions

by PAUL GOLDBERG
Service Manager

This Month's Problems:
a) Insufficient Height
b) Weak Picture

THE following are a few odd troubles that occur in television receivers. Methodical trouble shooting is of the utmost importance in solving these problems.

Philco RF 41-D-1

The receiver was turned on and it was observed that there was insufficient vertical size. The vertical oscillator, ½ 7N7, and vertical output tube were replaced individually but had no effect. The diagram was then studied. This receiver utilizes ½ the 7N7 as an ordinary blocking oscillator. The vertical output section uses a 6BQ6. This tube is normally used in a horizontal output stage and its characteristics prevent the use of a cathode vertical linearity control. Thus you will note the vertical linearity control is located in the grid circuit of the 6BQ6. The screen voltage required for this tube in this circuit is somewhere around 85 volts. Thus we see the use of resistors *R709* and *R708* in a voltage dividing network. Knowing these facts, voltage checks were made at the plate and screen of the 6BQ6, but the voltages were found to be about the correct value. The vertical linearity of the picture seemed normal so we eliminated the possibility of a leaky coupling condenser. Condenser *C703* across the secondary of the vertical output transformer was checked for leakage but was found to be satisfactory. Resistors *R819, R818, R702* and the height control *R706* were all checked for value and found to be correct. Before going so far as to replace the vertical output transformer or the yoke, filter condenser *C704* was bridged with a new filter. When *C704,* the screen bypass condenser was bridged, the height became normal. The defective *C704, 20 mf,* was then replaced with a new *20 mf,* filter. The receiver then functioned properly.

When the defective capacitor was checked it was found to be open. This open bypass condenser caused the screen grid to act in a degenerative fashion, thus lowering the output current of the 6BQ6.

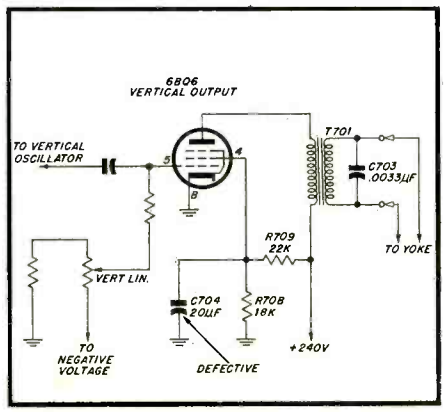


Fig. 1—Open condenser caused reduced height in Philco RF-D-1.

DuMont RA-112

The receiver was turned on and it was seen that the video was very weak and on some stations was barely visible. The sound however, was satisfactory. The diagram was then studied and it was observed that the sound was taken off at the plate of the second video *if, V206.* Thus, because the sound was normal we eliminated the possibility of trouble in the tuner or first and second video *if* circuits. The third video *if* tube *V207,* fourth video *if* tube *V208,* video detector *V209A,* 6AL5, and the video amplifier, *V210,* 6AC7, were all replaced individually but had no effect. The scope was set up and a wave form check was made at the plate of *V210,* 6AC7, the video amplifier. The signal was much too weak and barely distinguishable. The signal was also weak at the grid of *V210* and at the diode plate of *V209A.* Next, voltage checks were made at the plate, screen, and cathode of *V207,* 6BA6 and *V208,* 6BC5 and found to be approximately correct. The ohm-meter was next set up and resistance checks were made, starting at the plate of the video detector circuit *V209A.* The peaking coils *L219, L205, L201,* and *L203* were all measured and checked correctly. A resistance check was next made from pin 7 of *V209A* to ground. Here the ohm-meter measured about 6 ohms to ground. This was the trouble. The circuity was examined and *C220, 2.5 mmf.* was clipped off its ground connection. When this was done the ohm-meter no longer measured 6 ohms to ground, but now measured 3900 ohms to ground which was correct. When the shorted *C220* was removed and a new *2.5 mmf.* was installed the receiver then fuctioned properly. ■ ■

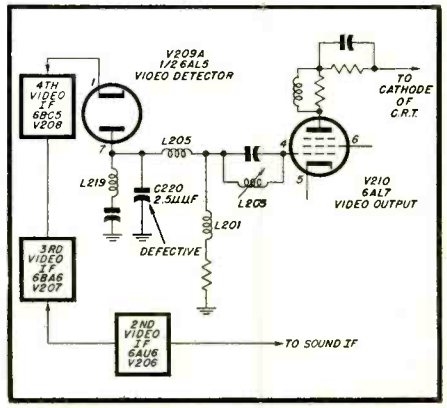


Fig. 2—A weak picture in this DuMont was caused by short in C220.

Mfr: CBS **Chassis No.** 1601/1602

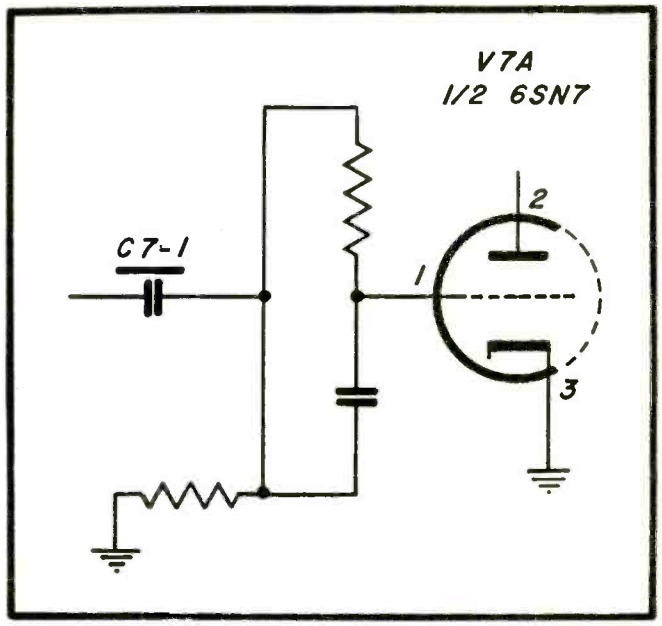
Card No: CBS 1601-1

Section Affected: Sync.

Symptoms: Horizontal pulling. Unstable horizontal hold.

Cause: Leaky *C7-1*.

What To Do:
Replace *C7-1*, .022 *mf*.



Mfr: CBS **Chassis No.** 1601/1602

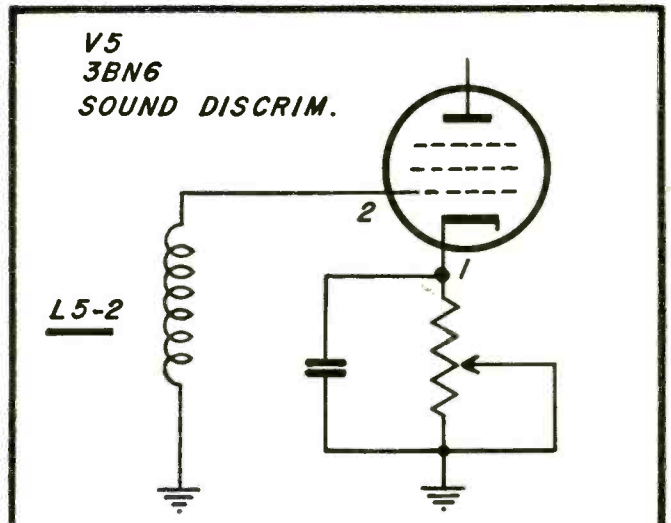
Card No: CBS 1601-2

Section Affected: Sound

Symptoms: Sound buzz.

Cause: Shorted winding in *L5-2*.

What To Do:
Replace *L5-2*.



Mfr: CBS **Chassis No.** 1601/1602

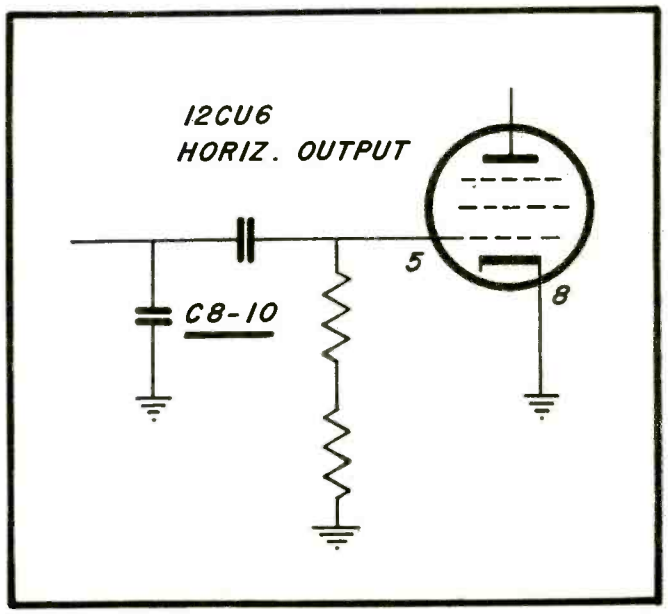
Card No: CBS 1601-3

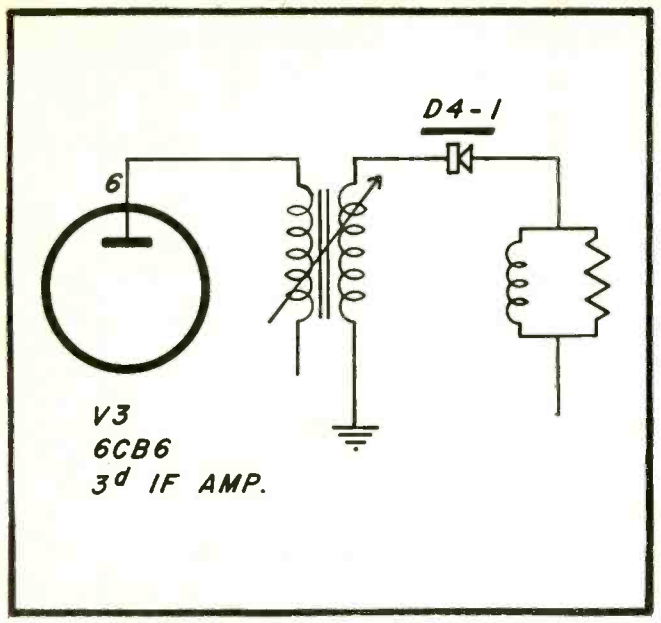
Section Affected: Raster

Symptoms: Lack of width. Blooming.

Reason For Change: Circuit improvement.

What To Do:
Change: *C8-10* (1500 *mmf*) to 1200 *mmf*.





Mfr: CBS **Chassis No.** 1601/1602

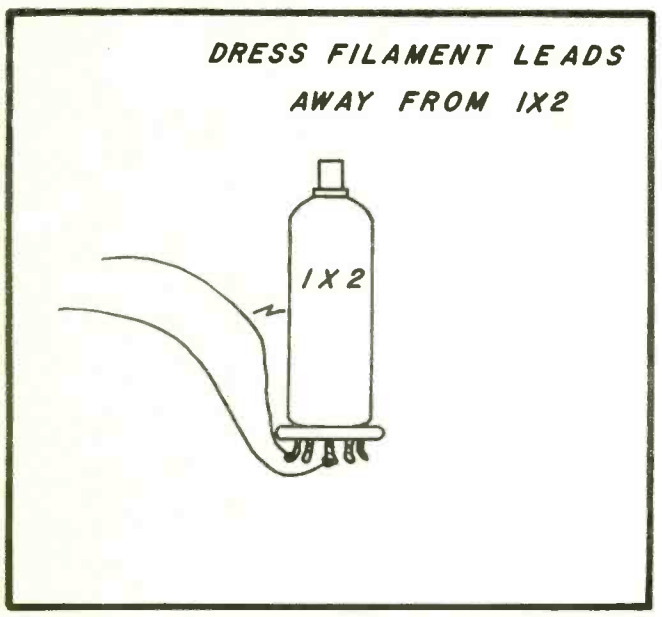
Card No: CBS 1601-4

Section Affected: Sync.

Symptoms: Horizontal pulling at low contrast levels.

Cause: Defective video detector crystal.

What To Do:
Replace *D4-1* 1N64.



Mfr: CBS **Chassis No.** 1601/1602

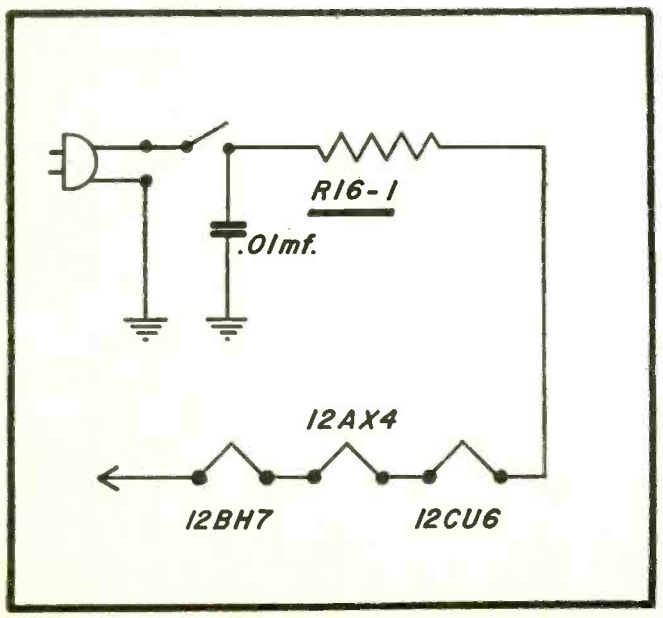
Card No: CBS 1601-5

Section Affected: High Voltage.

Symptoms: No high voltage. Repeated failure of 1X2B due to arcing.

Reason For Change: Circuit improvement.

What To Do:
Dress filament leads away from 1X2.



Mfr: CBS **Chassis No.** 1601/1602

Card No: CBS 1601-6

Section Affected: Raster

Symptoms: Lack of width. Pix blooming.

Cause: *R16-1* has changed value changing filament voltage of 12CU6 horizontal output.

What To Do:
Replace *R16-1*; 46 ohms, 25W.

MOTORBOAT ELECTRONICS

[*from page 27*]

install any heavy-drain equipment to insure that motor operation will keep the battery charged.

Special battery packs are available, which incorporate an outboard-motor battery charger, that can be plugged into a shore line to bring the battery up while the boat is not in use.

The radiotelephone ground-plate problem is somewhat aggravated on small high-speed boats, but this essential part of the installation should not be overlooked. The outboard motor itself is entirely insufficient as a ground for efficient transmitter operation. On some boats it may be possible to attach thin narrow strips of copper to both sides and the bottom of the keel, or on lap-strake boats, on several of the lower planks.

Another suggestion is to lay a screening of bronze window wire, or preferably, copper screen, flat against the bottom of the boat on the inside, securing it in place by the liberal use of copper tacks. While this "ground plate" will have no direct connection with the water, the capacitance of the large area of screening to ground should permit fair telephone operation.

On Fiberglas hulls, it is suggested that a thin copper sheet can be laminated to the bottom of the boat on the outside, using epoxy resin, such as is used for securing Fiberglas patches to hulls. This will cure at ordinary air temperatures, providing a firm bond. Suitable material is available from suppliers of plastic products. When installing a ground plate in this manner, the copper should be squeegeed very carefully so air pockets do not form which would damage the bonding to the hull. To run a ground bolt through a plastic hull, drill and tap the hole, then dunk the the bolt in resin before screwing it in from the outside. Install a rubber washer, as well as a bronze washer, and terminal nuts, of course, on the inside of the hull.

Go at it properly, and there is no reason why the vast outboard boating market should not soon become an important part of your marine-electronics business. ■ ■

Mfr: Firestone **Model No.** 13-G-168

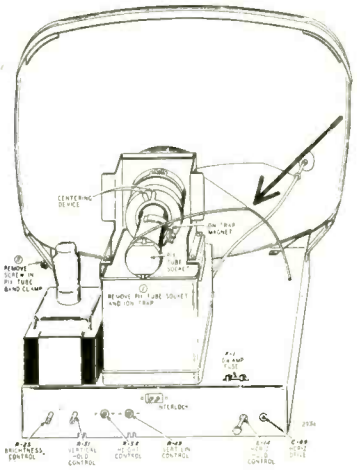
Card No: F13G-168-1

Section Affected: Sync.

Symptoms: Poor stability—Picture jitter at high contrast settings.

Cause: Field pick up by the CRT control grid lead.

What To Do:
Dress CRT grid lead away from sync. tubes on chassis by use of spring fastened to yoke bracket.



Mfr: Firestone **Model No.** 13-G-168

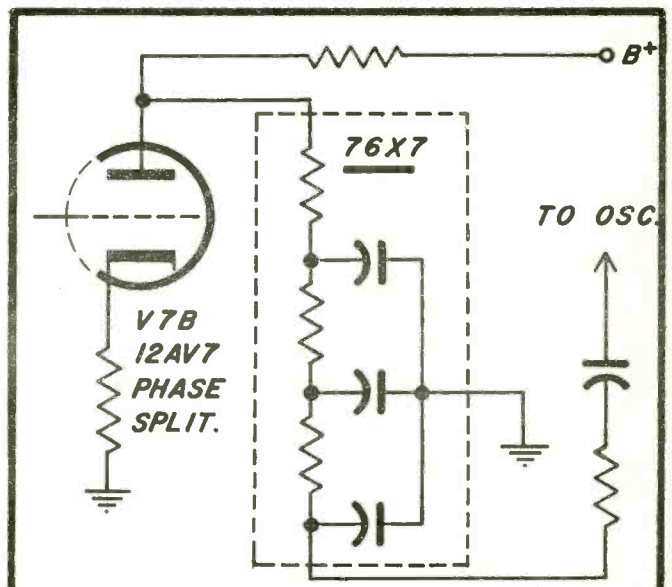
Card No: F13G-168-2

Section Affected: Sync.

Symptoms: No vertical hold. Horizontal normal.

Cause: Defective integrator network.

What To Do:
Replace printed circuit unit 76X7.



Mfr: Firestone **Model No.** 13-G-168

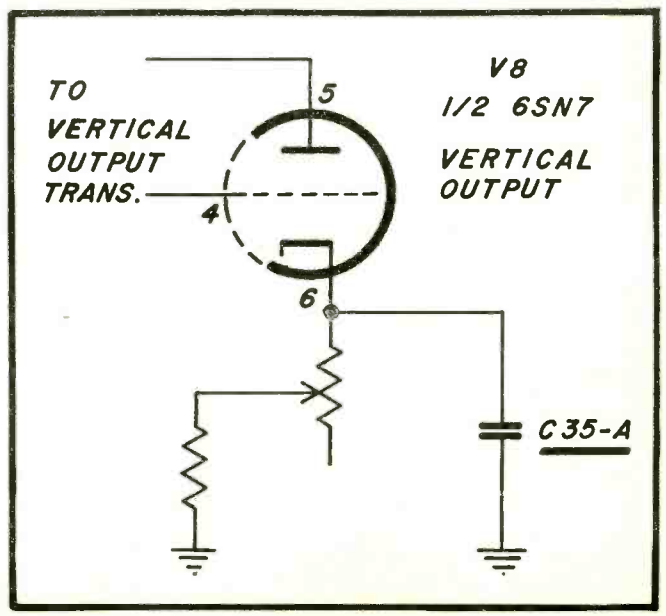
Card No: F13G-168-3

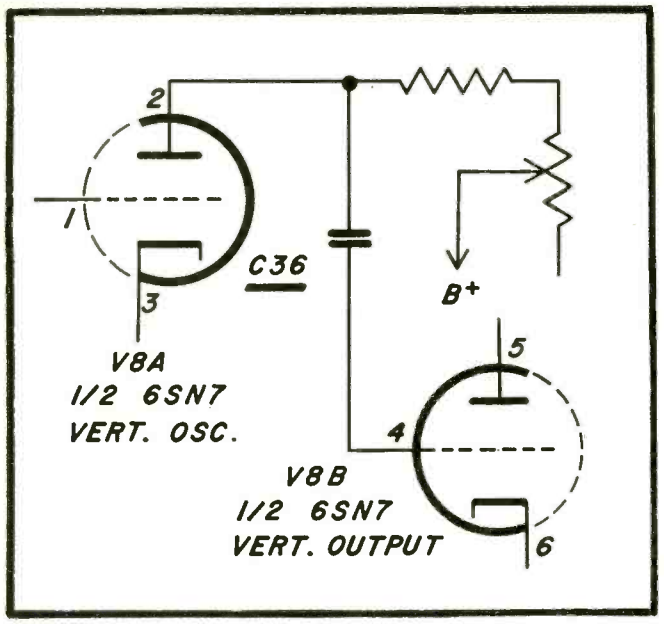
Section Affected: Raster

Symptoms: Poor vertical linearity. Lack of height.

Cause: Defective *C35A*—loss of capacity.

What To Do:
Replace *C35A*, 100 *mf.*





Mfr: Firestone **Model No.** 13-G-168

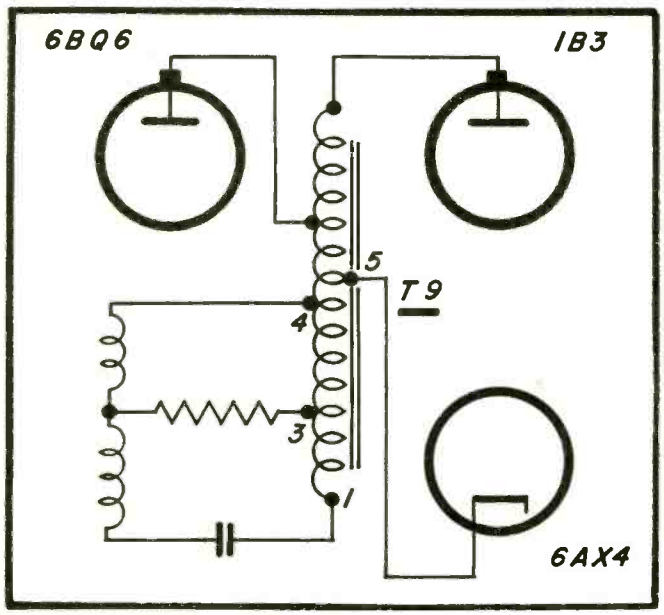
Card No: F13G-168-4

Section Affected: Raster

Symptoms: Poor vertical linearity. Fold over at bottom.

Cause: Leaky or shorted *C36*.

What To Do:
Replace *C36*, .1 *mf*.



Mfr: Firestone **Model No.** 13-G-168

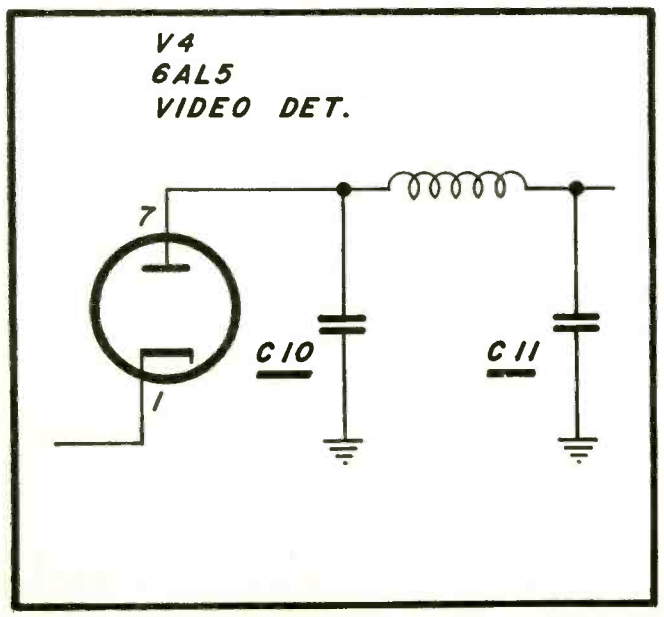
Card No: F13G-168-5

Section Affected: Raster

Symptoms: No raster—6AX4 overheating.

Cause: Shorted flyback transformer, *T9*.

What To Do:
Check terminals #1, 3, 4 and 5 of transformer T9 for low resistance to chassis. Replace T9 if defective.



Mfr: Firestone **Model No.** 13-G-168

Card No: F13G-168-6

Section Affected: Pix.

Symptoms: Poor resolution.

Cause: Leaky *C10* and *C11*.

What To Do:
Replace *C10* and *C11*, 5*mmf* each.

PRODUCTION LINE FUGITIVES

[*from page 7*]

Some manufacturers use a 50-50 ratio and one in particular uses a 70-30 ratio, but with the latter the hold and lock-in is quite critical.

The following troubles are less specific and are most often intermittent so far as set operation is concerned.

Philco C-1. Deflection Chassis Using 7N7 Final Sync & Vertical Oscillator

Several of these sets were found with unsoldered connections on the 7N7 tube socket, and on one set the only leads soldered were the filament leads. The result was intermittent sync or vertical deflection. One or the other would cease to operate with the slightest tapping of chassis.

Teleking—Extremely Sensitive to Tapping

Visual inspection revealed a seven lug terminal strip with about fifteen wires connected to it, and not a drop of solder on any of the lugs.

GE "K" Line—Intermittent Video

This set using the component board assembly common to GE had fading video. It was found that if the board containing the video components was pressed slightly, the pix would come and go. A close examination of all connections on and to the board revealed nothing, but after sweat soldering the entire board the trouble cleared. The component board consists of a fiber board with hollow rivets through it. The component leads are inserted in the rivets and the entire assembly is dip soldered, thus the solder to each lead is not visible to inspection.

One other set with a built-in fault was an RCA 12 inch picture tube set. The customer had purchased the third picture tube for this set in less than four years. Now with the new tube no raster was obtainable. Voltage checks to the picture tube socket showed the tube to be biased beyond cutoff, and a wiring check turned up a resin joint in the brightness control wiring.

This discussion of factory made faults does not include the faults of circuitry in receivers which operate improperly in the field, and for which circuit changes were recommended. It is suggested however when a stubborn fault is encountered, that a review of factory notes be made, to discover if subsequent changes are recommended to cure these faults. ■■

SERVICING INTERMITTENTS

[*from page 9*]

the lead is connected to the coil. A slight pull on the lead may cause the faulty condition to develop. Trouble within *if* cans is especially annoying and deceptive. When an *if* appears defective, double-check your conclusions by means of voltage or resistance measurements. In fact, *any* apparently defective part should be double-checked because false conclusions are common when the trouble is an intermittent.

It is often possible to repair a defective coil or transformer, if the break can be seen and is accessible. A delicate and patient touch is required. Clean the insulation off the coil wire where it is to be soldered. Use a small soldering iron. Where necessary, secure the wire with tape to prevent pulling at a vulnerable point.

Miscellaneous Troubles

A cold soldered connection often causes intermittent operation (as well as permanent failure). The connection may appear to be properly soldered, yet may be held together through the adhesive property of rosin, making only mechanical contact. It is often necessary to resolder many connections, all of which appear normal, to resolder the cold connection causing trouble.

A tube, loose in its socket, can cause intermittent receiver failure. The holes,

in which the tube prongs fit, may be too large, causing poor contact. Or the holes or tube prongs may be tarnished.

Tarnished switch contacts, or worn contacts, are a frequent cause of trouble. Recurrent trouble may be due to a poor ground through a rivet or screw. When a wire or part is grounded with a rivet or screw, paint or corrosion may cause trouble, although the connection appears proper.

In the home, a defective antenna lead-in (corrosion at the antenna, at the lead-in point of entrance into the house, or a broken lead-in), or a badly rusted or corroded antenna, are common causes of intermittent TV operation, breaking down of the picture and sound, and recurrent loss of sync. If rabbit-ears are substituted for the antenna, to check this type of trouble, sync troubles may persist due to a weak signal being picked up by the rabbit-ears. This fact should be kept in mind, to prevent false conclusions; the sync may be normal when a good outdoor antenna and good lead-in are provided.

Conclusion

Few servicemen enjoy fixing intermittents. Such repairs are often exasperating and unprofitable, yet necessary to maintain customer good will. It is a good idea to make a note of information on intermittent conditions likely to develop in certain receivers, and the part likely to be defective. Such information is found in *Video Speed Servicing Systems* Data Sheets, published in each issue of ELECTRONIC SERVICING. New data sheets are published monthly. Systematic study of this data will enable you to fix intermittents, as well as other troubles, more quickly and more profitably.

Servicing intermittents, and other types of elusive troubles, requires a great deal of knowledge and considerable patience. ■■

HORIZONTAL RETRACE BLANKING

[*from page 5*]

horizontal retrace a negative pulse developed across *C83* is applied to the first anode of the CRT to cancel the B plus applied through *R35* thus accomplishing blanking.

The Olympic 21CV16 employs the circuit shown in *Fig. 7*. This circuit makes use of a resistive type voltage divider. Resistors *R80* and *R35* act as the voltage divider to reduce the intensity of the pulse taken from the flyback while *C66* is a blocking condenser that prevents the B plus from reaching the control grid of the CRT. The negative pulses coupled through *C66* cut the CRT off during retrace. Notice that the vertical blanking pulse is also fed to the control grid.

If a set exhibits the need for horizontal retrace blanking any of these circuits may be used. The circuit selected should be the one most easily adapted to the set. That of *Fig. 5* is the least practical since it requires the addition of a triode. The circuits shown in *Figs. 6* and *7* are more practical since they require only a few additional components and slight circuit modification. A simple horizontal blanking circuit suitable for most sets is shown in *Fig. 8*. Resistors *R1* and *R2* are connected across the deflection yoke. The first anode is connected to the mid-point of the two resistors. The voltage at this point contains the negative pulse which occurs during retrace. The pulse voltage applied to the first anode may be controlled by varying the value of *R2*. A good starting value is about 330,000 ohms. As the value of *R2* is reduced the *ac* component is lowered and the amount of blanking is reduced. Excessive blanking is indicated by a shadow encroaching upon the left side of the

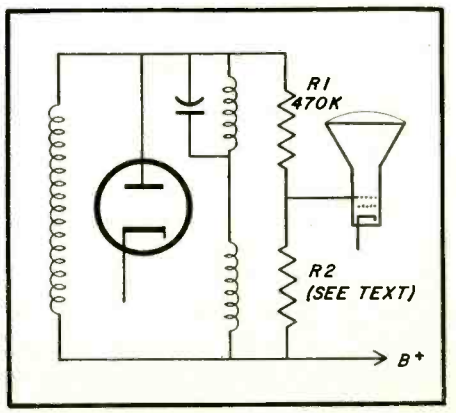


Fig. 8—Simple circuit for providing horizontal retrace blanking pulses.

picture. *R1* and *R2* should be ½ watt resistors.

Service Problems

The service problems that may arise in horizontal blanking circuits are for the most part, routine in nature. There are three major defects which may occur. These are: 1—Loss of raster; 2—Loss of brightness control action; 3—Excessive blanking (shadow on left side of screen).

In the circuit shown in *Fig. 5*, leakage in *C278* would impair the action of the brightness control because of the introduction of positive voltage to the control grid. This would cause a constant raster and the CRT could not be cut off. The circuit shown in *Fig. 6* may develop several defects. The raster would be lost if *C83* shorted, due to the grounding of the first anode. Should *C83* open, the *ac* voltage divider action would no longer take place and the full pulse voltage would be applied to the first anode. This would result in excessive blanking and appear as a vertical shadow encroaching upon the extreme left portion of the picture. The circuit of *Fig. 7* could produce a problem similar to that mentioned for the circuit shown in *Fig. 5*. If *C66* develops leakage, it will reduce the effectiveness of the brightness control, making it progressively less effective as the leakage increases. ■■

1957 PHILCO TV

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the remaining trap provides reduction of the associated sound signal at 41.25 *mc*. The latter is necessary to assure the proper ratio of sound to video carriers for the 4.5 *mc* intercarrier system.

One stage of video amplification is used, with the output coupled to the CRT cathode. Sound is taken from the output of the video amplifier stage by means of a transformer, whose primary is a 4.5*mc* trap in the video output circuit. The sound system contains a sound *if* amplifier (4.5*mc*), dynamic limiter, dual crystal-diode discriminator, first audio and audio output stages. Certain chassis of these series contain a duo-diode tube in place of the crystals in the discriminator stage. Composite video from the video amplifier output is coupled to a conventional triode sync-separator stage from which is obtained composite negative-going sync pulses. The *agc* voltage is developed partially in the video detector output circuit and also from the grid current of the sync-separator stage. This voltage is supplied to the tuner and to the first and second *if* stages.

Sweep Circuits

The output of the sync separator feeds both the horizontal and vertical sweep circuits. A duo-triode tube in the vertical section is employed as a modified blocking oscillator and vertical output stage to feed the vertical deflection circuits. The vertical sync signal is applied to the cathode tap of the autotransformer of the oscillator. The inductive action of the transformer places a high positive overshoot on the sync pulse which by the action of the transformer is applied to the grid of the oscillator for synchronizing purposes. An *R-C* network from one side of the vertical output transformer to the CRT grid provides vertical retrace suppression.

A phase comparer employing dual selenium diodes controls the frequency of the horizontal oscillator, a cathode-coupled multivibrator. The horizontal output stage, high voltage and deflection circuits are conventional. Horizontal width in this chassis series is obtained by a width link in the screen circuit of the horizontal output tube. The width link shorts out a portion of the voltage divider network in the screen circuit to provide width variation. On 24-inch models the width link is replaced by a width coil.

Power Supply

The transformer-operated power supply provides full-wave rectification. The transformer contains a 12 volt center tapped winding. Filament supply voltages are obtained from the center tap to either side of the winding. The entire 12 volt winding is used to power the stepper motor for the automatic tuner system.

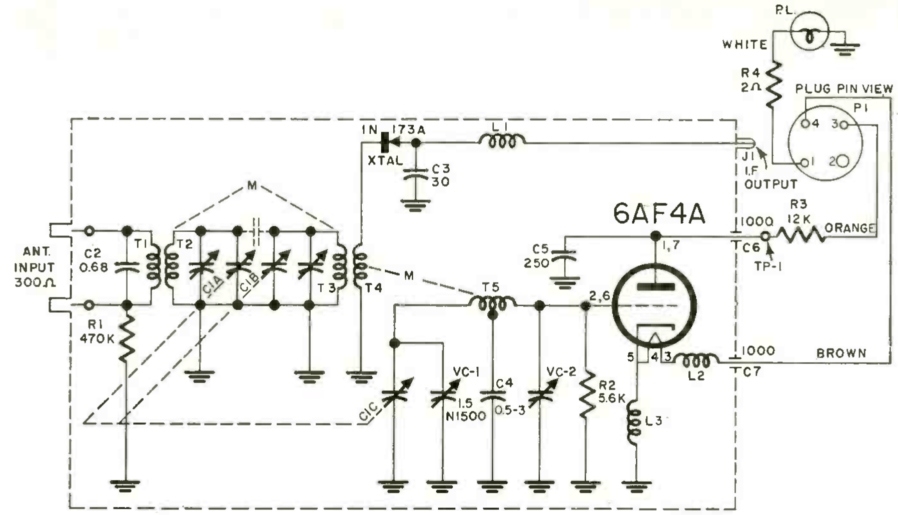

Fig. 8—Schematic of the Model UT-27 *uhf* tuner. This tuner is used in the chassis of the 7L40 series and tunes through all *uhf* channels.

UHF Tuner

The *uhf* tuner used in the chassis of the 7L40 series is the UT-27. This unit tunes through all *uhf* channels. It contains a *vhf-uhf* change-over switch which provides power to the unit and connects the unit into the *vhf* tuner circuit. It is also provided with a jack and a test point for operational checks.

The circuit of the tuner is illustrated in *Fig. 9*. The incoming *uhf* signal is coupled through a 300 ohm antenna input line to the antenna coupling inductor, *T1,* and transferred to the antenna tank circuit. Mutual coupling of *T2* and *T3* with the stray capacitances existing in the tank assemblies couples the signal to the mixer tank *T4*. A 6AF4 tube is used in the oscillator circuit, the output of which is coupled by mutual inductance of *T4* and *T5* to the mixer circuit which employs a 1N173A crystal. The output of the mixer, a 45.75 *mc* video *if* carrier signal, is coupled by coaxial cable to the *uhf* input of the *vhf* tuner.

In *uhf* position, the local oscillator in the *vhf* tuner is inoperative due to the switching arrangement and the *rf* amplifier and the mixer of the *vhf* tuner operate as *if* amplifiers.

The purpose of the antenna and mixer tank circuits is to pass only frequencies of desired incoming signals (selectivity) and to prevent possible feedback of the oscillator signal to the antenna where radiation might cause possible interference with other receivers.

The mechanical coupling arrangement of the UT-27 tuning assembly permits fast tuning of a desired *uhf* channel along with vernier tuning for precise adjustment of the *uhf* channel. An antenna crossover network panel is available with these tuners for *uhf* and *vhf* signal reception with single antenna lead-in. The crossover panel provides a high-pass filter to the input of the *uhf* tuner adapter for *uhf* signals and a low-pass filter to the *vhf* tuner on *vhf* signals, thus isolating the inputs of both tuners one from the other.

UHF Tuner-Adapter Operational Check

The operation of the crystal mixer stage can be checked by connecting a milliammeter, with a *dc* resistance of 25 ohms or less, from the crystal output test point, J1 of *Fig. 9,* to ground. The current should be within 0.5 to 5.0 *ma*. Should the crystal be found defective, it is easily accessible for replacement. A test lug is available on the tuner to check the oscillator plate voltage. This test point is TP-1 in *Fig. 8* at which point the voltage should be approximately 60 volts to ground.

Replacement of the *uhf* oscillator tube may cause a detuning affect. To avoid the necessity of realigning the unit, a number of tubes may be tried until the most satisfactory substitute for the original is found.

[*To be continued*]

Advertisers' Index