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Electronic Servicing

Formerly PF Reporter

WARRANTIES...

a special report, page 26

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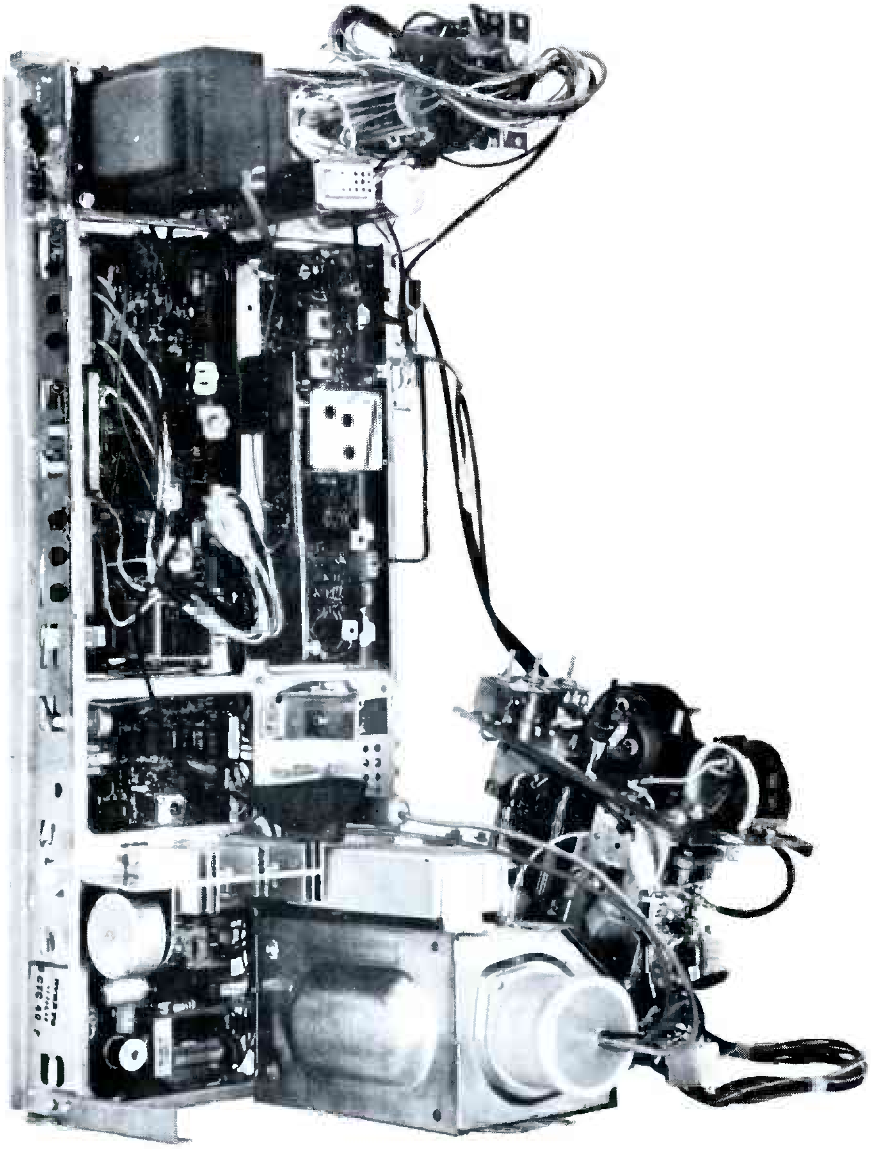

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*one tube rectifier

RCA

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September, 1969 • Volume 19, No. 9

Electronic Servicing

Formerly PF Reporter

in this issue...

DEPARTMENTS

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electronic scanner

news of the industry

AM Receiver in a Single IC

Amperex Electronic Corporation has announced the development of a complete AM radio receiver on a single integrated-circuit chip. Designated the TAD100 and available in a 14-lead, dual-in-line package, the device contains all the active components for a complete AM radio receiver: oscillator, mixer, IF amplifier, detector, AGC and audio preamp and driver stages.

An external high-frequency RF front end with the addition of an Amperex TAD100 can also be used as an FM receiver since its frequency response permits its input to be used as a 10.7-MHz IF amplifier.

Performance of the TAD100 receiver reportedly equals that of a quality AM receiver made from discrete components: AM sensitivity is 50 microvolts/-meter for 100 milliwatts audio output; AGC range is 65 dB for an audio output change of 10 dB; and total harmonic distortion is typically 2 percent.

Complete AM and FM radio using the TAD100 can operate on battery supplies from 6 to 9 volts, with quiescent current drains as low as 15 ma. The TAD100 dual-in-line package measures less than 0.68 inch long, 0.255 inch wide and 0.197 inch high. It can be soldered directly into wired circuits, or it can be dip- or flow-soldered into standard printed-circuit boards.

Craig Opens Eastern Branch

Craig Corporation, Los Angeles, has opened its first eastern branch operation, a 50,000-square foot combined office and warehouse facility located at 50-52 Joseph Street, Moonachie, N.J.

The expansion move ties closely to Craig's debut in June as a producer of color and black-and-white television receivers, and introduction of an expanded new line of car stereo and tape recorder products. It reportedly will bring deliveries many days closer to distributors and dealers in eastern and some central and southern area markets. Consumer electronic products will be shipped direct to the new plant for complete in-house quality control, servicing, warehousing, and shipping.

The new facility houses customer service and parts department operations, quality control, factory technical, general warehousing staffs, and office space for eastern region sales office personnel representing Craig's Products Division.

Donald R. Fisher, former Seattle Branch operations manager for Craig, has been promoted to branch manager of the New Jersey facility, which also serves as new headquarters for Syl Pitasi, eastern manager for the Products Division.

Craig operates six similar warehousing facilities. Two are headquarter-based in Los Angeles. Others, operating in conjunction with branch sales operations are located in San Francisco, Seattle, Denver and Honolulu.

Former "Hard-Core Unemployed" Graduate From RCA Pilot Electronic Course

Thirty young New York ghetto residents, recent

graduates of RCA's 12-month pilot electronics course for so-called "hard-core unemployed", have been employed as apprentice technicians by RCA Service Company. One other graduate has accepted a similar position in his native Puerto Rico.

Only nine of the original 40 enrollees failed to complete the special course in radio and television technology operated by RCA under a contract with the U.S. Department of Labor and the National Alliance of Businessmen. Those who failed to complete the course were dropped for either poor attendance or academic dificiencies.

Another 40 young men from New York's ghetto areas already are receiving training in a similar 12-month course that involves four hours of instruction daily and four hours at various jobs with RCA and its subsidiary offices in New York. Each students receives a full-time salary and other RCA company benefits while in the program. Those graduating receive salaries of approximately $100 a week as apprentice technicians.

The program is one of a number now under way at RCA to train the "hard-core unemployed" as radio-TV technicians and, thus, "help meet a severe shortage of radio-TV servicemen," according to a spokesman for RCA.

Setchell Carlson Leaves Consumer TV

Setchell Carlson, producer of TV sets for the past nineteen years, has quit the consumer TV business.

Marquette Corporation, owner of Setchell Carlson since 1966, has announced the sale of its Setchell Carlson assets, including the closed-circuit monitor and related educational business, to Audiotronics Corporation, a North Hollywood, California, educational equipment supplier.

According to Richard L. Lange, President of Marquette, that company has quit the consumer TV-phonograph business and will concentrate on the automotive service equipment field.

Setchell Carlson is credited with being the pioneer of modular chassis, which they labeled "Unitized."

Another long-time producer of consumer TV, Westinghouse, recently announced their "bow-out" of the consumer TV field.

Roberts Portable VTR Uses ¼-inch Tape

A portable battery video tape recorder that uses ¼-inch tape has been developed by Roberts.

The unit, designated Model 1050, features its own video monitor, 20 minutes of record time on a 5-inch reel, better than 250 lines resolution and can be adapted to AC power. The complete system—including camera, recorder and monitor—weighs under 20 pounds.

The VTR system, complete with AC adapter/battery charger, will retail for less than $1800.00.

FM Broadcasters Push For AM & FM on All Radios

The National Association of FM Broadcasters is planning action to encourage Congress to hold hearings before the end of the year on House and Senate bills which, if passed into law, would require all radios imported and manufactured in the United States to have both AM and FM bands.

According to a recent report in **Home Furnishings Daily,** a spokesman for the FM Broadcasters said it is hoped that the bill will become law by early 1970. ▲

Color Chassis Help Offered

I read the letters to the editor section of ELECTRONIC SERVICING very carefully. In the February, 1969 issue a Mr. Warren Haferkamp of Hazelwood, Missouri, requested some help in handling color chassis during bench servicing. The color chassis is quite bulky for the average service bench, but with a few modifications bench servicing of the color chassis can be made tolerable.

Each television technician must appraise his own shop's capabilities as to available space and test equipment location. Some very helpful suggestions that I can pass on to Mr. Haferkamp are to either purchase a commercial color test jig with a color kinescope, yoke and convergence system, or to build his own test jig from parts cannibalized from an old, unrepairable color set . . .

Mobility is the key to effective color servicing. All my color test equipment can be moved to the color test jig within minutes. A mobile test equipment bench can be built easily using one-half inch plywood for the bench top; the leg supports can be made from two-by-three-inch standard studding lumber; and each leg should be castered. This mobile bench can move all the necessary color testing equipment right to the color test jig. All the necessary lumber, casters and hardware can be purchased at the local lumber or hardware dealer at a nominal cost. No technician can specify exact dimensions for a mobile bench of this type because shop space variations control size and shape, etc. The suggestions outlined in this letter have worked successfully for me. With a little initiative and proper planning, any color chassis handling problem can be solved.

William P. De Rita
48 Wainwright St.
Providence, RI 02908

(Continued on page 8)

Help Needed

I am in need of a schematic for the Solar Capacitor Tester CF 160. This company is no longer in business and I have been unable to obtain any information on this tester.

I would appreciate any help your readers could give me.

Steve P. Christian
23653 Hazen
Southfield, Mich. 48075

Radio Tubes for Sale

I have old radio tubes for sale at reasonable prices. If any of ELECTRONIC SERVICING readers are interested, please write:

G. C. Goodwin
Goodwin Radio Shop
Rankin, Ill. 60960

Back Issues

If you know of anyone interested in acquiring a library of PR REPORTER, I have all of the issues from January, 1954 through December, 1968, in good condition.

George D. Snyder
139 Greenwich Street
Reading, Pa. 19601

Receiver Noise Figure Explained

In your June, 1969, issue the article "TV Antenna System or Receiver Defect" by Bruce Anderson contains a statement regarding receiver noise which I believe could be misleading to your readers.

The statement reads: "The IF bandpass of a color receiver is somewhat more broad in most instances, increasing the inherent receiver noise. (Receiver noise varies directly with bandpass)."

This statement, I feel, can be misinterpreted. The noise figure of a device is established by electron shot noise, etc., and is primarily determined by the gain and noise figure or noise temperature of each stage of the device:

$$f = f_1 + \frac{f_2 - 1}{G_1} + \frac{f_3 - 1}{E_1 G_2} \text{ etc.}$$

Also, if the antenna is connected, as in the case of a receiver, this contributes to the device or system noise temperature. The noise figure (a figure of merit expressed in dB or as a number) and/or the noise temperature (expressed in °K) is independent of bandwidth. For a given receiver with a given noise figure, the bandwidth will directly affect the receiver's sensitivity and signal-to-noise ratio requirements.

Since the subject of receiver noise is often confusing to the technician, I though it should be clarified.

I wish to compliment you on your fine magazine. I recently returned to TV servicing after a number of years and still find SAMS and PHOTOFACT serving the industry well.

Frank Heverly
Richardson, Texas

▲

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Vertical Sync Simplified

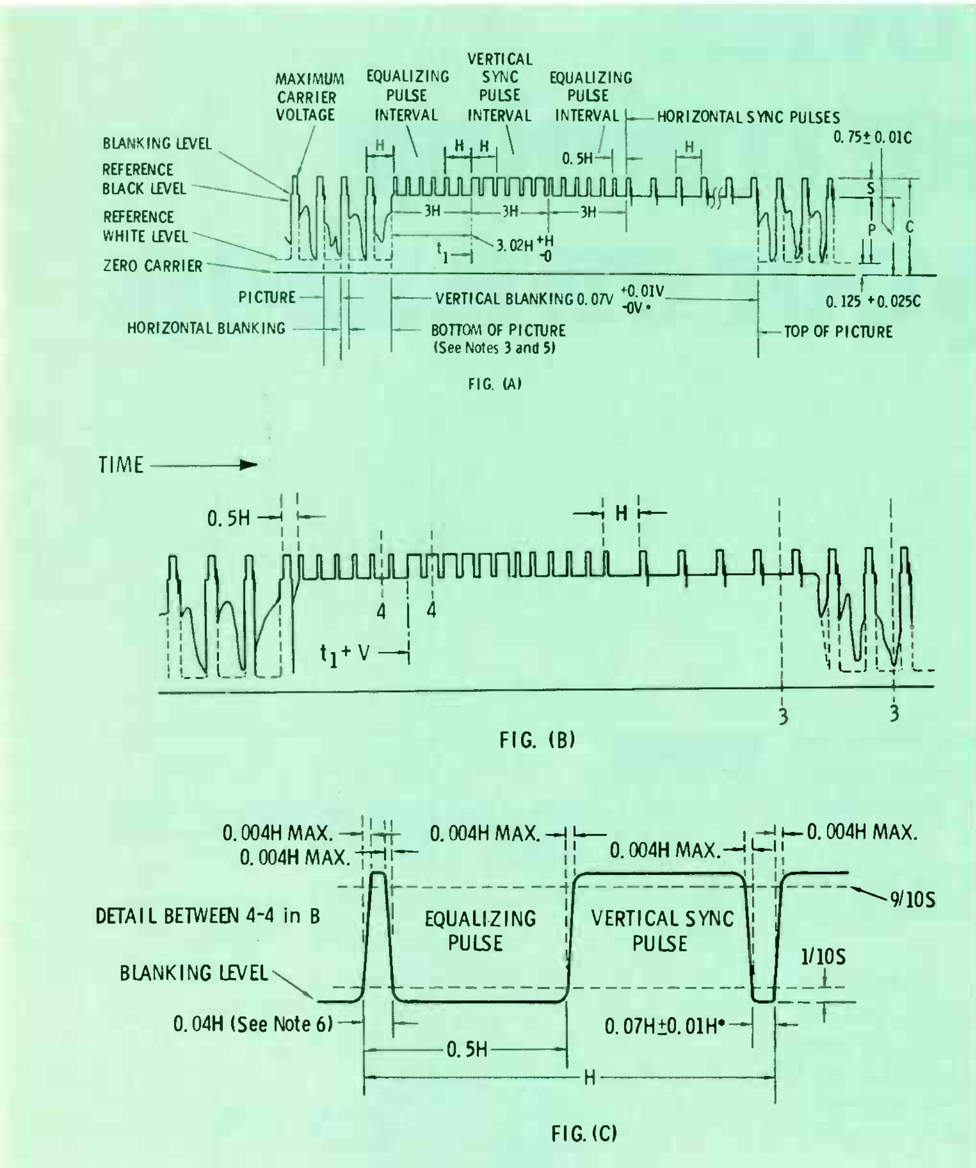

Fig. 1 Television signal standards.

NOTES:

1. H = Time from start of one line to start of next line.
2. V = Time from start of one field to start of next field.
3. Leading and trailing edges of vertical blanking should be complete in less than 0.1H.
4. Leading and trailing slopes of horizontal blanking must be steep enough to preserve minimum and maximum values of (x + y) and (z) under all conditions of picture content.
5. Dimensions marked with asterisk indicate that tolerances given are permitted only for long time variations and not for successive cycles.
6. Equalizing pulse area shall be between 0.45 and 0.5 of area of a horizontal sync pulse.

Analysis of circuit action, common troubles and logical troubleshooting techniques.

by Bruce Anderson

When one begins to consider the vertical synchronizing system of a television receiver, probably the first conclusion reached is that there is really very little circuitry involved. This is true in the narrowest sense, but since the proper operation of so many other parts of the instrument is necessary for good sync, some of the more difficult service problems to come into the shop are sync problems. Because of this, not only the sync separator itself, but also the other receiver circuits which may affect vertical sync are discussed in this article.

The Vertical Sync Signal

Broadcasting standards in the United States were chosen as a reasonable compromise between number of frames per second, number of lines per frame, and a reasonable bandwidth for the channels. Each channel, containing both video, synchronizing and audio signals, (and later, color) was assigned a total bandwidth of 6 MHz. This allows a total of 15,750 horizontal scanning lines per second, which can be used to display 30 complete frames, each containing 525 lines. It was determined that the quality of the presentation is enhanced by a process called interlaced scanning, in which every other line of the frame is displayed as one field and the alternate lines of the same frame are presented as a second field.

From the above, we can see that the synchronizing pulses, which are transmitted to cause the receiver vertical-deflection circuit to be synchronized with the vertical scan of the camera, must be generated at a rate of 60 pulses per second. Further, these pulses must be synchronized with the horizontal scanning lines so that one field begins at the start of a horizontal line and the next field starts at the center of the 263rd horizontal scanning line. The third vertical sync pulse then will be coincident with the start of the 526th horizontal line, the fourth field starts at the center of the 788th line, etc.

It is interesting to note that some low-cost, closed-circuit TV systems do not use synchronized interlacing (as the technique just described is called). Instead, the vertical and horizontal sync pulses are not synchronized to each other, and this is known as random interlace. There is, of course, some degradation of the display, but the reduced cost and relative simplicity of the sync generating equipment may offset the disadvantage of a somewhat poorer picture.

With the advent of compatible color telecasting, it became necessary to modify slightly the scanning standards in order to minimize the effects of beats in the receiver caused by the interaction of the chroma and sound subcarriers. For several years, the stations equipped to originate color programs were using the new scanning standards, but stations not so equipped still used the monochrome standards. Some of these stations occasionally broadcast network color programs, in which case they used network sync for color and their own monochrome sync the rest of the time. Now, the color sync rates are almost universal. These are 15,734.264 horizontal sync pulses per second, and 59.94 vertical sync pulses per second. 262.5 lines still make one field, and of course, a frame contains 525 lines. Since the new scanning standards are so nearly the same as the former ones, no modification of pre-color monochrome receivers was necessary.

Sync Separation

Since the sync pulses, both horizontal and vertical, must be transmitted along with the video information (to conserve spectrum), it is necessary that they be made different in some way from the remainder of the signal. This is done by transmitting the sync pulses at a higher level of amplitude than the maximum level ever attained by the video. In broadcasting, an amplitude scale of from 0 to 140 is normally used to measure the composite video. On this scale a white picture is at an amplitude of about 12 and a black picture reaches an amplitude of about 93. During the interval in which the sync pulses are transmitted, a pedestal is generated at an amplitude of 100, and the sync pulses, which ride on top of the pedestals, reach an amplitude of 140, the maximum output power of the transmitter. These four levels are known as the white level, black level, blanking (or pedestal level) and sync-tip level, respectively. Fig. 1 shows the standards for both the amplitude and timing of the sync pulses.

Notice in Fig. 1 that a series of pulses at twice the frequency of the horizontal sync pulses precede and follow the vertical sync pulse. These are known as the equalizing pulses. If it were not for these, the interval between the last horizontal sync pulse of a field to the start of the vertical sync pulse would be twice as long for even-numbered fields as for odd-numbered fields (remember that the odd fields start in the middle of a horigontal line). The equalizing pulses are generated so that the interval from the last one of these to the vertical pulse will always be the same. Insofar as the horizontal oscillator is concerned, the extra pulses at the center of a scan line have no effect on its frequency.

The vertical sync pulse itself is not truly a single pulse, but consists of a series of six wide positive pulses and five intervening, narrow negative pulses. For this reason, the vertical sync pulse sometimes is called a **serrated** pulse. The reason for this shape is that some means of synchronizing the horizontal oscillator is necessary during vertical retrace time. By **differentiating** the serrated pulse, positive pulses similar to the equalizing pulses are recovered and fed to the horizontal oscillator. Every other one of these is used as a horizontal sync pulse. By **integrating** the serrated pulse, a single positive pulse may be derived, and this is what is actually used to synchronize the vertical oscillator.

Since the amplitude of the sync pulses is greater than the amplitude of the video, they may be recovered from the composite signal from the receiver second (or video) detector simply by feeding the composite signal to a stage which is biased so far below cut-off that only the sync pulses can drive it into conduction. Fig. 2 shows a simplified circuit designed to do this. Actually, two circuits are shown, one using a tube and the other a transistor; otherwise, they are essentially the same.

From Fig. 1 we see that if the peak amplitude of the composite signal is three volts, the only part of the signal which exceeds about 2.25 volts is the sync pulses. Therefore, by applying a fixed cathode (or emitter) bias which is 2.25 volts greater than the cut-off voltage of the device, only the sync pulses will be amplified. The video signal, of course, cannot drive the stage out of cutoff.

In practice, the circuits of Fig. 2 will not work very well; the input coupling capacitors will "average" the input, producing a bias voltage on the sync separator grid (or base) which will become more positive when a dark scene is being received and less positive during reception of lighter scenes. Because of this, the amplitude of the output sync pulses would vary with the overall illumination of the scene, leading to a tendency of the picture to pull and roll.

(This characteristic of bias to vary with average video level may be demonstrated by connecting a servicing-type scope to the output of the video detector of a receiver. Notice

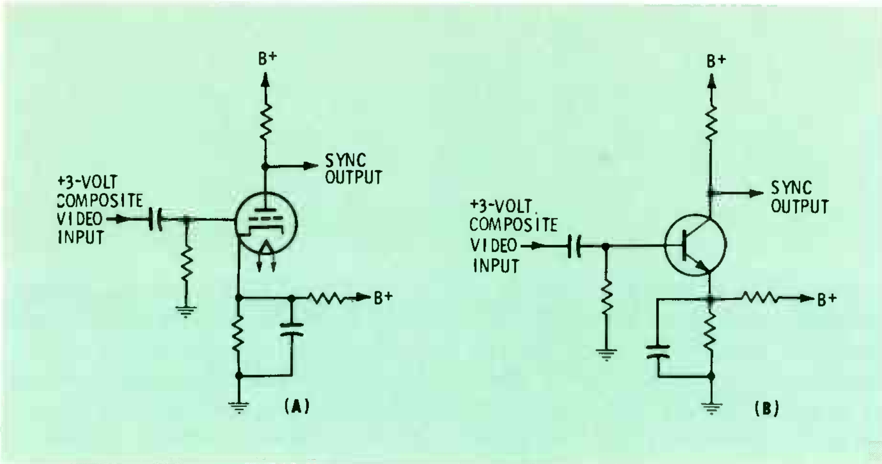

Fig. 2 Simplified sync separators.
A) Vacuum tube circuit.
B) Transistor circuit.

grid voltage approaches the cutoff point, that the instantaneous plate voltage changes only slightly. If the grid components and the drive signal are selected so that the sync pulses drive the grid into cutoff, but the video does not, the instantaneous plate voltage will rise to B+ when the sync pulse is present and will remain at a nearly constant, very low value at all other times. This results in very great amplification of the sync pulses and practically no amplification of the video; therefore, only the sync pulses are present to any significant degree in the output.

that the peak-to-peak amplitude of the waveform will be maximum when the full scale of grays is contained in a picture and that the amplitude will appear to diminish if an all-white picture is received, as during a program break. If a direct-coupled (DC) scope is used, the sync-tip level will remain unchanged.)

To overcome this problem, the general configuration of the sync separator need not be changed very much from Fig. 2, but the component values are significantly different from those which would be found in a conventional amplifier. By increasing the value of the grid resistor several times, to perhaps 3 to 20 megohms, and adjusting the drive so that the tube draws grid current during conduction, the equivalent input circuit of the sync separator appears like the circuit shown in Fig. 3. When the positive sync pulses cause the diode to conduct, a charge is stored on the coupling capacitor. Between pulses, this charge "leaks" off to ground through the resistor; but if the RC time constant (resistance times capacitance) of the capacitor and resistor is large enough, the amount of voltage decay between pulses will be rather small. The next sync pulse again will charge the capacitor to the peak voltage of the pulse, and again a small portion of this charge will leak off. As a result, a bias level is established which always is just slightly less than the peak positive amplitude of the input signal. This method of biasing is known as "grid leak biasing" in a tube. In a transistor, there is always base current when the device is conducting collector current, and this base current charges the capacitor in the same manner as grid-leak current.

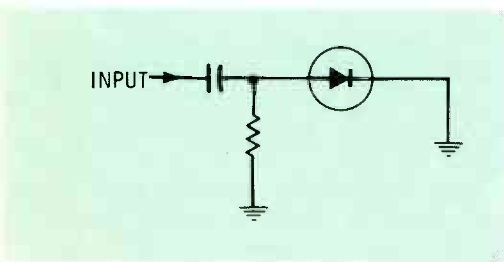

Fig. 3 Sync separator equivalent input circuit.

A transistor sync-separator circuit for use with negative composite video is similar to the circuit of Fig. 2B, except that the transistor used is a PNP type instead of an NPN type. This circuit is shown in Fig. 4. In this case, the bias is generated by virtue of the fact that the coupling capacitor discharges through the transistor when the negative-going input signal drives it into conduction. Between pulses, the base of the transistor is held positive as the capacitor charges through the resistor.

A vacuum-tube circuit also may be used with negative-going video, as shown in Fig. 5. This circuit also has about the same configuration as the circuit of Fig. 2, but the plate-load resistance is made very large. This causes the voltage at the plate to be very low, resulting in tube saturation. So long as the tube remains saturated, it cannot amplify the signal at its grid, because the drop across the plate-load resistor is so great, even when the instantaneous

Improper Input to the Sync Separator

In the descriptions of all the above circuits, it was assumed that the sync-pulse amplitude is actually significantly greater than the video amplitude. It will be, of course, if the tuner and IF amplifiers of the receiver are capable of linear response to the variations in amplitude of the incoming signal. Unfortunately, many failures in the receiving system affect linearity without having too much effect on the amplitude of the output video. For example, suppose that a receiver which is designed to produce a 3-volt peak-to-peak video signal (including sync pulses) fails in such a way that its maximum output is reduced to only 2.5 volts. If all portions of the composite signal simply were reduced to 83% of their normal amplitudes, this might be barely noticeable; but if the video signal reaches 2.25 volts, the normal level, then the sync-pulse excursion above the video is only .3 volt instead of the normal .8 volt. Effectively, the sync-pulse amplitude has been reduced to only 38% of its normal value.

From the above, it is apparent that the receiver malfunction has destroyed the essential difference between sync pulses and video, without affecting the video itself. As a result, the brightness information fed to the picture tube will be about the same as usual, but the sync separator no longer will be able to recover the sync pulses properly, and some of the video signal will pass on to the deflection systems. Usually, this causes poor vertical stability, as well as horizontal instability, particularly if a predominately black picture directly precedes the sync pulse.

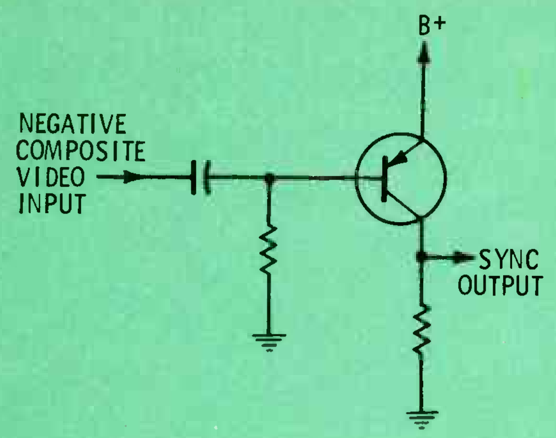

Fig. 4 Sync separator for negative video.

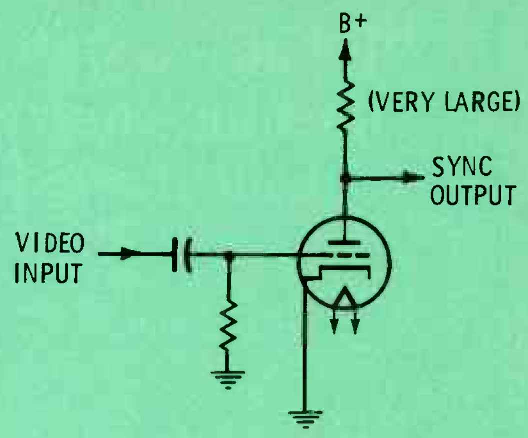

Fig. 5 Saturated sync separator.

Sync-pulse clipping, as the phenomenon just described is known, can be the result of many specific failures, but the following faults are definitely possibilities. (Naturally, it should be determined by observation of the video that the sync pulses are clipped before proceeding to explore these possibilities.)

1. Several weak tubes in the tuner and IF strip. I recall vividly an example of this, even after nearly 15 years. The 6CB6's were checked by substitution in the home—one at a time. After the set was taken to the shop and all three of them were changed at once, the rolling stopped. Needless to say, there was no profit on that job.
2. Greatly reduced supply voltage for the IF amplifier tubes. This can result from a seriously off-tolerance decoupling resistor, or a dropping resistor which is used to reduce the supply voltage only for the IF tubes. This type of problem is unlikely to occur in the tuner, because the first symptom of low supply voltage is that the local oscillator stops.
3. Serious misalignment. This is not likely unless someone has "tightened up all those screws in those little metal boxes on top."
4. AGC malfunctions which result in insufficient bias and partial saturation of the IF amplifiers. In this case, the peak-to-peak output from the video detector will be nearly normal (or perhaps slightly higher than normal), but the sync pulses will rise only slightly above the video. Clamping the AGC line with a bias supply is the quickest way to isolate this condition.

Sync Separator Output

Many technicians mistakenly assume that an incorrect output from the sync separator always will affect both horizontal and vertical deflection, but this is not the case. It is quite possible that the vertical circuit of a specific receiver will be more critical regarding its input than is the horizontal circuit, or vice versa. Therefore, it is good policy to check the output of the sync separator with a scope before proceeding into the circuits which follow it. If the amplitude of the sync-separator output is approximately what is specified in the service data, and if there is no video in the waveform, it may be assumed that the sync separator is operating normally.

If the separated sync pulses appear normal and the raster rolls, either the vertical-sync integrator is at fault, or the problem lies within the vertical oscillator. The integrator is essentially a low-pass filter which passes the vertical sync pulses and rejects the horizontal sync pulses. During the time that one field is being scanned, the integrator output is low because the energy content of the very narrow horizontal-sync pulses is quite small. When the equalizing pulses are received, the integrator output begins to rise slowly, and it tends to rise even more sharply when the serrated vertical pulse is received. Since the function of an integrator is always to average its input, the serrations do not appear in the output. At some point along the rise of the integrated pulse, the voltage becomes sufficient to trigger the vertical oscillator to initiate retrace.

The integrator may be checked by observing its output when the input is known to be normal; but since its output ties directly to the vertical oscillator, it cannot be seen unless the oscillator is disabled. In many oscillator circuits, this may be done by simply shorting to ground the plate which is **not** connected to the vertical-output transformer, or the yoke, if there is no transformer. Before attempting this, check the schematic to determine the amount of resistance between the plate and B+. If it exceeds about 1 megohm, a short will draw so little current that no damage will result; if in doubt, merely disconnect the supply voltage at some convenient point. If the sync input is fed to the oscillator plate, this will be necessary anyway, since grounding the plate also will ground the output of the integrator.

The signal at the output of the integrator will be of the same polarity as the output of the sync separator, but its amplitude probably will be rather small, perhaps less than one volt. Check the service data to determine the normal amplitude; if the observed pulse is either abnormally high or low, or if horizontal sync pulses are visible, suspect the integrator. If it is composed of discrete components, these may be checked with an ohmmeter, or by substitution. If modular construction is used, as it is in many instru-

Circle 12 on literature card

ments, substitution is necessary; however, an integrator using separate components can be fabricated in an emergency.

Oscillator-Caused Sync Problems

It is not unusual to find that what appears to be a sync problem actually is a fault within the oscillator. For the oscillator to be synced to the integrated pulse, its natural, or free-running, frequency must be **slightly slower** than the sync-pulse frequency for this reason: The oscillator must be designed so that it will run, even in the absence of sync; otherwise, the raster would collapse to a horizontal line whenever a sync signal was not available, eventually burning the picture tube. Oscillation without external sync is sustained by a feedback pulse from the output to the input which takes the place of the sync pulse. If the free-running frequency is too high, this feedback pulse will initiate the next cycle **before** the arrival of the normal sync pulse. **Only if the external sync pulse precedes the feedback pulse can the oscillator sync to this external pulse.**

To explain the complete process here is unnecessary, but it may be proven that if the raster rolls downward, the oscillator frequency is too high. On the other hand, if it rolls upwards, the frequency is too low. But since the oscillator must sync if the frequency is slightly low, a slow upward roll indicates loss of sync, but a slow downward roll indicates a too-high oscillator frequency. Of course, if the oscillator is completely off frequency (more than perhaps 20%) it should be fairly obvious that the oscillator is at fault.

Another type of fault which we shall attribute to the oscillator is not technically an oscillator fault at all. Actually it is a deficiency in the power supply. Normally, the input voltage to the vertical oscillator is well filtered and bypassed to prevent the vertical signal from being coupled to other circuits and also to filter the power-supply ripple. If this filtering is insufficient, 60-Hz or 120-Hz voltage will find its way into the oscillator. Because the vertical sync pulses also have a frequency of about 60 Hz, the oscillator can lock onto the ripple frequency instead of the sync pulses. Since the sync pulses and the ripple probably are not in phase, there will be times when the positive part of the ripple will follow the sync pulses. In this case there is no problem, since the oscillator will be triggered by the sync pulse. However, a few seconds later, the positive excursion of the ripple voltage will occur just before the sync pulse. Now, the oscillator may sync to the ripple and not the sync pulse. This causes the raster to begin to roll, then return to normal and repeat the process over and over.

Conclusion

There are four major sections in which defects commonly cause vertical-sync problems: the receiver section (including AGC), the sync separator, the integrator, and the vertical oscillator. In cases of poor vertical **and** poor horizontal sync, it is good practice first to observe the output of the sync separator. This waveform should be of the specified amplitude and also it must be free of video signal. If this is not the case, check the input to the sync separator to make sure that the ratio of the amplitudes of video and sync pulses is correct.

If the sync pulses are being clipped in the receiving section, look for any problem which can cause saturation of one or more stages. Low supply voltage to the IF amplifiers, several marginal tubes, and insufficient AGC bias are probabilities. If the sync-separator input is normal but the output is not, check the components in that circuit.

In order to observe the output of the integrator, it is necessary to disable the oscillator, either by grounding the plate or by removing the supply voltage. The former procedure is more convenient, but be sure that no damage will result. In some instances, grounding the oscillator plate also will ground the integrator output; check the schematic to determine the best procedure.

If the raster tends to roll downward and then snaps back at a fairly regular rate, suspect that excessive power-supply ripple is feeding into the oscillator circuitry. If the raster rolls downward continuously, the natural frequency of the oscillator is too high, and the frequency-determining components of the oscillator should be checked.

Although it was not mentioned specifically in the text, the values of several of the capacitors in the vertical sync and oscillator circuits are rather critical, making vertical sync subject to component tolerance shifts to a greater degree than many of the other circuits in the receiver. This can lead to some annoying problems, since the drift may be caused by the heat rise within the set after it has been operating for prolonged periods. By carefully noting the symptoms and applying the information set forth in this article (as well as a little freeze mist), it should be possible to avoid the costly process of wholesale parts replacement resorted to by many technicians when sync troubles are evident. ▲

"I figured out the circuitry, myself, and built a hearing aid. Try it . . . This part goes in your ear."

Dale's service bench

by Allan Dale

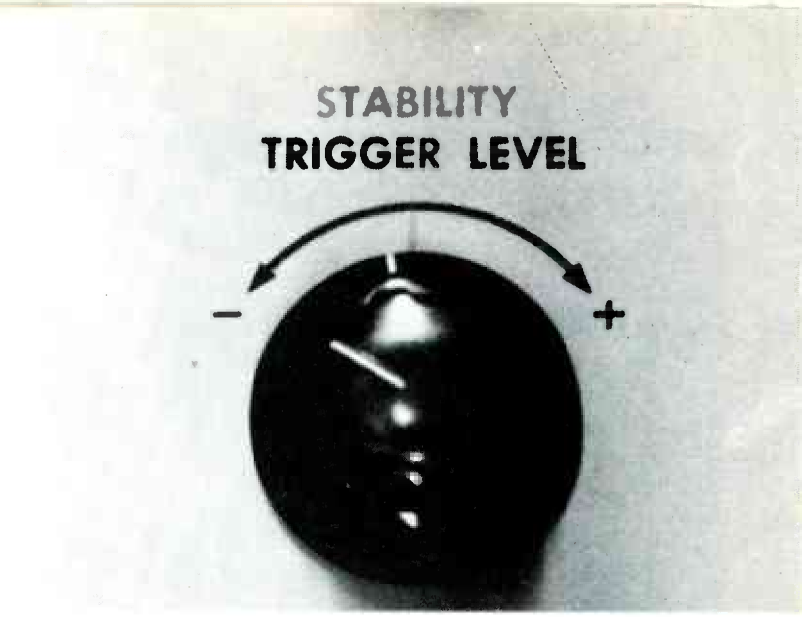

Fig. 1 STABILITY sets sensitivity of sweep oscillator; **TRIGGER** chooses point on slope of waveform where sweep fires.

Triggered scopes simplified

Basic facts about the operation of this useful test instrument.

A pal of mine—we can call him Emil—has a new toy. He's bought himself a triggered-sweep oscilloscope. After a dozen evenings with the instructions, he's having a lot of fun with the scope and learning a lot, too.

But when I asked him how he likes using it in the shop he told me he hasn't had the guts to try it out yet. Well, that threw down the challenge. Any friend of mine who has a shiny new triggered scope he can't use is just asking for my help, whether he wants it or not.

It just happens I'm a real fan of triggered scopes. They do so much more than regular scopes (you know, the recurrent-sweep kind). And if you set them up right, they do it better. Emil isn't the first guy I've talked to who has bought a triggered scope and then hasn't got his money's worth of use out of it. Some rather simple ideas about using these instruments are helping Emil. He uses his triggered scope now for TV troubleshooting. And he says he likes it better than the best of his old scopes.

What Emil had to do was change his thinking a bit. Any good technician, if he knows how to use his service scope, can make this transition. There are only two common hangups.

One: Instead of locking in on the input frequency, a triggered scope locks in on some portion of a waveform. I'll explain that further in a moment.

The other problem is one of words. Users of triggered scopes don't talk about **frequencies** of waveforms; they talk of **time bases.** That, too, I'll explain in detail. But first things first.

The Stable Trace

If there's one real advantage in a triggered scope, it's how tightly it holds whatever waveform you feed it. At least, it does if you lock the waveform in correctly. You do that with the stability and the trigger controls. These are two concentric knobs in Fig. 1.

Let me explain the stability control first. The horizontal sweep generator in a triggered scope is a one-shot circuit. When something triggers it, the circuit sweeps the scope beam across the face once and then quits. It doesn't sweep the beam across again until it's triggered again.

What keeps the sweep circuit cut off is a bias voltage. However, that bias is adjustable. When it's at zero, the sweep stage runs free. In that condition, the circuit is turned into a regular recurring oscillator. The beam sweeps across the CRT over and over, making a line trace just like the base line on a service-type scope. If the bias voltage on the oscillator stage is turned up enough, the sweep stops—unless a trigger pulse hits the tube grid and fires the sweep.

If you have a triggered scope you can experiment with, you can see how this bias adjustment works. It's the control labeled **stability.** Just turn it back and forth. Clockwise, you see the base line; counterclockwise blanks it off. Try it a few times.

While the trace is cut off is also a good time to set the **intensity.** With stability counterclockwise and no trace visible, turn the intensity up until you see a dot. (If you don't see it, try shifting the positioning knobs until you do.) Then reduce the control setting until the dot disappears. Don't go too far past that point; just barely quench the dot.

Turn the stability up again, and you'll see the base line again. Touch up the position knobs so the line starts exactly at the left edge of the graticule. (I assume you know the graticule is the grid, sometimes numbered, on the face of the screen.)

In order to set generator stability for operation, start with the knob turned all the way down. Turn it

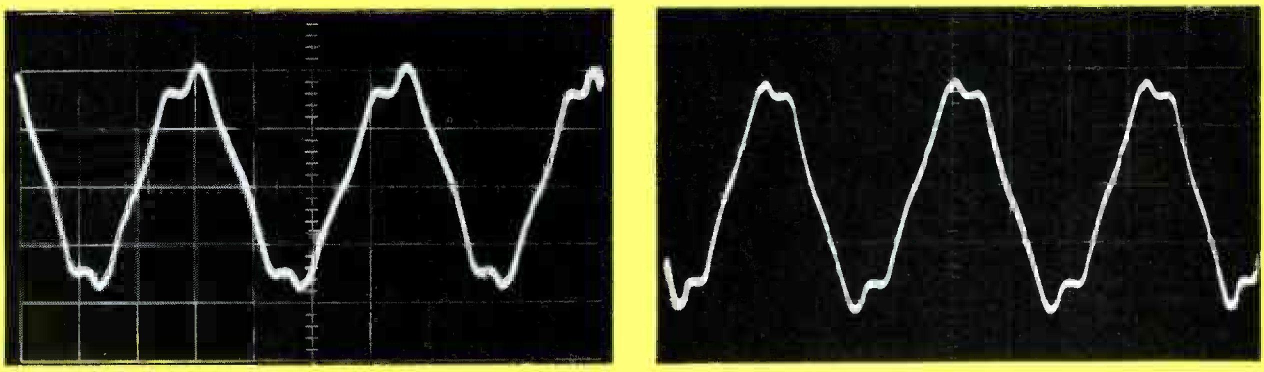

Fig. 3 Power-line sine waves. (A) is triggered near zero on negative side; (B) is triggered far negative from zero.

up until the generator stage starts free-running and you see the base line. Then turn it down barely far enough to blank the line out. To make sure it is set correctly, turn the switch that's marked **time base** or **time/cm** to all its positions. If the sweep self-triggers at any of them, turn the stability control down just enough to quench the line.

That sets the sweep generator right on the edge of its operating characteristic. You don't have to touch stability any more unless you turn the scope off and start over. The one-shot oscillator is ready to fire at the slightest trigger pulse. And that brings me to the **trigger** control. The one shown in Fig. 1 is the concentric knob in back. It turns in both directions from zero center.

A Place on the Slope

To understand **trigger** settings, you have to realize this about waveforms: They sometimes have unusual shapes. Look at the one I've sketched in Fig. 2, paying special attention to the labels on the various parts. The important parts of this horizontal sync pulse, as far as triggering is concerned, are the steep leading edges.

A triggered scope oscillator triggers somewhere on the steep slope of a waveform. The **trigger** knob determines where. With the waveshape in Fig. 2, you could set the

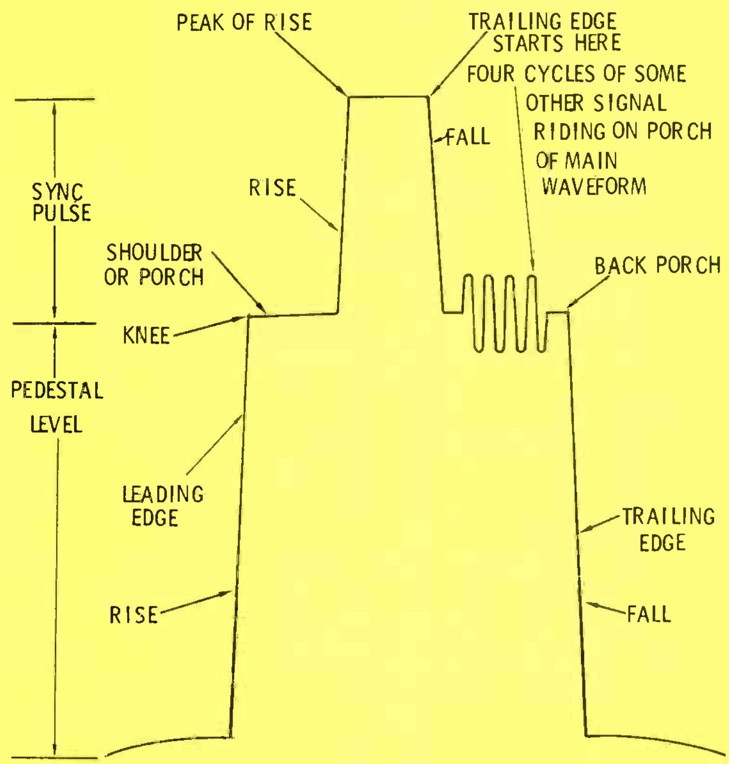

Fig. 2 Exaggerated version of horizontal sync and blanking. Note especially the leading edge; that's what triggers.

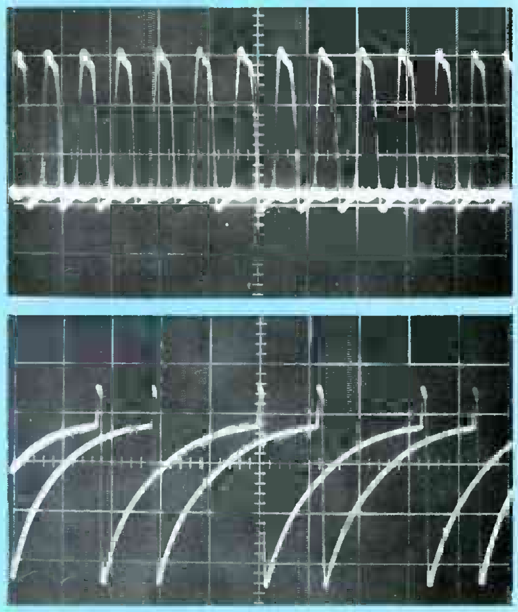

Fig. 4 Self-triggering of oscillator makes multiple or unstable wave display.

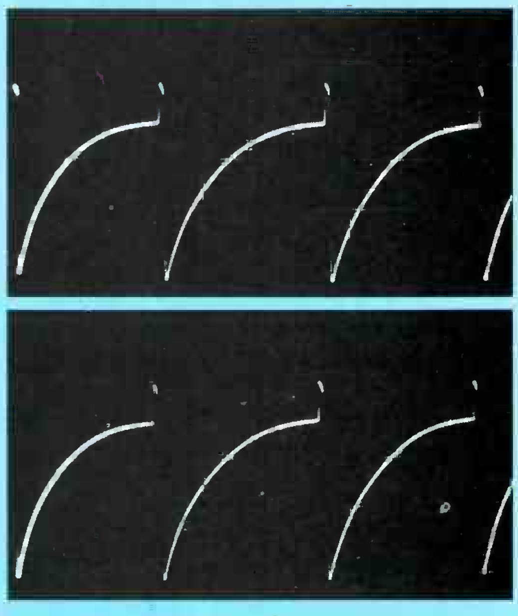

Fig. 5 Waveform triggered on steepest slope (A) near zero and (B) near its tip.

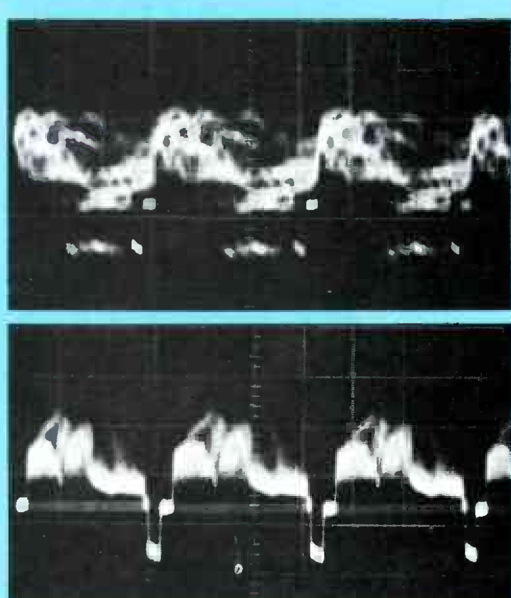

Fig. 6 Video waveform (A) triggered at wrong polarity and (B) locked correctly.

control to trigger halfway up the first rise, at the knee of the pedestal or somewhere on the upper rise.

Something to remember, though: If you set the trigger for a point that is beyond the peak of the waveform, the sweep can no longer trigger. You've set it to trigger at too high a voltage.

Something else about the **trigger** control is **polarity.** How do you know whether to turn the knob toward the plus sign or the minus sign? Just notice the direction of the steepest slope. If both slopes are steep, the oscillator will trigger on the leading edge. In Fig. 2 the leading edge is positive-going. Later, I'll show you a photo of an actual one that is negative-going.

The two photos of power-line sine waves in Fig. 3 show even better the effects of changing the trigger knob setting. The vertical input of the scope must be set to accommodate whatever value you think the waveform voltage is. (Remember that you can't see the waveform until after the trigger level is set.) In both photos, trigger is turned toward the negative (minus) sign. That makes the sweep oscillator trigger on a down-going slope. If the knob had been turned toward the plus sign, the first edge would have been positive—or upward-going. (A sine wave can be made to lock either way because both slopes are alike.)

In Fig. 3A the trigger control is barely cracked away from zero. If it were any closer to zero, the sweep might start self-triggering and the waveforms wouldn't stand still. Don't touch **stability** if that happens; change the **trigger level.**

In Fig. 3A the knob has been turned further from zero. It has moved the triggering point far down the negative-going slope of the waveform. If you turn the knob further, the screen will go blank because you have set triggering level beyond the amplitude of the waveform.

The photos in Fig. 4 show some examples of self-triggering in the sweep. Photo A is a series of AGC keying pulses from a TV receiver. The trigger level is set so near zero that the trigger can't "get hold" of the sweep oscillator. Photo B is a TV horizontal sweep waveform, and again trigger is not set high enough on the waveform to lock it.

Fig. 5 shows the waveform from

Fig. 4B, but locked in solidly. In A, the control is set just a little up from zero in the negative direction. In B, the trigger control has been advanced far negative. Much further and it would be beyond the waveform tip, and the screen would be blank.

Notice in all these locked waveforms that triggering is best on the **steepest** side of the waveform. If both sides of a waveform are steep, as in a TV sync pulse, the triggering is best on the leading side.

You can see in Fig. 6A what can happen if you try to trigger a television video waveform in the wrong polarity. The sharp **leading edge** is negative-going; you can tell that even with the unstable signal. When you turn the trigger control in the right direction, the display locks in solidly as in Fig. 6B. The control knob is turned just far enough negative from zero to trigger the sweep oscillator at the pedestal level of the waveform.

What's A "Time Base"?

One cycle of a signal takes a certain length of time. A simple example is 1000 Hz. If a thousand cycles occur in 1 second, any one of those cycles takes a thousandth of a second (.001 sec). At 2000 Hz, one cycle takes .0005 sec. You can figure out the duration of one cycle at any frequency: Divide 1.00 by the frequency.

Each time the scope beam sweeps across the CRT screen, it takes some definite amount of time. The time it takes for the trace to sweep across the screen once is called the time base of the triggered sweep.

The time base is controlled by a switch on the scope. It is labeled **time/cm** in Fig. 7. Its positions are marked in decimal fractions of a second—tenths, milliseconds, and microseconds. Those marks mean the speed of the beam sweeping across the screen is calibrated so each centimeter of the base line or waveform display width takes that length of time.

The graticule in Fig. 4 is well lighted. You can see it is ten squares wide. Each division is 1 centimeter (1 cm). If the time/cm switch happens to be set at 10 milliseconds (10 msec), each square represents that much time. A waveform that fills the graticule with one cycle is therefore 100 msec wide.

If the time/cm switch is set at 100 microseconds (μsec), a full-width waveform is 1000 μsec or 1 msec wide. With the same setting, you know a waveform that reaches across three divisions is 300 μsec wide (100 μsec/cm).

You probably noticed the switch in Fig. 7 that's marked **"multiplier"**. That's for easier viewing if a waveform width isn't exactly at some setting of the time/cm switch. You multiply the setting on the time/cm switch by the multiplier setting.

For example, look at a display like the one in Fig. 6B. Each cycle is a horizontal line of TV video. If you were displaying them on a recurrent-sweep scope, you'd set the frequency dial for about 5 KHz; you'd see three cycles. Instead, on the triggered scope, you set up a time base that lets you see the three waveforms.

You can figure out the time duration (or width) of one cycle by dividing 1.0 by 15,750. The answer is about .000064, or 64 μsec. With time/cm at 10 μsec, a cycle (one sync pulse and the video that goes with it) would be a little more than six divisions wide on the screen. If you want to see three, as is being done in Fig. 6B, you leave time/cm at 10 μsec and turn the multiplier to 2. Each centimeter division thus covers 20 μsec. One 64-μsec cycle is slightly more than three divisions wide, so three cycles covers not quite ten divisions.

To view television signals at the TV vertical rate, you change the time base of the triggered scope to fit the width or duration of 60-Hz pulses or signals. Again, divide 1.0 by the frequency. The time duration of one 60-Hz cycle is about .017 sec, or 17 msec. Three cycles occupy just over 50 msec. A time/cm setting of 1 msec gives a full-graticule width of 10 msec; a multiplier setting of 5 extends that to 50 msec.

The power-line signals in Fig. 3, which of course are at 60 Hz, are displayed at a time/cm setting of 1 msec and a **multiplier** setting of 5.

All television waveforms are viewed at either the vertical or horizontal rate. Those are the only two time-base settings you have to memorize for TV work. That's what Emil did. Whenever he wants to view any waveform related to horizontal frequency, he sets **time/cm** for 10 μsec and **multiplier** at 2. Whenever he wants to look at waveforms related to vertical or power-line frequency, he sets **time/cm** for 1 msec and multiplier at 5.

Works out great. All he has to do then is adjust **trigger** level for amplitude of the waveform.

What's Next

Letters you've written about this monthly department sound good. Best of all, you're telling me what gear is giving you service problems. I'll be writing about some of them in future columns.

In the next issue I'll explain something that has seemed hard for many technicians to understand. That's **single sideband.** Hams use it extensively, CB gear is giving it a good tryout and now marine high-frequency radiotelephone has it.

I'm going to explain why single sideband is not really mysterious at all. Even if you don't work on that kind of gear every day, you'll like knowing about this modern bit of our fascinating technology. ▲

Fig. 7 Switches for setting up a time base; determines cycles of waveform seen.

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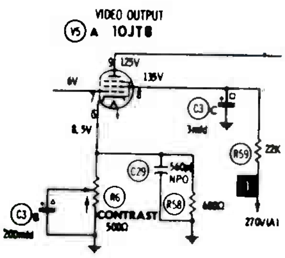
symcure

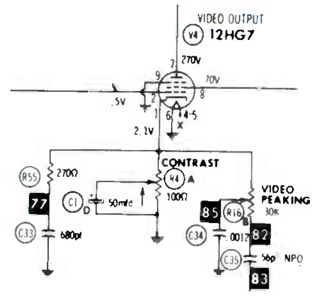
Symptoms and cures compiled from field reports of recurring troubles

Chassis—Sylvania DO5
PHOTOFACT folder—905-3



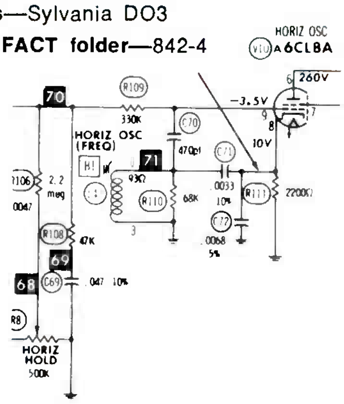
Symptom—picture blooms when contrast increased.
Cure—replace shorted C3B

Chassis—RCA CTC31
PHOTOFACT folder—928-3



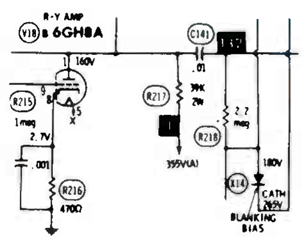
Symptom—no raster, high voltage okay
Cure—replace contrast control

Chassis—Sylvania DO3
PHOTOFACT folder—842-4



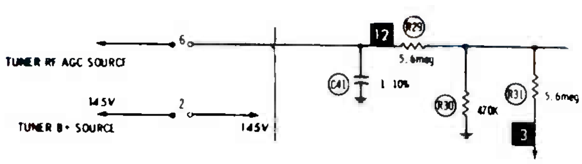
Symptom—horizontal bending and weaving
Cure—replace open C69

Chassis—RCA CTC31
PHOTOFACT folder—928-3



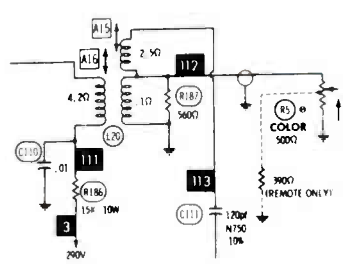
Symptom—red screen color
Cure—replace X14.

Chassis—Sylvania DO3
PHOTOFACT folder—842-4



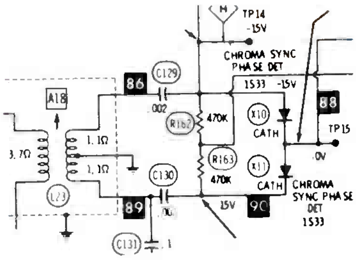
Symptom—horizontal pulling, may be shaded dark
Cure—replace open C41

Chassis—RCA CTC31
PHOTOFACT folder—928-3



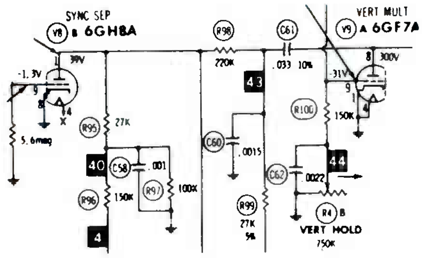
Symptom—weak color sync
Cure—check C111, it should be 120 pf.

Chassis—Olympic CT910
PHOTOFACT folder—918-1



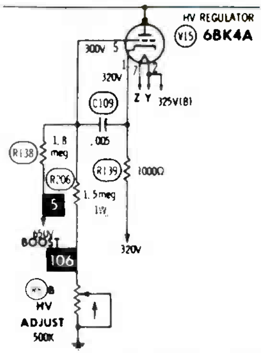
Symptom—color out of lock
Cure—replace X10 or X11 diodes

Chassis—RCA CTC31
PHOTOFACT folder—928-3



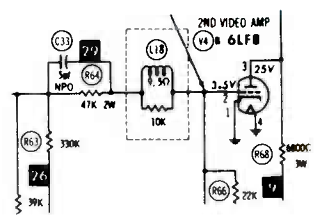
Symptom—weak vertical locking
Cure—parallel R98 with 220K-½W resistor.

Chassis—Olympic CT910
PHOTOFACT folder—918-1



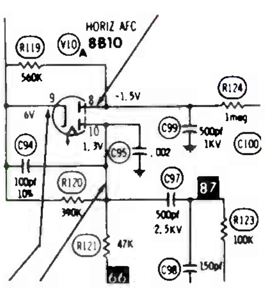
Symptom—picture blooms, focus poor
Cure—replace open R139 in cathode of 6BK4 tube

Chassis—RCA CTC35
PHOTOFACT folder—925-2



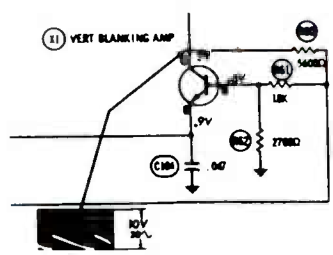
Symptom—video ringing in picture
Cure—check C33, should be 3.5 pf.

Chassis—Olympic CT910
PHOTOFACT folder—918-1



Symptom—horizontal bend or twist
Cure—replace R123 (100K inside high-voltage)

Chassis—RCA CTC17X
PHOTOFACT folder—829-2



Symptom—dark shading at top of raster
Cure—replace X1 transistor ▲

WARRANTIES...a special report

by Wendall J. Burns

Testing of in-board warranty labor and the continuing problems of parts availability, parts mark-up and warranty labor rates are the highlights of the current warranty scene.

Warranty-wise technicians in the electronic servicing business are finding it more and more difficult to keep score in the warranty game as the manufacturers change their programs to keep up with competitors. The warranty on color-TV has been a big factor in setting this pace.

Attention is focused now on the practice of more manufacturers to warrant labor for 90 days. Although some companies, including mass merchandisers such as Sears, have already established such a practice, it is believed significant that RCA and other manufacturers that together produce a big share of the TV sets are testing the labor warranty. Should they determine to adopt as a standard program the 90-day in-boarded warranty on labor, it is likely that it will become a universal policy in the industry.

The firms now testing are: RCA, in Los Angeles and Indianapolis; Motorola, in Dallas, Phoenix and San Diego; GE, in Michigan. Admiral is offering in-boarded warranty on labor on its 1970 line on an optional basis.

As Table I indicates, eight companies already have established policies of 90-day warranty on labor.

The two-year warranty on color picture tubes, which was the big innovation not too long ago, has become almost a universal practice.

Robert J. O'Neill, RCA vice president in charge of sales, recently discussed the testing program on labor warranty in a talk before servicing technicians

Table I: Length of warranty (months)

	Color TV									Monochrome								
	Tube Chassis			Hybrid			Solid State			Tube Chassis			Hybrid			Solid State		
	Chassis Components	Picture Tube	Labor	Chassis Components	Picture Tube	Labor	Chassis Components	Picture Tube	Labor	Chassis Components	Picture Tube	Labor	Chassis Components	Picture Tube	Labor	Chassis Components	Picture Tube	Labor
Admiral Corp[1]	12	36	0	12	36	0				3	12	3	3	12	3			
Broadmoor Indus.				12	24	3				3	12	3						
Curtis Mathes[2]	12	24	0				12	24	0	12	24	0						
Delmonico	3	24	0							3	24	0						
Emerson Radio Inc.	12	24	0	12	24	0				12	12	0	12	12	0			
General Electric	12	24	0	12	24	0												
Int'l. Electrohome	12	24	3													12	12	3
Magnavox	12	24	0	12	24	0				12	12	3				12	12	3
Motorola[1]	12	24	0	12	24	0	24	24	0	12	12	0				12	12	0
Olympic Radio & TV	12	24	0	12	24	0	12	24	0	3		0	3		0	3		0
Panasonic	12	24	3	12	24	3	12	24	3	3	12	3	12	12	12	12	12	12
Packard Bell	12	24	0	12	24	0	12	24	0	12	12	0	12	12	0	12	12	0
J. C. Penney Co.	12	24	3	12	24	3	12	24	3	12	24	3						
Philco-Ford	12	24	3	12	24	3	12	24	3	12	12	3	12	12	3	12	12	3
RCA[1]	12	24	0	12	24	0	12	24	0	3	12	0	12	12	0			
Setchell-Carlson	12	24	0	12	24	0	12	24	0									
Sony Corp.							12	24	3							12	12	3
Sylvania[3]	12	24	3	12	24	3	12	24	3	12	12	3	12	12	3	12	12	3
Symphonic	12	12	0							3	12	3	12	12	3	12	12	3
Western Auto	12	24	3	12	24	3	12	24	3	12	12	3	12	12	3	12	12	3
Sears Roebuck	12	24	3	12	24	3	12	24	3	12	12	3	12	12	3			
Zenith	12	24	0	12	24	0				3	12	0						

[1] Testing a factory in-boarded 90-day warranty on labor.

[2] Curtis-Mathes gives a full 2-year warranty on the picture tube, plus an extended warranty for another six years that is pro-rated to decrease each of the six years.

[3] The warranty is the dealer's obligation on color TV and b-w console, and Sylvania's obligation on b-w portable.

in convention in Waterbury, Connecticut: "In our test program, we are checking the reactions of the dealers, the distributors and we are checking consumer reaction. In-boarded service means that the manufacturer warrants the product for labor. The manufacturer reimburses the servicing agent or dealer for this labor—or, the dealer has the option of buying the set for less dollars, but must stand the 90-day labor warranty," O'Neill said. The dealer, or the servicing agency he chooses, is reimbursed at his established rate in the RCA program being tested.

Although varying in some details, the programs of the in-boarded service being tested by other companies, in effect, are very similar to the RCA test program.

How is the extended warranty affecting the business of the independent servicing technician?

There are several variables here, and there is no one answer, but rather several answers depending on geographical location and the type of business the independent handles most.

Without a doubt, the extended warranty on labor will mean a loss of business to many of the smaller shops. Even shops which retain the business, and are paid their regular labor rate by the manufacturer, find that the cost of doing business increases. Lew Edwards, Trenton, N. J., explained this was the case in his shop. He said that a time-consuming process of confirming that a product is actually under warranty often begins the moment a customer walks in the door, and a lot of time is spent before any work at all is done on the product. Then, after repair, there is the task of parts exchange and billing and collecting for labor done. None of this paper work is involved on out-of-warranty products when strictly "demand labor" is being sought.

The problem Edwards describes has caused some servicers to refuse warranty labor work even when

This table shows some of the basic provisions of warranty policies of the leading manufacturers or mass merchandisers involved in marketing home entertainment electronic products. Due to the large number of variations in products and warranty provisions, the table is intended to reflect only the firms representing the greater part of the industry and to reflect the trends being set by manufacturers. All warranty periods expressed in months. However, in actuality, the manufacturers' warranty literature expresses the labor warranty period in terms of days (90) instead of months (3).

Warranty on radio

The variations on warranty provisions for radios are so many that it is not possible to tabulate them all here. Some manufacturers simply provide for an exchange —giving the customer a new radio for a defective one within the first 90-day period after purchase.

Here are the warranty programs of some other firms:

Magnavox, Olympic, Philco-Ford, Sylvania and RCA give a 90-day warranty on both components and labor.

A 12-month warranty on both components and labor is given by Pansonic, Sony and Broadmoor.

Emerson gives a 12-month warranty on components; none on labor.

J. C. Penney and Western Auto give a 12-month warranty on components; three months on labor.

Table II: Survey of manufacturers' warranty policies on stereos

	Tube		Hybrid		Solid State	
	Components	Labor	Components	Labor	Components	Labor
Admiral Corporation	12	1*				
Curtis Mathes	12		12		12	
Delmonico						
Emerson Radio Inc.	12		12		12	
Int'l Electrohome					12	3
Magnavox	12				12	12/3
Motorola					12	
Olympic Radio & TV	3		3		3	
Panasonic					12	12
Packard Bell	12		12			
J. C. Penney Company	12	3				
Philco-Ford	12	3	12	3	12	3
RCA					3	
Setchell-Carlson	12		12			
Sony Corporation					12/36	12/36
Sylvania[1]	12	3	12	3	12	3
Symphonic	3	3	3	3	3	3

[1] Sylvania. Manufacturer's obligation on stereo portables, radios, tape recorders and b-w portable TV. Dealer's obligation on console stereo.

*90-day warranty on portable only.

Table III: Warranty service performed by . . .
(% where available)

	Mfr's Service Organization	Distributor's Facilities	Dealer's Facilities	Independent Shops (auth)	Independent Shops (unauth)
Broadmoor Indus[1]			15	75	
Curtis Mathes			x	x	
Delmonico			x	x	x
Emerson Radio Inc....		50	25	25	
Int'l Electrohome	10	30	60		
Magnavox	0	0	50	45	5
Motorola	0	5	30	65	
Panasonic	20	2	5	72	1
Packard Bell	30		60	10	
J. C. Penney	20			80	
Philco-Ford	0	5	20	75	
RCA	10	0	50	40	
Setchell-Carlson	5	10	70	10	5
Sony Corp. of America.	40			60	
Sylvania	5	10	60	15	10
Symphonic	5	3	2	90	
Zenith		x	x	x	

[1] Broadmoor—100% of warranty service on radio done by manufacturer.

Table IV: Warranty replacement parts supplied by:

	Factory only	Either Manufacturer or distributor	Authorized distributors only
Admiral Corp			x
Broadmoor Industries	x		
Curtis Mathes	x		
Delmonico	x		
Emerson Radio Inc.			x
General Electric			x
Int'l Electrohome		x	
Magnavox	x		
Motorola			x
Olympic Radio & TV		x	
Panasonic	x		
Packard Bell	x		
J. C. Penney Co.		x	
Philco-Ford		x	
RCA			x
Setchell-Carlson		x	
Sony Corp. of America	x		
Sylvania		x	
Symphonic		x	
Zenith			x

the manufacturer is willing to pay the servicing agency's normal charge.

Three firms indicated a policy of compensating the servicing agency at its normal labor rate for warranty labor performed. They are Broadmoor Industries, International Electrohome and Sony (and some of the firms engaged in the test programs). Four other firms—Panasonic, J. C. Penney, Philco-Ford and Symphonic—determine the labor compensation in negotiation with the servicing agency; and Admiral, Motorola and Sylvania compensate according to the rate that the manufacturers themselves establish.

Although at least one aspect of servicing, the rate paid for labor, appears to be improving from the technician's point of view, the ever-present parts problem has been complicated further because of the extended warranty, the technicians believe. Most manufacturers, under their warranty programs, handle the parts compensation on an exchange basis only. Only two, responding to an ELECTRONIC SERVICING survey, indicated the servicing agency receives a mark-up on parts under warranty: Broadmoor shows that the servicer gets a 25% markup over his cost and Panasonic shows a 10% markup for the servicer on parts. With Motorola, the parts compensation depends on the choice of the distributor.

These two factors, parts availability and compensation problems and lack of a labor rate acceptable to the servicer, have made a mockery of warranty from the viewpoint of a large segment of the servicing industry. They are watching warranty changes to see if the trends might change in their favor.

They want servicing agencies

While independent servicing agencies in some market areas report a continuing decline in the demand for their services on products of GE, RCA, and some other manufacturers which have established factory-owned servicing organizations, there is a continuing demand for servicing agencies by other manufacturers.

Manufacturers which have indicated they are now accepting applications from established service shops which desire their warranty servicing business are Magnavox, Motorola, Philco-Ford, Panasonic, Sylvania, Sony, Olympic and Symphonic.

Reaction to warranty

"Warranties have evolved out of the nature of competition. If one manufacturer provides a particular warranty feature, the competition is sure to follow."—The president of a distributorship of radio and TV imports.

"A warranty program that promises more than it can perform is like a beautiful TV console without a picture tube. It proves to a tremendous disappointment for the unsuspecting."—An independent servicer.

"I think that the trend to extend warranty will open up the field for us. It will simplify warranty in the mind of the customer. Most customers already think that the warranty covers labor."—The president of an independent agency that operates high-volume service centers in several states.

Table V

	Shops doing your warranty service (number)	More shops needed in next two years
Admiral Corp.	1500	500
Broadmoor Industries	650	?
Delmonico	100	?
Emerson Radio Inc.	?	+25%
Int'l Electrohome	2600	
Magnavox	2000	100
Motorola	6000	
Olympic Radio & TV	none	none
Panasonic	990	1500
Packard Bell	unknown	....
J. C. Penney Co.	300+	100+
Philco-Ford	5000	1000
RCA	?	?
Setchell-Carlson	3	?
Sony Corp. of America	400	200
Sylvania	600	200
Symphonic	1000	500

Table VI: Warranty servicers authorized by:

	Only mfr.	Only distributor	Mfr. and distributor	Mfr. and dealer	Mfr., dealer and distributor
Admiral			x		
Broadmoor Indus	x				
Curtis Mathes			x		
Emerson Radio Inc.					x
Int'l Electrohome					x
Magnavox	x				
Motorola			x		
Olympic Radio & TV	x				
Panasonic			x		
Packard Bell	x				
J. C. Penney Co.	x				
Philco-Ford			x		
Setchell-Carlson	x				
Sony Corp.	x				
Sylvania	x				
Symphonic	x				
Zenith		x			

"Warranties on home products seem to be a competitive gimmick to go along with an esthetically designed, eye-catching modern cabinet."—Projects analyst for the President's Committee on Consumer Interest.

"The service agency should never have to pay postage, insurance and handling charges for in-warranty parts."—Editorial comment in **Appliance Service News.**

"The government will step into this warranty business."—The service manager of a major manufacuretr of TV, radio and stereo.

How Manufacturers Evaluate Service Agencies

A study of the U. S. Department of Commerce praises efforts of associations of manufacturers in some industries to launch voluntary programs to correct warranty problems. It mentions a provision by the manufacturers that would establish minimum requirements before a servicing agency would be "authorized" to service its products. The servicing centers that were "authorized" would be subject to specific requirements as to personnel training, parts availability and inspections by manufacturers.

The survey of manufacturers by ELECTRONIC SERVICING asked the national service managers to indicate "The most important attributes of a servicing facility which performs warranty servicing of your firm's products."

The responses by the manufacturers fell into these categories, listed here in order of importance as given by the service managers:

Technical Competence, Customer Relations, Good Business Practices, Appearance of Shop and/or Truck, Speed of Service, Adequate Parts Supply, Adequate Test Equipment, Consistent, Fair Pricing, Appearance of Technicians, Adequate Service Literature.

Some other individual attributes listed by national service managers and the name of the responding manufacturer are: Good location (Sony); capable office staff and ability to service entire line (Symphonic); adequate record keeping (Sylvania); pleasant telephone answerers, follow-through on all complaints, clear and concise repair bills and clearly defined guarantee of work performed (Emerson); pick-up and delivery and in-home service (Setchell-Carlson); good credit rating (Electrohome).

Here are some other factors that show how the manufacturers evaluate various facets of the business: They were asked if parts availability is a problem. Only two out of 14 answered in the affirmative. One out of four specify test equipment that a servicing agency must have in order to qualify as a warranty service shop for the products their firms produce.

Free factory service literautre is supplied by the majority of manufacturers.

Functions of field representatives are about the same for all the manufacturers, according to the survey, and include interpreting warranty policies and evaluating warranty servicing agencies, as well as providing technical training and technical assistance. ▲

Don't sell a color picture tube unless its been on a test ride.

Down at the bottom of the page, you have a major advance in space-age homeliness.

And a major advance in color tube testing as well.

That machine squatting down there is our beloved Iron Horse, the fully-automated, revolving carousel we use to test our color bright 85® tubes for emission, gas leakage, shorts, arcing and screen uniformity prior to shipment.

Now we don't intend to go into a song and dance on how total automation reduces testing error.

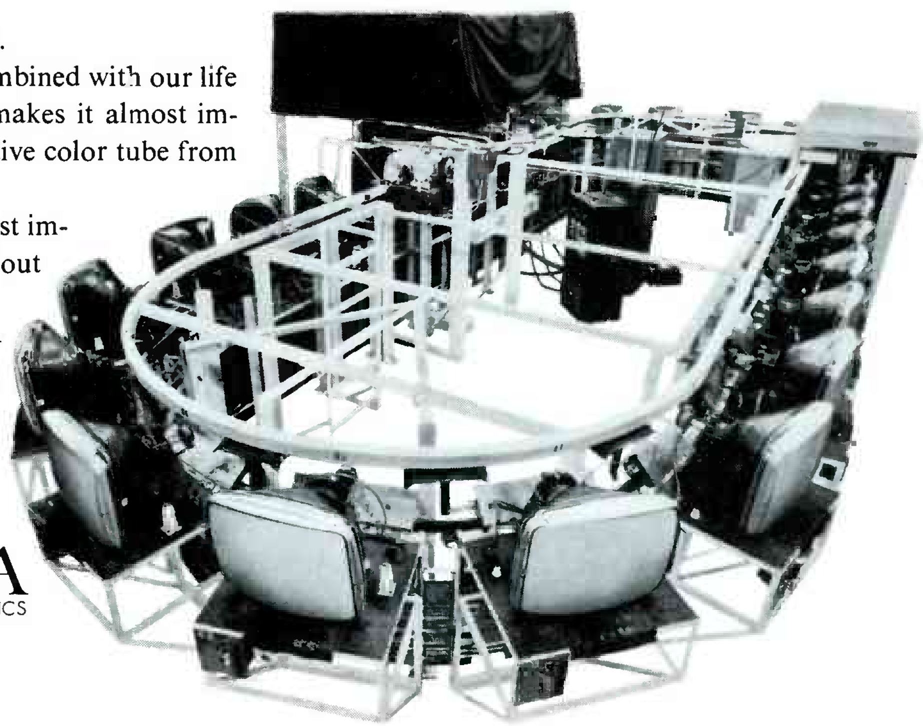
But we will tell you one thing.

Our Iron Horse test ride, combined with our life testing and 100% set testing, makes it almost impossible for you to get a defective color tube from us.

Which in turn makes it almost impossible for you to get chewed out by a customer.

Next time you need a color replacement tube, remember the great thing about the color bright 85. We don't send it to you till it's been around.

SYLVANIA
GENERAL TELEPHONE & ELECTRONICS



Circle 41 on literature card

Use AFT to diagnose TV antenna systems

Automatic fine tuning can help you determine the condition of an antenna system. **by Carl Babcoke**

Automatic Fine Tuning (AFT) action can be used as a fast and effective way of checking the color characteristics of antennas, lead-ins and cable or distribution systems. Before you dismiss this statement as some sort of April Fool joke, let's consider what AFT is actually supposed to do in a color receiver.

When we manually tune in a colorcast, we adjust the fine tuning between smear and beat-pattern for the best color picture; in other words, we tune for the best *visual* results. The sole function of AFT, as shown in Fig. 1, is to adjust automatically the IF picture carrier frequency to 45.75 MHz; this is accomplished by varying the tuner oscillator frequency.

The response curves of Figures 2C and 2D show how improper fine tuning can shift the picture- and color-carrier frequencies and affect the quality of the picture.

If the overall response curve of the receiver and the signal source is perfect, (see Fig. 2B) both of these methods will produce identical results. That is, manual adjustment for the best color picture will bring the picture carrier frequency to 45.75 MHz. Conversely, the AFT action, in bringing the picture carrier to 45.75 MHz, will produce the best color picture on the screen.

Any condition, either inside or outside the receiver, which tilts or distorts the response curve will cause the manual fine-tuning and AFT actions to produce different results. In this case, the manual adjustment will produce the better (but still degraded) color picture as shown in Fig. 2E and F. When such response distortion is present on only one channel, the AFT visually *appears* to malfunction on that channel, although the AFT works normally on the other stations.

This phenomena leads to a convenient rule-of-thumb: If the AFT works normally on the majority of channels, the AFT circuit is NOT the source of the trouble causing mistuning on the remaining channels.

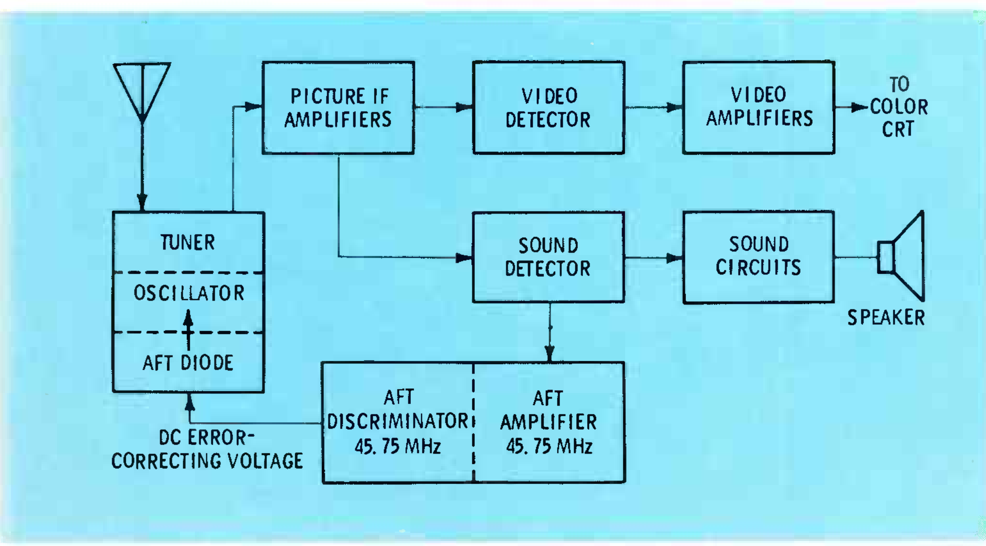


Fig. 1 AFT is a "closed loop" system for adjusting automatically the picture carrier to 45.75 MHz.

Sources of trouble that affect AFT action

Some of the rare receiver defects that will cause a visually different AFT action on a few channels are:

1. Improper alignment of the antenna and mixer stages in the tuner (on the defective channels).
2. The balun coil may have an open or shorted winding.
3. The FM trap or high-pass filter between the balun and the first tuned circuit in the tuner may be mistuned or defective.
4. A wire may be broken at the antenna terminal board.

By far the most likely sources of trouble that can cause such

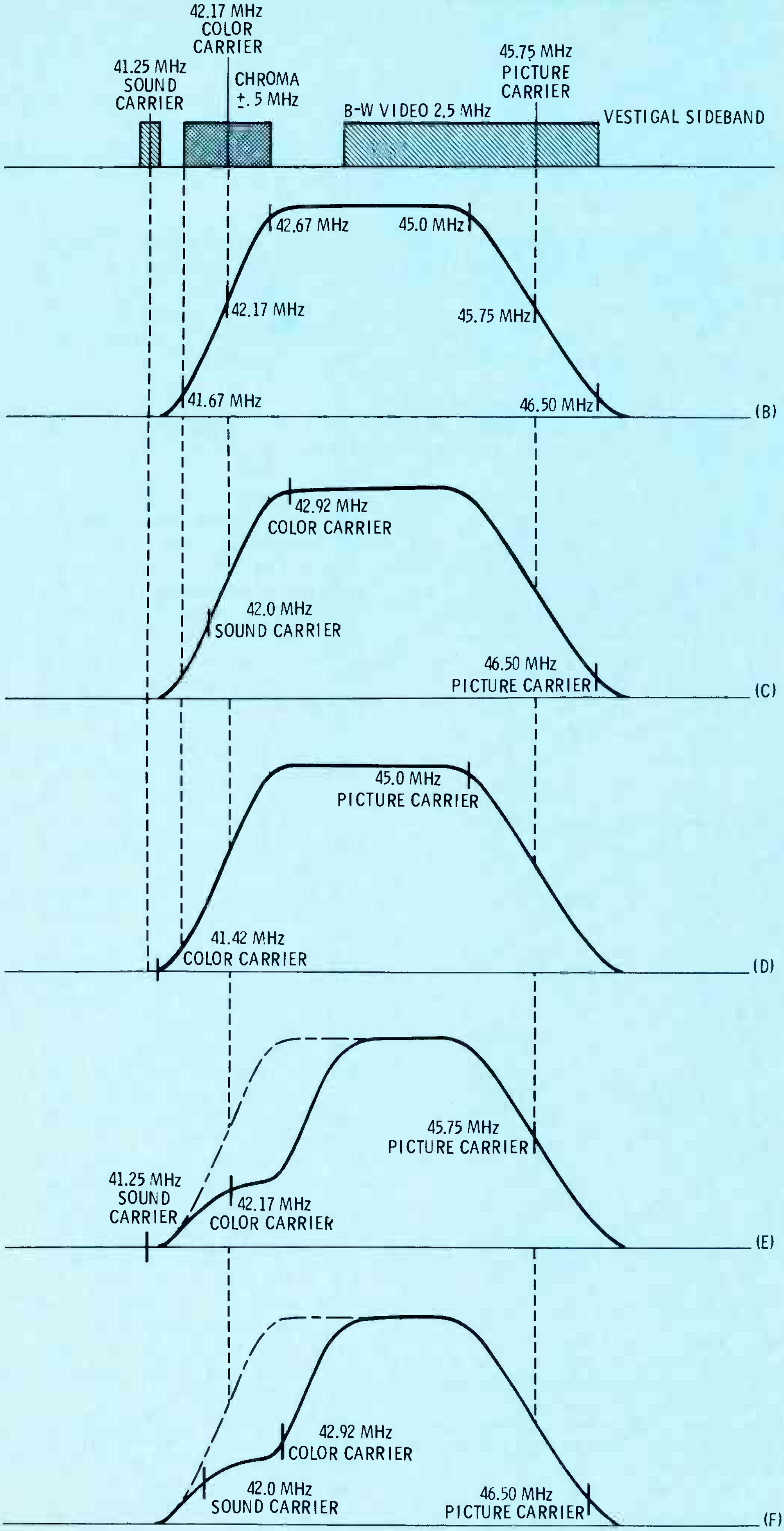


Fig. 2 The frequencies of the picture, sound and color carriers and their position on the IF curve are changed by the fine-tuning adjustment. The shape of the response curve and the frequency of the carriers determine the quality of both the b-w and color pictures.

A) How the IF bandwidth is used in the color receiver.

B) This is the ideal overall IF response curve; or if the fine tuning is set correctly, it is also the right overall curve for the circuitry from antenna to video detector.

C) If the fine tuning is adjusted .75 MHz low, the color picture has beat-patterns and the b-w picture has sound bars.

D) With the fine tuning .75 MHz high, the color picture is missing and the b-w is smeared.

E) If the bandwidth is narrowed on the color side of the IF curve, either by antenna defects or misaligned IF's, the AFT still will adjust the picture carrier to 45.75 MHz. The color picture will be weak and blurred.

F) If the conditions are the same as in example E, but the receiver is tuned manually for the best color obtainable, the color will be fairly good but with some beat pattern.

misleading AFT actions are antenna system defects. Such sources of trouble include:

1. An antenna that has "suck-outs" or a tilted response on the bad channel.

2. The lead-in wire coiled in a ball or cut to a critical length.

3. Two or more sets operated from the same antenna without proper couplers.

4. Improperly terminated wires run to other rooms for future use.

5. UHF and VHF lead-ins twisted together.

6. CATV or master-antenna amplifier cables incorrectly terminated.

7. CATV or master-antenna amplifiers improperly tuned, thus producing a tilted response curve.

8. Too much signal, causing a borderline overload condition in the receiver.

9. Any other condition which causes standing-waves or poor frequency response.

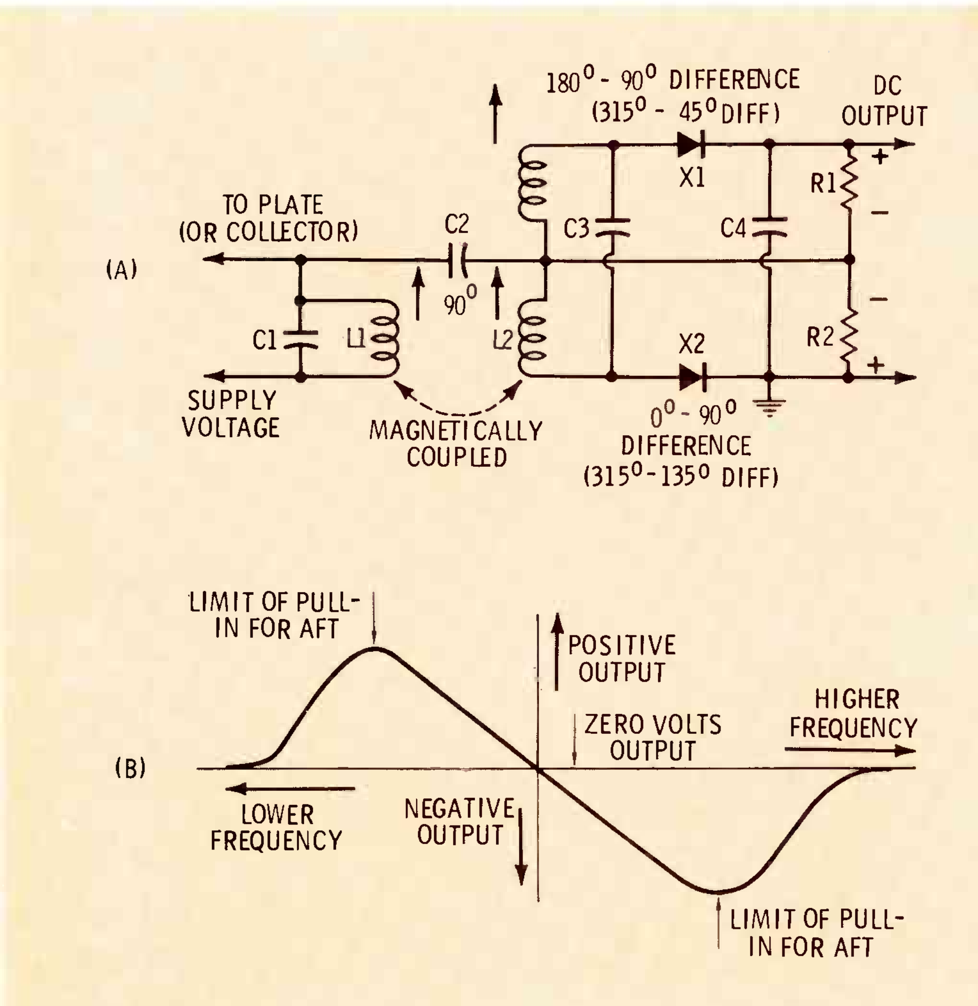


Fig. 3 A) Two paths feed the signal from L1 to L2. One is through C2 to both diodes in "parallel": the other is through the coupling between L1 and L2, and is applied to the diodes in "push-pull". The phase of the signal transferred by the coupling of the coils varies with incoming frequency; the phase of the signal through C2 does not change with frequency. As the phase angle between the two signals change, so does the resultant voltage applied to the diodes. When the voltage on X1 increases, the voltage applied to X2 decreases, and vice-versa.
B) Voltage plot showing how the DC output voltage changes with a shift in the incoming frequency.

The Procedure

How do we use AFT to ascertain the condition of the antenna system? The best method is to use a known good color TV with AFT as a standard (perhaps an 18" portable that has been checked in other locations with different antennas to be sure the AFT action is normal on all channels). Then if channel 12 mistunes on AFT, yet channels 3 and 10 are normal, it is proof enough that something in the antenna system is defective.

On a service call where both the receiver and the antenna are of unknown characteristics, the decision is more difficult. It is advisable first to check the more obvious possibilities such as:

1. Mechanical or lightning damage to the tuner antenna coils.

2. Trace the lead-in through the house, or ask the customer if another receiver is connected to the same antenna.

3. If the antenna system of the receiver uses an inside booster or distribution amplifier, temporarily run the lead-in directly to the set for a test.

4. If the set is fed from a CATV system, and the customer still has the old antenna, substitute it for the CATV cable and check the results by comparison.

5. If the bad channel is a high-band one, try the old test of wrapping the lead-in wire with metal foil, then slide it along the wire to see if the reception can be improved.

6. In an extreme case, the antenna and wire should both be correctly replaced with a type you know to be good.

7. Check for anything else ob-

viously wrong with the antenna installation.

"Why should I care if the AFT doesn't work on one channel? There is an AFT defeat switch on the set; let the customer manually tune the set." The answer to this question is that any channel showing wrong AFT action will also have poor and inferior color. Yes, you can tune manually and produce some kind of color, and it possibly will be better than that obtained with the AFT, but the color is likely to be smeared, moved to the right of the b-w picture, or weak and with a narrow range of fine-tuning adjustment. Or you may have to tune slightly into the sound bars to get any color at all.

Conclusion

Any antenna system that permits normal AFT action on all channels of a receiver previously checked by sweep-alignment analysis or by correct performance on other antennas is certain to be working perfectly insofar as frequency response is concerned. And conversely, any antenna system that does not permit the AFT to work correctly on all channels must be considered to be defective. ▲

A simplified theory of automatic fine tuning (AFT)

The basic theory of AFT operation is the same as that of Automatic Frequency Control (AFC) used in FM receivers, but the practice is more complicated because a TV receiver does not have a discriminator and the AFT circuit must supply one.

How a discriminator works

A Foster-Seeley type of FM discriminator operates by changing carrier-frequency shifts into phase differences. The carrier sine waves that have been changed in phase are added vectorially and the resultant AC voltage is rectified to supply an audio signal or a DC voltage for control purposes.

Just remember these simple rules for phase arithmetic: Two equal-voltage sine waves of the same phase (O° difference) will add completely when connected in series. Two equal-voltage sine waves of opposite phase (180° difference) will cancel out when connected in series. Two equal-voltage sine waves of 90° phase difference will add partially (1.4 times either voltage) when connected in series. The two sine waves do not have to be equal in voltage to add or subtract, but the mathematics becomes more involved. Generally stated, the nearer the phase difference is to 0°, the larger the sum of the voltages, and the closer the phase difference is to 180°, the smaller the sum will be. This vectorial addition is the foundation for the action of all discriminators.

The diodes in Fig. 3 are supplied with sine waves that have been channeled through two different paths. One is by transformer action through the magnetic coupling between L1 and L2. The phase of this signal will be opposite (180° difference) at the diodes because of the center-tapped winding of L2. The other path is from the top of L1 through C2 (used only to block DC) and through the windings of L2 to the diodes; the phase of this signal will be the same at both diodes. If the incoming frequency is the same as the resonant frequency of L2 and C3, the phases will be as shown in Fig. 3A. Since the phase of the signal coming through C2 is shifted 90° from the phase of the magnetically induced signals at the two diodes, the resultant voltage is the same at both diodes; therefore, the rectified DC across R1 will be equal to that across R2, producing an output DC voltage of zero.

If the incoming signal is changed to a certain lower frequency, the phase relationships change to those in parenthesis in Fig. 3. The phase of the signal through magnetic transformer action is changed, while the phase of the signal through C2 is the same as before. There is now less phase difference between the two signals at X1, causing the vectorial addition to produce a higher resultant voltage. After rectification by X1, the DC voltage across R1 is higher than before. The sine waves at X2 are now farther apart in phase, so the resultant voltage is less and the DC voltage across X2 is lower. The DC voltage output from the discriminator circuit is now positive.

Opposite actions take place when the incoming signal is higher in frequency than the resonant point of L2. In that case, the DC output voltage will be negative.

If the incoming carrier frequency is varied at an audio rate, as is done in FM broadcasting, the discriminator output is a rapidly varying DC voltage which, after some filtering, becomes the audio signal. When the circuit is used for AFT or AFC, the output is a DC voltage which varies from positive to zero to negative as the incoming frequency is changed. During AFC or AFT alignment this results in the well-known "S" curve, shown in Fig. 3B. ▲

testequipment

notes on analysis of test instruments, their operation and applications

In- and Out-of-Circuit Tester

Systomation, Inc., has introduced Guardohm, a test instrument that can measure the values of individual electronic components either in or out of circuit.

Guardohm is designed for use by engineers and technicians in manufacturing tests, development labs, field engineering and service shops. It isolates the effects of parallel cir-

cuitry, thus making it possible to measure resistors and check semiconductors without removing them from the circuit.

Characteristics

- Resistance Measurements: 13 overlapping ranges (including in-circuit resistance) 10 ohms to 10 megohms, ± 1%.
- DC Current Measurements: 7 overlapping ranges, 100 nanoamperes to 100 milliamperes, ± 1%.
- DC Voltage Measurements: 9 overlapping ranges, .1 volts to 1000 volts, ± 1%.
- DC Current Generation: 13 selectable constant currents; 100 nanoamperes to 100 milliamperes, ± 1%.
- Meter: Taut-band movement, magnetically shielded, scale readings displayed linearly.

Instructions are included with each Guardohm. The price is $335.00.

Circle 50 on literature card

DC Power Supply

Lafayette Radio Electronics Corporation offers a solid-state regulated DC bench power supply. Designated No. 99-5077, it features automatic protection against overloads and shorts.

The unit has dual range, continuously variable DC voltage of 5-13 or 12-20V at up to 2 amperes. Output voltage and current is monitored

by two D'Arsonval meters. Input and output of supply are fused for full protection.

It is housed in a rugged steel case with rubber feet, measures 6½" x 4½" x 8¾", weighs 9 lbs. and is priced at $39.95.

Circle 51 on literature card

Combination Sweep and Marker Generator

The Sencore Model SM152 sweep and marker generator combines in one instrument a VHF sweep generator, a UHF sweep generator, a crystal-controlled marker generator and a marker adder—all the equip-

ment needed for TV and FM alignment, except a scope and associated pads.

The SM152 provides linear sweep from 10MHz to 920 MHz, with the sweep-frequency generator calibrated in both MHz and TV channels 2 through 6. A calibrated sweep-width control permits selection of seven sweep widths ranging from 0.3MHz to 15MHz, with calibration unaffected by the frequency generated.

A 3.58-MHz chroma sweep signal, which is added to the RF output of the unit, is available for checking the chroma response of a color TV receiver through to and including the bandpass amplifiers. A separate chroma signal also is available at the chroma output jack for direct injection into the bandpass amplifiers.

Crystal-controlled markers for both IF and RF alignment are selected by labeled push buttons. Markers provided for IF and chroma alignment are 39.75, 41.25, 41.67, 42.17, 42.67, 44.25, 45,75, 47.25, 4.50, 3.58 and 3.08MHz. Markers at the RF video carrier frequencies of TV channels 4, 5, 10 and 13 also are available at the push of a button. The sound RF carrier is obtained by pushing the 4.5-MHz pushbutton on any RF channel. An extra pushbutton and crystal jack permit adding other crystal-controlled markers, if needed.

The unit also contains features that aid the technician in aligning FM stereo. Pressing one pushbutton simultaneously selects FM crystal-controlled markers of 10.7, 10.6 and 10.8MHz, which permit viewing on an "S" curve the center frequency and the 100-KHz points on either side of the center frequency.

A variable marker generator (39-MHz to 48MHz) in the SM152 permits IF spot alignment of older sets.

The unit features post-marker injection on all markers.

Housed in a vinyl-clad steel case, the SM152 is priced at $349.50, complete with instruction manual.

Circle 52 on literature card

Moving?

Send your new address to:

ELECTRONIC SERVICING

Circulation

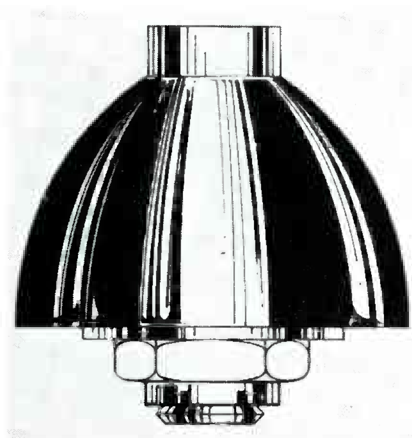
1014 Wyandotte St.

Kansas City, Missouri 64105

antenna systems report

Mobile Antenna Snap Mount

This new mobile-antenna mount from Avanti is designed to be installed from one side of a ½-inch



mounting hole, eliminating the need to get at the back of the mount in order to tighten the mounting bolt on the car. The mount shell is made of molded ABS, a high-impact plastic that is impervious to all weather conditions, and is rust proof. The shell can be painted to match or contrast with the color of the car. A special Neoprene "O" ring insures a positive weather seal. The unit will accept any ⅜-inch, 24-thread mobile antenna. Price is $9.95.

Circle 53 on literature card

Indoor TV Coupler

The Model 761 directional wall tap, manufactured by Craftsman Electronic Products, Inc., has a sloped bandwidth from 54MHz to 240MHz (or 54MHz to 300MHz), a typical return loss of 25dB and

input and output impedances of 75 ohms. Compensated tap values from 6dB through 30dB with low insertion loss help assure more balanced response on cable systems that are designed for extra wide-band response.

The coupler housing and matching off-white plastic or stainless steel wall plate can be installed in standard electrical wall boxes. Through cables are crimped on, and the tap fitting accepts CF-59, CF-59A, CF-56 or CF-11 connectors.

The price of Model 761 is $6.50.

Circle 54 on literature card

TV and FM Receiver Protector

Manufactured by Telecommunications Industries Inc., the Model 300 TV and FM Receiver Protector is connected to the twin-lead antenna transmission line at the point where it enters a building or at the receiver itself. When an over-voltage occurs on the transmission line, a fusible spacer melts, placing a permanent short circuit across the line and grounding both sides of the line. The spacer is replaced to renew service.

Model 300 is housed in a high-impact plastic case and is designed for either indoor or outdoor installation. Other models are available for use with coaxial cable and for insertion in power-line circuits to protect electronic equipment from voltage transients and surges.

Model 300 sells for $8.50 in lots of less than 100. ▲

Circle 55 on literature card

NEA Convention Report

by Wendall J. Burns

Highlights of the National Electronic Association's Annual Convention in Waterbury, Conn. Warranties, pricing, serviceability and more effective relations between servicers and manufacturers were among key issues discussed.

The electronics servicing industry got a searching look from several angles of view last month. The occasion was the annual convention of the National Electronics Assn. at Waterbury, Conn.

The convention included technical seminars and business management sessions, and some participation by representatives of the manufacturers.

A high degree of interest and participation was shown in the panel discussions on warranty, pricing, serviceability and the demonstration on training procedures.

The many well-known objections to warranty policies of the manufacturers were aired at the convention. At the conclusion of a panel on that subject there was reiterated a resolution (presented elsewhere previously) "That the manufacturer and distributor, with due haste, set up meetings with State and National representatives of the independent television dealers to discuss disagreements and problems facing our industry."

The resolution was presented by Anthony F. (Bud) Lackipo, chairman of Connecticut's Board of Television Service Examiners, and proprietor of a TV sales and service firm in Meriden, Conn.

"There is a war on warranties, and I believe the service industry has taken the brunt of it," Lackipo affirmed. Later, he expressed his attitude towards warranty and other industry problems, including contacts with the manufacturers—attitudes that were pretty typical among the NEA members present:

"We are hoping to set up meetings on a continuing basis with participation by manufacturers and the sales and servicing sectors of the industry. The contacts that are possible at the annual conventions of the servicing associations are too infrequent."

During the panel discussion on serviceability (and also during some dinner speeches) the NEA's initiative to resolve that problem received almost universal praise and promise of cooperation from manufacturing representatives present.

"I want to congratulate you on your serviceability guidelines," said John Borlaug, national service manager for Sylvania. "Frankly, we are more than happy to hear from you." He went on to say that to some degree "serviceability is consistency with what has been done in the past in regards to set design . . . making it so the chassis will pull out the same way year after year after year."

John Borlaug, national service manager for Sylvania, one of the dinner speakers, urged the servicing industry to make better use of existing training facilities offered by the manufacturers. He also congratulated the NEA for its initiative in prodding manufacturers to improve serviceability. Seated at far left is Gail Carter, executive vice president of the National Electronics Distributors Assn. (see story) and, seated center is O. C. Brown, Jeffersonville, Ind., who acted as MC at this dinner meeting.

The subject: This was one of the many intense working sessions at the NEA convention. At the microphone is Lew Edwards, service shop operator from Trenton, N.J. Seated at his left is Leon Howland, Indianapolis, chairman of the certification committee, and at his right is Homer Davidson, Ft. Dodge, Ia., a member of the panel.

The GE representative on this panel, John Dobel, said, "We try to motivate the engineers into thinking in terms of serviceability. This is an area that we are working on continuously." Dean Mock, chairman of the committee on serviceability, said among other things that the committee is requesting the manufacturers to label test points by function rather than by code. The panel on pricing touched mainly on "What to charge?", 'How to explain rate increases to customers", and "What to do about the problem of the servicing technicians who charge inadequately for their service, and try to make up for it by selling replacement parts."

The need for better business management in the great majority of shops was stressed during this session. Shop owners must determine such factors as their cost of doing business before they can accurately set their charge to the customer, it was pointed out.

Vince Lutz, St. Louis, said that nine out of ten service shop proprietors make a mistake in not figuring into their rate structure a return on their investment in real estate, test equipment and other capital investments.

Joe Vitt, a panelist, and a staff member from the Howard W. Sams Co., told the NEA technicians present, "You have a missionary job of going out to the shops to convince them to bring up their service rates."

Miles L. Sterling, Garden Grove, Calif., told of the effect on his business when his basic service call rate (first 30 minutes) was hiked from $17.50 to $24.50, and other service charges were hiked accordingly. His firm, Electro TV, operates five service centers in Southern California. The $7.00 rate hike for the basic charge caused him some anxious days, he admitted. His conclusions however are that "you don't have to worry much about competition with people who charge $5.00 (even less) for the basic service call." He said

Emmett Mefford, second from left, Fontana, Calif. is congratulated upon being re-elected president of the NEA. He is shaking hands with George Dukas, NEA convention chairman. Other officers elected were (left) Norris Browne, Houston, secretary; and Warren Baker, Albany, N.Y., (right)treasurer.

Pondering some questions from the NEA members regarding problems created by manufacturers' warranty programs are (seated, left to right) William Sherman, from Philco-Ford's parts and service division; Sol Fields, general manager of the Service and parts division of Matsushita Electric (Panasonic), and R. H. Shoemaker, manager of Product Services, RCA.

David Krantz, president of the Pennsylvania Federation of Radio and Television Service Assn., told this audience: "The battle now is over the parts situation. The NEA should try to convince the manufacturers and parts distributors to make a sincere effort to obtain parts at a minimum loss of time." Krantz is general manager of Certified Calibration Laboratories, Inc., Philadelphia.

he is able to pay his technicians more, and "customer complaints are no greater than before."

Other panelists and technicians told of raising service rates (but none as high as $24.50). Some of their comments on pricing:

"A technician should generate income equal to four times his wages," Jim Ballard, San Jose, Calif. (His firm employs a fulltime CPA.)

"We (in Detroit) have shops that are getting $17.50 for the basic service call. You do not price yourself out of business if you give the customer his money's worth."— Pete Fabbri, Detroit.

"The appearance and attitude of the technician is a big factor."— Bill Russell.

One dinner speaker, Bill Woodbury, of the Sprague Co., manufacturer, asked the NEA members, "What are you going to do when every new TV set is modulized and requires very little service?"

He offered this advice: "Prepare now. Attend every home show and every new goods show, to see the new gadgets that are going to be part of every home. You had better prepare now . . . But, first, you need to organize. You need a trade association to provide an exchange of ideas and views—an effective channel of communications between manufacturers and the government to your industry . . . Your first objective should be one national trade association with a voice that can be heard from coast to coast. The service associations cannot continue to exist on the route they are now following."

Another speaker, Gail Carter, vice president of the National Electronic Distributors' Assn., also called for better organization within the industry. He suggested specialization and preparation to handle various sectors of electronic servicing.

"Divisions within your organization could be TV, hi-fi, medical electronics, digital read-out equipment, and on and on."

Carter also told the servicing technicians present that the problem of parts availability and the subject of back-orders gets top priority at all meetings between distributors and manufacturers.

Morris L. Finneburgh Sr., of the Finney Co., said, "The manufacturers and wholesale distributors must work with you and guide you for you to survive . . . It is about time the EIA put somebody **from the service industry** on its advisory council who talks about the problems of the independent service technician."

Finneburgh told them that the force of organization depends on membership. He presented awards to NEA members who had been most successful in recruiting members in the past year.

John Borlaug, national service manager for Sylvania, took the service industry to task for not making better use of existing training facilties and courses offered by manufacturers. He suggested also that they work through their local school boards to encourage them to provide better electronics courses at the high school level.

He also talked on "togetherness".

"We, as manufacturers, find we can accomplish more for our industry by having one association. We suggest that you of the service industry could do a service to your industry by also working together." ▲

Service Training Schedule

Consumer electronic service training sessions conducted by TV manufacturers, distributors and service associations which are open to all interested consumer electronic service technicians will be announced in this column. Send the dates, location and a brief description of the subjects to be covered to: Service Training, ELECTRONIC SERVICING, 1014 Wyandotte St., Kansas City, Mo. 64105. All information should be submitted two months prior to the date of the training session.

General Electric (1970 Product changes—TV and stereo)

Sept. 16, 1969 **Las Vegas, Nevada**—8:00 a.m. Meeting Sambo's Resaurant—3737 Las Vegas Blvd. So.

Sept. 17, 1969 **Blythe, Calif.**—8.00 a.m. Meeting Sambo's Restaurant—9266 Highway "60"

Sept. 18, 1969 **Yuma, Arizona**—8.00 a.m. Meeting Sambo's Restaurant — 2961 Fourth Avenue

Sept. 19, 1969 **El Centro, Calif.**—8.00 a.m. Meeting. Sambo's Restaurant — Highway 86 at El Centro Ave.

Sept. 23, 1969 **Santa Maria, Calif.**—8:00 a.m. Meeting. Loop's Restaurant—1206 South Broadway.

Sept. 25, 1969 **Carpenteria, Calif.**—8.00 a.m. Meeting. Loop's Restaurant—4405 Via Real

Sept. 30, 1969 **Bloomington, Calif.**—7:30 p.m. Meeting. General Electric Co., 10121 Cactus Ave.

Oct. 7, 1969 **San Diego, Calif.**—7:30 p.m. Meet- General Electric Co., 3464 Midway Drive

Oct. 10, 1969 **Oceanside, Calif.**—8.00 a.m. Meeting. Uncle John's Pancake House—1024 So. Hill

Oct. 14, 1969 **Los Angeles, Calif.** — 7:30 p.m. Meeting, General Electric Co., 2815 E. 46th Street

Oct. 21, 1969 **Van Nuys, Calif.**—7:30 p.m. Meeting. General Electric Co., 6843 Lennox Ave.

Oct. 28, 1969 **Santa Ana, Calif.**—7:30 p.m. Meeting. General Electric Co., 241 E. Stevens Street ▲

Tips and shortcuts for more accurate color TV alignment

Part 2

Second part of a series that provides both general alignment information and step-by-step procedures for specific chassis. The RCA CTC38 and CTC40 color chassis are covered in this installment.

by Carl Babcoke

Color TV alignment is not easy! However, such alignment is very important and it should be checked or readjusted during more repair jobs.

A complete step-by-step procedure for aligning the RCA CTC38 hybrid color chassis is given in this part of the series, plus notes and tips inserted at the appropriate points. These notes will often tell you **why** a certain method is suggested, and many of them will apply to other RCA chassis as well.

General Alignment Specifications

All modern color receivers have an IF response which is essentially flat from the picture carrier (45.75 MHz) to 42.75 MHz and then falls gradually to 41.67 MHz (4.08 HMz total bandwidth) with traps to eliminate all frequencies below that point. The adjacent channel sound, at 47.25 MHz, is also trapped out completely. IF traps of 41.25 MHz and a video trap of 4.5 MHz are necessary to eliminate the 920-KHz beat between the 3.58-MHz color carrier and the 4.5 sound carrier.

The basic chroma bandwidth requirement is for flat response from 3.08 to 4.08 MHz, plus one circuit sharply tuned to 4.08 to produce a rising response to make the overall chroma curve an exact mirror image of the declining IF curve. If the requirements for IF and chroma are satisfied, the overall chroma response from the tuner mixer to the color demodulators will be fairly flat from 3.08 to 4.08 MHz. (You might want to review the alignment article in the July '69 issue of ELECTRONIC SERVICING for more details.) This is a simple concept, but difficult to do in practice since the 4.5-MHz trap must not attenuate the 4.1-MHz signal. Also, the antenna-to-demodulator response curve tilts with adjustments of fine tuning, thus making it mandatory for all traps and markers to be at the right place when the fine tuning is adjusted to the narrow point between picture beat and smear.

A New Alignment Approach

Previous alignment procedures have advocated an IF curve with 45.75 and 42.17 MHz at the 50% point on their respective slopes. The chroma IF's were then adjusted (during VSM alignment) until the desired curve was fairly flat from 3.08 to 4.08 MHz. This approach often has resulted in a fairly good overall curve only when the bandpass transformer was mistuned for response between 4 and 5 MHz. You might ask, "What possible difference can it make, so long as the overall result is within specifications?" The answer: Because such radical mistuning usually results in weak color, beat patterns, and green skin color that tint or color locking adjustments will not cure.

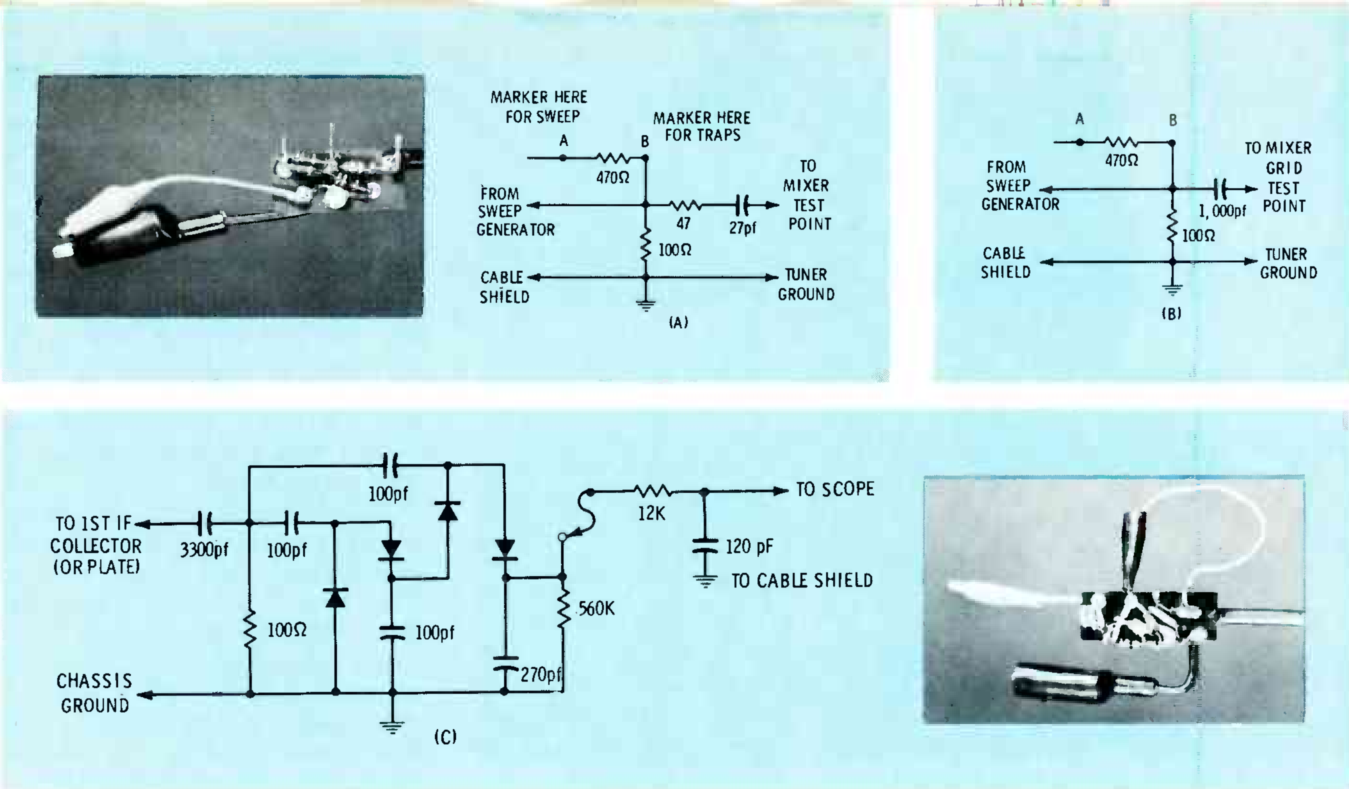
A reversal of the older method is strongly suggested. The IF response curve should be held to tighter specifications on the color carrier side by the use of more markers. The chroma should be prealigned to the theoretically correct curve, and only minor adjustments would be attempted during VSM. If more adjustment of the curve seems necessary to obtain the overall response, the IF curve is wrong and should be done again with more precision. The following step-by-step alignment procedure will give these suggestions in practical form.

Equipment Considerations

For purposes of clarity and accuracy of terminology, any cable- and impedance-matching network that feeds a generator signal to the chassis will be called a "pad," and any cable and parts assembly that feeds a chassis signal to the scope will be called a "probe". These pads and probes are very important in obtaining a truthful alignment curve.

Fig. 1 contains the latest recommendations on pads and probes for all models of RCA color TV. Note especially the "solid-state" mixer input pad of Fig. 1A; it is a must for CTC38 and CTC40 alignment to prevent a falsely tilted curve.

The tube-type mixer pad of Fig. 1B does double duty. It is the correct mixer-grid pad for all other RCA chassis, and is used for injecting the sweep into the chroma channel of the CTC38 and all other RCA's except the CTC40. The 470-ohm resistor shown in these two pads is the author's idea, and is used for injecting the marker at point "A" for normal sweep opera-



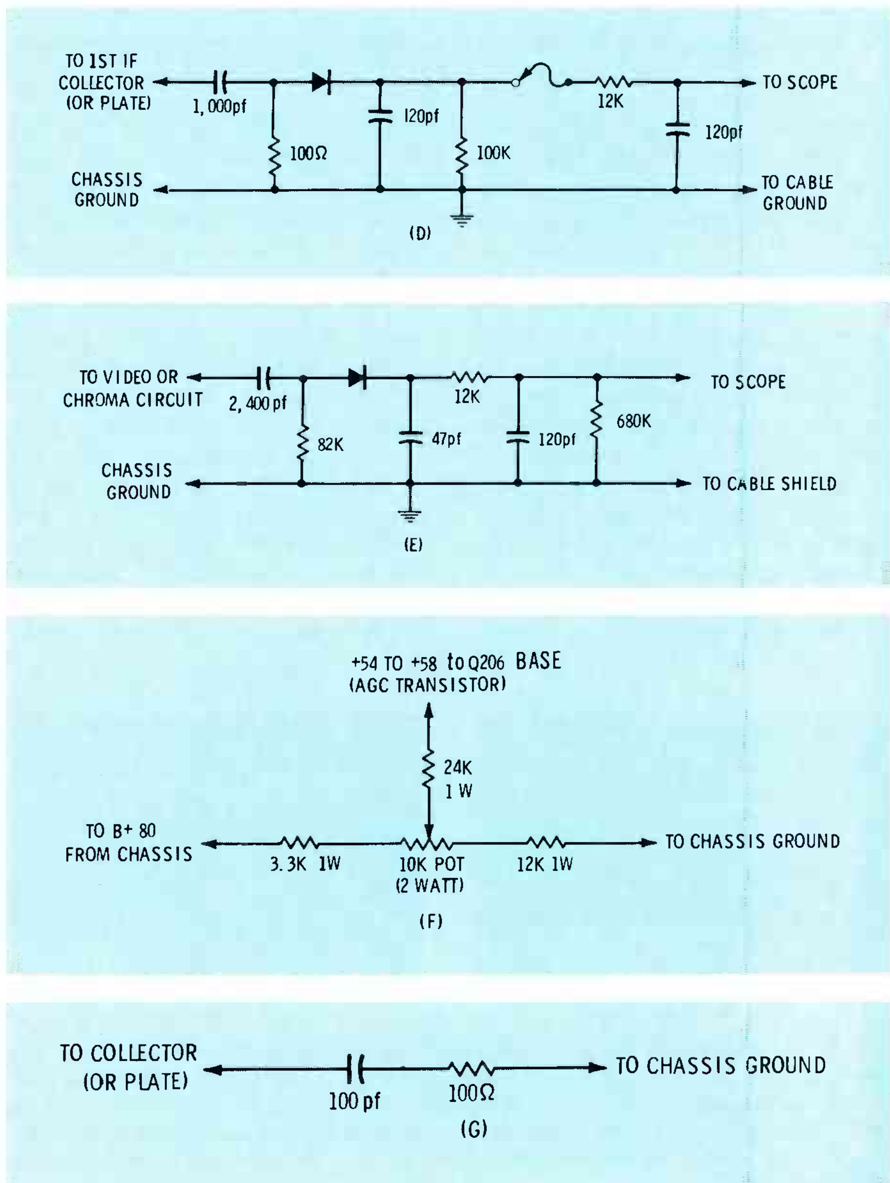


Fig. 1 Pads and probes recommended for all RCA chassis. A) Solid-state mixer pads for RCA CTC38 and CTC40. B) Tube-type mixer pad for all other chassis. C) 100-ohm loading detector probe for use with CTC38 and all three-tube IF chassis during link alignment. D) 100-ohm loading detector probe for use with CTC40 and all two-tube IF chassis during link alignment. E) Universal video or chroma detector probe for all models. F) AGC bias supply for the CTC38. G) Load to eliminate tuning of other stages (do not include in a detector probe assembly). Note: all resistors are carbon type; all diodes are 1N60. The flexible wire and clip shown in C) and D) is to be connected as shown for link alignment; remove it from the probe, connect it to the video detector test point for trap or overall alignment.

tion. This, in addition to the marker attenuation switches, supplies the proper amount of marker signal without changing the sweep curve. With the marker connected to point "B", the marker amplitude is very high, as needed for accurate trap adjustments.

The 100-ohm loading detector probes shown in Fig. 1C and D seem to give identical curves, but the "quad" detector of Fig. 1C has about 3 times the output of the other, and is useful for those models having lower output during link alignment. Older probes similar to Fig. 1D have a 180-ohm resistor (the new ones have a 100-ohm resistor) since they were made for

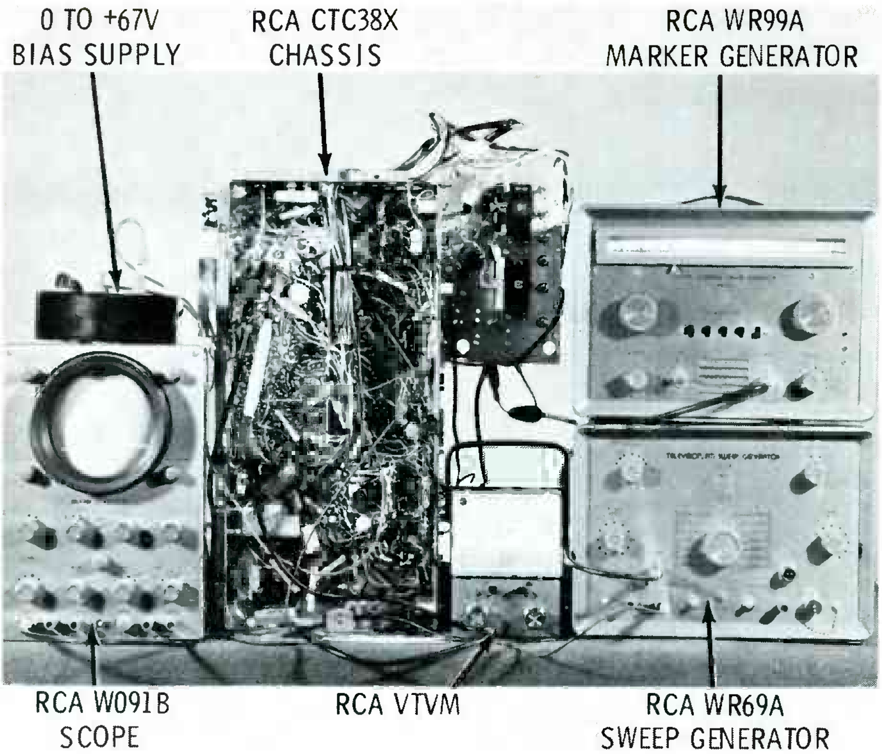


Fig. 2 One arrangement of equipment and chassis for convenient cable connections.

tube circuits. They can still be used for tube chassis; however, the 100-ohm probes, which you can make yourself, will replace the older ones and will reduce the number of probes needed.

The flexible wire and extra clip shown on the two 100-ohm probes is there to save time and provide the needed low-pass filter action for narrowing the markers. To set traps accurately during link alignment, it is best to connect the scope to the video detector of the receiver through a low-pass filter and disconnect the detector probe from the first IF collector. This change from link to overall operation can be done rapidly by using the extra wire and clip on the probe so that the scope cable does not have to be changed. Since the traps should be checked from two to four times, this represents a worthwhile saving in time.

Fig. 1E gives the schematic and parts values for a universal detector probe to be used in video or chroma circuits. It has a relatively high impedance, which minimizes circuit loading and detuning.

A load to swamp out the tuning of subsequent stages during link alignment is shown in Fig. 1G. Similar loads were specified in the past and were often built into the loading detector probe. They are seldom required on late model sets, but if used, the load should be **separate** from the probes for the following reason: In some cases where the built-in load was used on 2-IF tube chassis, the curve was distorted and ocassionally would appear to have a couple of traps affecting the response. Phase cancellation from the probe ground, which was also common to the load, was responsible for this odd effect; the curve became normal when a separate ground was used on the load.

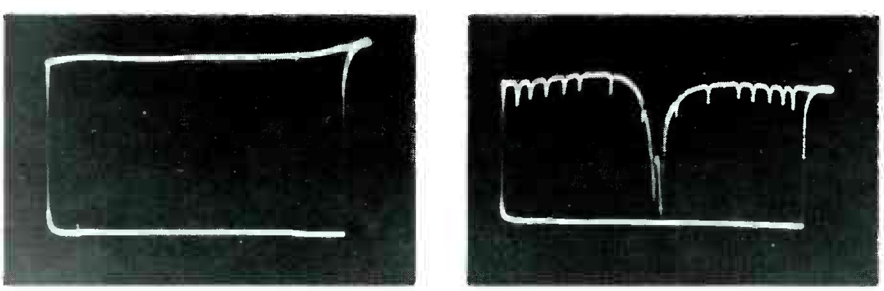
RCA transistorized IF circuits supply a positive AGC transistor, and this makes it possible to obtain from the internal power supply the fixed AGC voltage needed for alignment. In addition to the advantage of not requiring batteries, such a bias source is also safer for the transistors since it is impossible to have AGC voltage without supply voltage. Fig. IF gives the values for an AGC bias source powered from the +80-volt transistor supply. Be sure the power is off before switching to the AGC bias supply.

Fig. 2 shows a convenient grouping of chassis and test equipment. It is not necessary for the yoke or picture tube to be plugged in, since the horizontal circuit is disabled during alignment. The two generators should be close together, with the marker placed above the sweep because more accurate marker-frequency dial settings are possible with the dial scale near eye level, which minimizes reading errors. The position of the scope is not critical, although the probe cables will reach better if it is on the side opposite the generators. Smaller items of needed equipment should be placed wherever they are convenient.

The chassis is usually tuned to channel 3; however, I find it better to look at each channel, after a curve has been obtained, and select one that is not close to others that are different. To say it another way, suppose channel 2 was sloped down on the right, channel 3 was flat, and channel 4 was sloped to the left; it is difficult to determine which is right. But if channels 8 through 12 all produced the same response curve, I would select channel 10.

Generator Checkout

The frequency accuracy of the marker is checked against an internal crystal oscillator, while the flatness of the sweep signal can be



(A) (B)

Fig. 3 Two examples of normal sweep functions with satisfactory equipment. If you don't get a curve through the receiver, check the equipment operation this way: A) Sweep generators set for 3-MHz deviation with a center frequency of about 44 MHz. The output is almost perfectly flat. B) Sweep generator adjusted for video frequencies; output through absorption-marker box to video detector probe and scope.

checked by feeding it to the scope through the video detector probe (Fig. 1E). The video probe simulates the TV chassis, except that the bandwidth is too wide to produce a curve. Therefore, any slope to the curve as seen on the scope is due to a lack of flatness of the sweep signal. See Fig. 3 for two examples of normal equipment.

Use of Non-Critical Settings

The amplitude of the sweep or marker signals or the AGC bias should not change or distort the curve (except for the size of the waveform on the scope) when they are changed a reasonable amount. For example, change in IF attenuation to increase the sweep curve from 3 volts peak-to-peak to 5 volts or a reduction to 1 volt should not change the shape of the curve. Changing the AGC voltage enough to double or halve the scope trace height should not distort the trace. If any of these results are more critical than they should be, the cause should be investigated before any alignment is attempted; if not, the resultant curve may be false. Remember, however, that the scope itself becomes a little nonlinear at the extreme top and bottom of the screen. To avoid compression of the waveform, keep the scope gain low enough at all times so that the scope trace is not more than about 3 inches high.

In general, we prepare the chassis and equipment to get some kind of a curve, then we adjust the generator sweep width and attenuation, scope phasing and gain, etc. until the curve is the right size, centered and normal in every way except for the exact waveshape. Only then should we attempt alignment.

Complete Alignment Procedure for the CTC38

1. Prepare the chassis by removing the horizontal oscillator and horizontal output tubes. Slide the line voltage switch to the "high" position to compensate for the decrease in B+ load resulting from the output tube being pulled. It is not necessary for the yoke or picture tube to be plugged in at this time. Set the tuner for channel 3 (at least at first). Connect the AGC bias supply (Fig. 1F) to B+80, ground and the base of Q206, the AGC transistor. Turn the set on, and after the tubes have heated, adjust the bias control for +55 (measured at the base of Q206).
2. Prepare the two generators and the scope as shown in Fig. 4.
3. Attach the sweep solid-state pad to TP1 on the tuner, then attach the marker cable to point "A" and ground on the pad (see Fig. 5).
4. Fig. 6 shows the quad detector probe attached to TP203 and ground, and +55 volts of fixed AGC bias connected to the base of Q206. The equipment is now ready for link alignment.
5. Some sort of curve should now be seen on the scope. Fig. 7 shows the curve we want; however, it is very unlikely that we will obtain this curve until both the equipment and the link alignment are adjusted.
6. Adjust the horizontal gain and centering of the scope until the trace is centered and almost as wide as the scope screen. Adjust the IF/video attenuation (on marker) for about .2 volt p-p on the calibrated scope.
7. Turn the sweep blanking switch to "off". If two curves side by

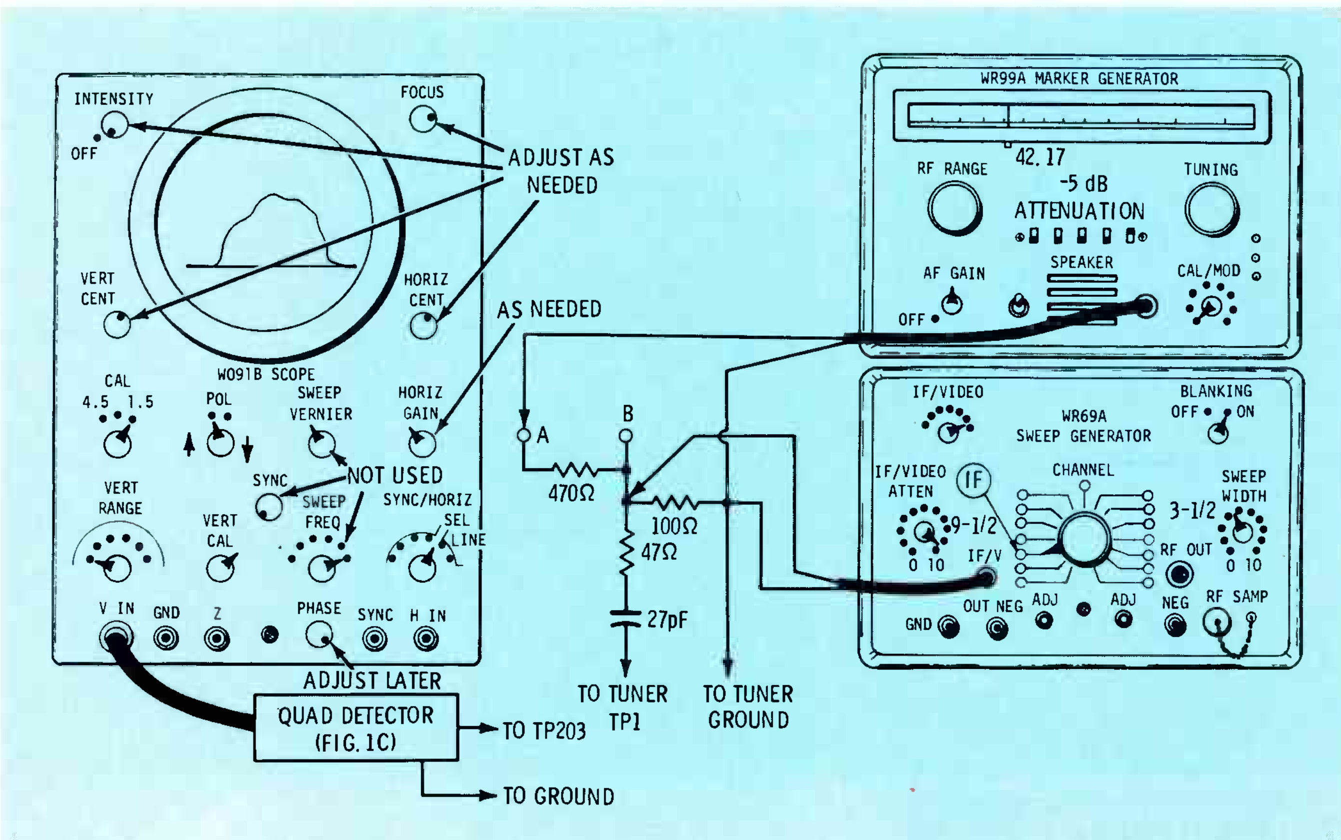


Fig. 4 Scope and generators preset for link alignment.

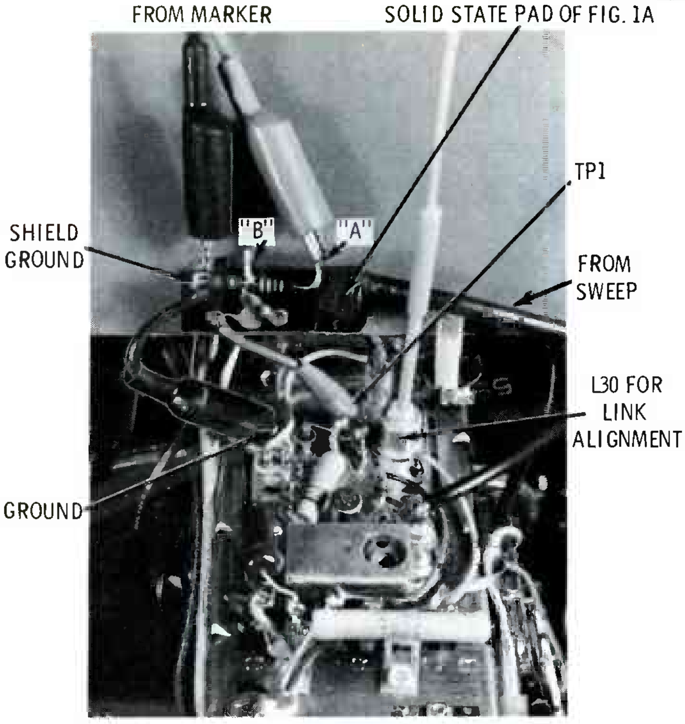


Fig. 5 Attach the sweep cable with the solid-state pad of Fig. 1A to TP1 on the tuner. Attach the marker cable to ground and point "A" on the solid-state pad.

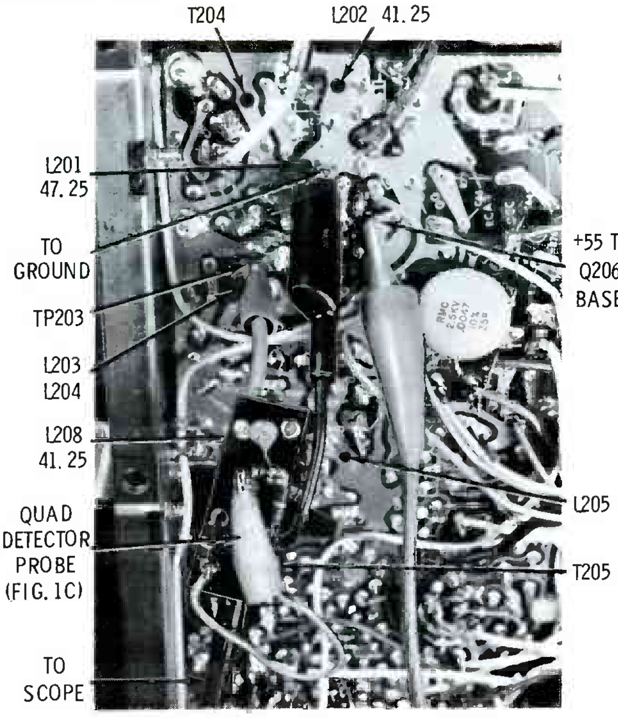


Fig. 6 Attach the "quad" detector probe to TP203 and ground, and connect the +55 volts from the external AGC bias control to the base of Q206.

side are seen (Fig. 8), adjust the phase knob on the scope to bring the two curves together. Switch the blanking back on. If the curve is not centered on the screen, adjust the IF/video knob on the sweep until it is.

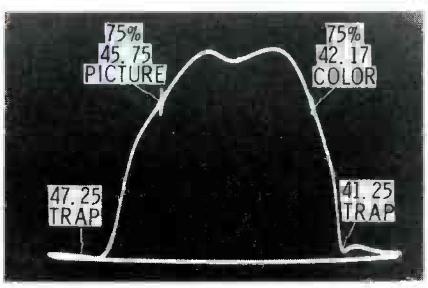


Fig. 7 The correct link curve with both color and picture carriers at 75%.

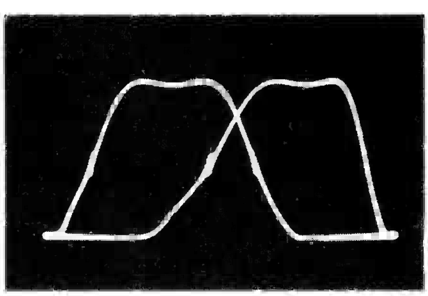


Fig. 8 With the sweep generator blanking turned off, two curves side by side indicate the scope phase control should be adjusted to bring them together.

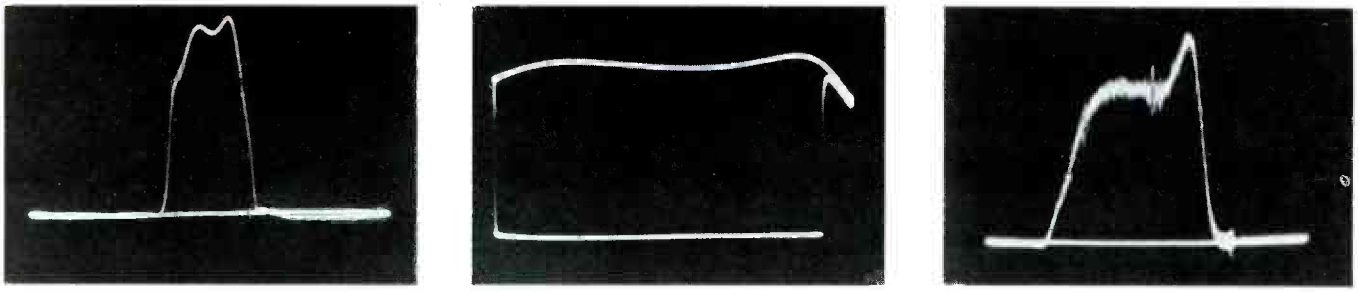
8. Fig. 9 shows several wrong curves that are caused by improper sweep width and AGC bias. Adjust the sweep width so that the curve is about the size of the one in Fig. 7.
9. Two marker problems are pictured in Fig. 10. The first shows the effects of not using a low-pass filter between chassis and scope—the curve is broadened by the wide-band beat frequency. Excessive marker amplitude, as shown in Fig. 10B, not only obscures the exact location of the marker on the curve, but causes the bottom of the curve to pull up.
10. Adjust L30 (on the tuner) so that the 42.17- and 45.75-MHz markers have equal amplitude.
11. Adjust T204 (base of Q203, 1st IF) until the response curve is level across the top. Adjust L30 again for markers of equal height, and T204 for a level top on the curve.

NOTE: If the markers are both below 75%, the curve is too narrow, or the traps are set improperly. If the markers are above 75%, the curve is too wide or the traps are set for the wrong frequency. To widen the bandpass, turn C220 clockwise a fraction of a turn. To narrow the curve, turn C220 counter-clockwise a fraction of a turn.

12. Scan the marker across the 47.25- and 41.25-MHz trap frequencies and estimate whether they are near frequency. If they are, you should decide whether the bandwidth is narrow, normal or wide and adjust C220 accordingly. If the traps are off frequency, they must be set temporarily before you can judge the bandwidth.

NOTE: The adjustments interact very much. The bandwidth adjustment (C220) changes the trap frequency and attenuation, as does T204. All of these adjustments must be made alternately several times to obtain accuracy.

13. Change the equipment to the trap adjustments setup—remove the quad detector probe from TP203; remove the extra wire and clip from the detector probe and clip it to the set's video detector at TP201. Reduce the IF/video attenuation on the sweep until the curve is smaller than the scope screen. Change the marker cable from point "A" to "B" on the solid-state pad connected to the tuner, and adjust the marker cal/mod switch to the "600-Hz modulation" position. Set the marker frequency to exactly 47.25



(A) (B) (C)

Fig. 9 Several curves produced by wrong equipment adjustments. A) Narrow curve caused by excessive (10 MHz) sweep width. B) Wide and incomplete curve caused by insufficient sweep width. C) Noisy and peaked curve with excessive gain caused by wrong AGC bias (between +65 and +70 volts).

MHz. If the scope shows too much 600-Hz modulation, reduce the scope gain temporarily and adjust the 47.25-MHz trap. When the 600-Hz signal is reduced, increase the scope gain.

14. Adjust the 47.25-MHz trap (L201) to reduce the 600-Hz signal on the **base line,** as shown in Fig. 12. When a minimum amount of 600-Hz signal is obtained, adjust the top core of T204 and the 47.25-MHz trap alternately for minimum. The final adjustment should be made with the scope gain at maximum.

NOTE: The sweep curve could be eliminated entirely since we are only concerned with the signal on the base line, but a false minimum can sometimes be found with a trap tuned to the middle of the curve, and this wrong condition can be prevented if the curve is seen at the same time.

15. Change the marker frequency to exactly 41.25 MHz, lower the scope gain until the pattern is smaller than the screen, and adjust L202 (41.25-MHz trap) and L206 (trap in last IF stage) for minimum 600-Hz signal on the base line. It is not possible to eliminate all of the marker signal, so stop at minimum. Increase the scope gain as needed as the marker signal decreases. **Do Not** adjust the top core of T204 during this step.

NOTE: A spurious carrier on the IF curve may prevent proper trap action if the carrier also has 600-Hz modulation. Turn off the 600-Hz signal at the marker, and examine the curve carefully for any extra markers. If there is one, try to move it off the curve with the receiver fine-tuning control, then reset the equipment for trap adjustments and try again. The 47.25-MHz trap should tune so sharply that it is difficult to withdraw the alignment tool without causing a noticeable change in the trap tuning. Older model sets had a variable resistor across the primary of the IF transformer; in those sets the resistor and the trap are adjusted alternatively for a minimum 600-Hz pattern. No other method can assure such accurate trap adjustments.

16. Restore the equipment for link alignment, and check the bandwidth and tilt. If it is not right, repeat steps 10, 11, 12, 13, 14 and 15. Turn the marker cal/mod control to the off position.

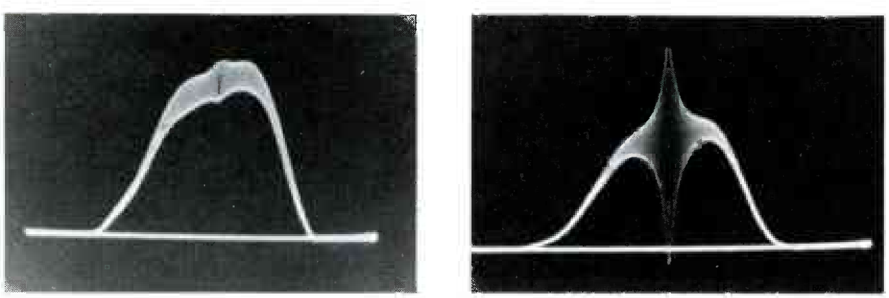
NOTE: The link curve is the foundation of the IF response and, therefore, it should be as close to perfect as possible. If both stagger-tuned and overcoupled stages are used in the IF (all RCA except the 2-tube IF models have both), each over-coupled stage should be aligned or prealigned separately. The link stage of the CTC38 is an overcoupled stage, and has already been adjusted. L205 and T205 comprise another overcoupled stage in the CTC38.

17. Remove the solid-state mixer pad from the tuner and attach it to the base of Q205 (last IF); keep the marker cable connected. Remove the quad detector probe and connect the low-pass filter part of it to TP-201 of the video detector, as was done in the trap adjustment steps. Sweep and marker amplitudes should be at maximum with the scope gain near maximum. Use IF sweep and the 44-MHz marker.

18. Adjust both L205 and T205 for maximum at 44 MHz. Fig. 13 shows a link-response curve with maximum amplitude at 44 MHz and a notch for the 41.25-MHz sound trap.

NOTE: Since in this case the stage is not overcoupled enough to flatten the top of the curve, this step could be eliminated; however, you should know how to check it.

19. Return the solid-state mixer pad and marker cable to TP1 on the tuner. Calibrate the scope and set it on the 5-volt p-p scale. To begin with, reduce the marker about 15 dB, and reduce the sweep until the scope shows 2



(A) (B)

Fig. 10 Two marker problems. A) The wide trace obtained if no low-pass filter is used before the scope. B) The effect of excessive marker amplitude—the curve is obscured and the bottom is pulled up.

volts p-p. Set the marker to 45 MHz, and adjust the attenuation switches for a small marker.

20. Adjust L203 to raise the marker as high as possible without regard to curve shape.
21. Set the marker for 42.75 and adjust L204 to raise the marker as high as possible. Reset the gain of the scope and marker attenuation, if needed.
22. Adjust L205 so that the 45.75- and 42.17-MHz markers are the same height above the base line. Adjust T205 for minimum tilt on the top of the curve.

NOTE: If the adjustments of L205 and T205 are changed very much, it may be necessary to check the 41.25-MHz trap (L206).

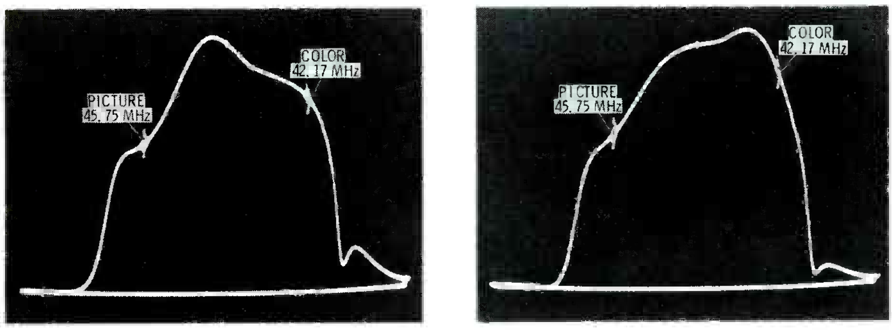
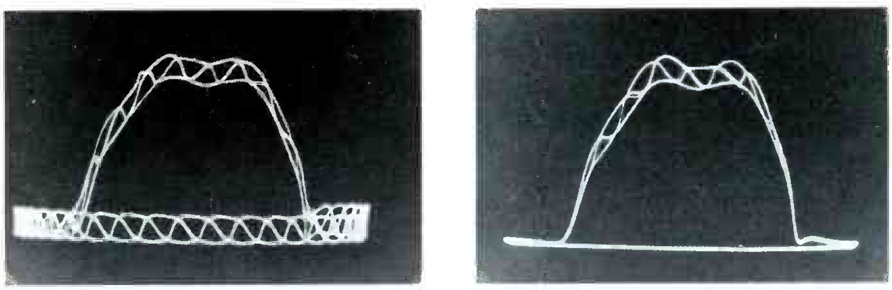


Fig. 11 Link alignment curves obtained when T204 is adjusted too far in either direction.



(A) (B)

Fig. 12 Adjust the 41.25-MHz and 47.25-MHz traps for minimum 600-Hz signal on the base line with the marker generator set for their respective frequencies. A) The trap is off frequency. B) The trap is adjusted correctly, and very little 600 Hz is seen on the base line.

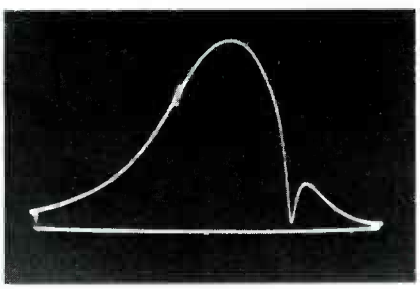


Fig. 13 Typical curve produced by tuned circuits L205, T205 and L206 in the last IF stage. Maximum gain should be around 44 MHz, with a notch for the 41.25 trap. The marker on the curve is 45.75 MHz.

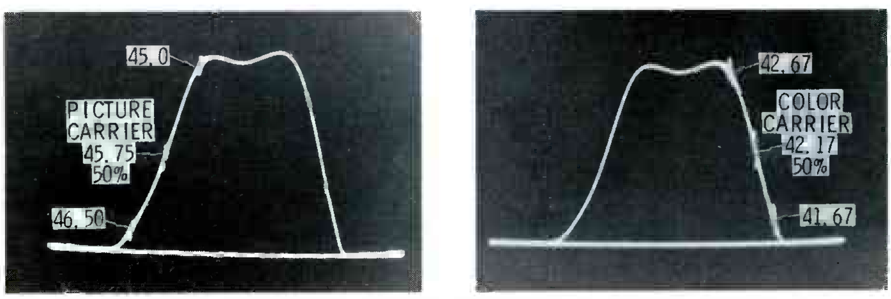


Fig. 14 Six markers, not just two, are required for accurate IF alignment. The three markers on the color carrier side are the most critical.

23. Readjust L203, L204, L205 and T205 for the best location of the 6 markers, as shown in Fig. 14.

NOTE: The 45.75-MHz marker should be as close as possible to the 50% level, while the 45.0-MHz marker is not so critical since it affects b-w video response (including ringing) more than it does color. The 42.67-MHz marker should NEVER be on the flat top part of the curve, while the 41.67-MHz marker should be as high up the curve as possible, although there is little chance of raising it above 20%. The 42.17-MHz color carrier marker should be halfway between 42.67 and 41.67 MHz for best results. This color carrier side of the response curve is vital for good color quality; it should be straight between the 3 markers, or better yet, exhibit a slight bow-in at the color carrier (it should NEVER bow-out). Stronger color is obtained by a higher 42.17-MHz marker position on the curve, but the other essentials should not be sacrificed for this one goal.

Chroma Alignment

NOTE: Presetting the chroma alignment is strongly recommended as a means of cross-checking the IF response, as outlined earlier in this article.

24. Prepare the scope as detailed in step 2. The marker generator is not used in this step. Prepare the sweep generator as shown in Fig. 15, with the IF/video output going to an RCA Model WG295C video multimarker. The output of the multimarker is through the tube-type mixer-grid pad.

NOTE: The first few times you do this it would be helpful to check the test equipment function without the color TV chassis. Simply connect the output of the sweep-multimarker-mixer pad through a video detector probe. You should get a curve similar to that of Fig. 16A. Touching the contact associated with each marker should make that marker disappear from **both** sides of the curve, since there are two "mirror-view" curves, one on each side of the zero beat. To eliminate one curve, reduce the sweep width to widen the curve, then adjust the IF/video knob to move the curve to the right, as shown in Fig. 16B.

Now you are prepared to check the chroma response.

25. Attach the sweep output (through the multimarker and tube-type mixer-grid pad) to pin 9 of V704A (2nd bandpass amplifier). Connect the scope through a video detector probe to the demodulator test point, TP702. Set the color control to midpoint (if this is not done, T701 acts as a trap and makes a notch in the curve).
26. Adjust the one core in T705 for a symmetrical curve on both sides of 3.58 MHz. See Fig. 17A.
27. Apply –5 volts bias to the 1st bandpass amplifier via point BG on the chroma board (4.1-MHz side of the response curve will be low otherwise). Move the sweep pad to pin 2 of V701B, and adjust both cores of T701 to produce the curve shown in Fig. 17B.
28. Connect the sweep pad to pin 2 of V202A (1st video amplifier). Reduce the sweep amplitude as required, then adjust L701 for maximum amplitude at 4.1 MHz, as shown in Fig. 17C.
29. Change the mixer pad to the marker generator output and connect it to terminal "B" of L212, the 4.5-MHz trap. Turn the cal/mod marker switch to 4.5 MHz, 600 Hz modulated.
30. Adjust L212 for minimum 600-Hz pattern on the scope. Adjust the marker level and the scope gain as required.

Video Sweep Modulation (VSM) Alignment

NOTE: This checks the response from the tuner mixer to the color demodulators.

31. Prepare the equipment as shown in Fig. 18. Feed the output of the RF modulator box through the solid-state mixer pad to TP1 of the tuner.
32. Connect the video detector probe and scope to TP201 of the video detector and compare the resultant curve to that in Fig. 19. Some variation is permissible, but the curve from 3.08 to 4.08 MHz should be fairly smooth. **Do Not** adjust anything, just LOOK at the curve. The "grass" on the curve is from the horizontal sweep circuit and is the reason the output and oscillator are to be removed during alignment. This grass becomes even more noticeable further on in the VSM alignment procedure.
33. Change the video detector probe to TP702. Adjust L701 and both cores of T701 (but as little as possible) to obtain the curve of Fig. 20A. If the best curve you can produce is like the one in Fig. 20B, the IF alignment probably is not right.

NOTE: Nothing was mentioned here about adjusting T705, because

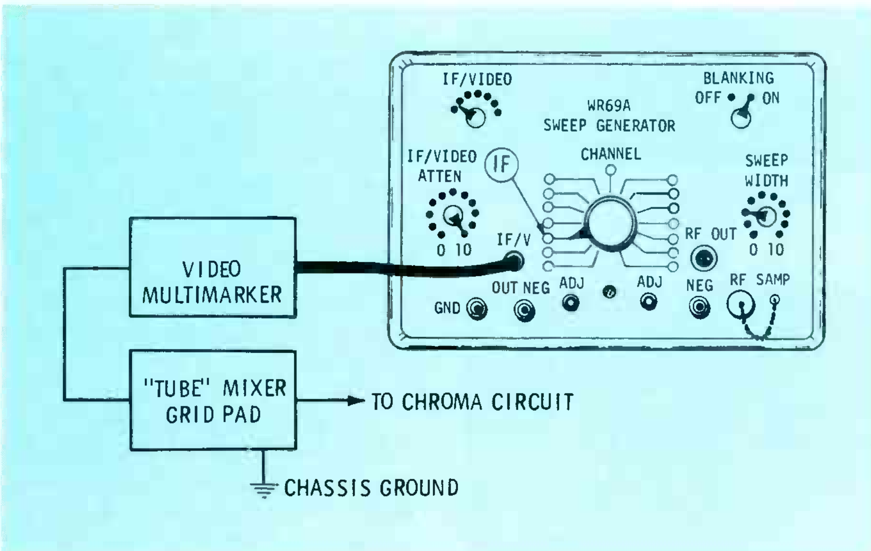
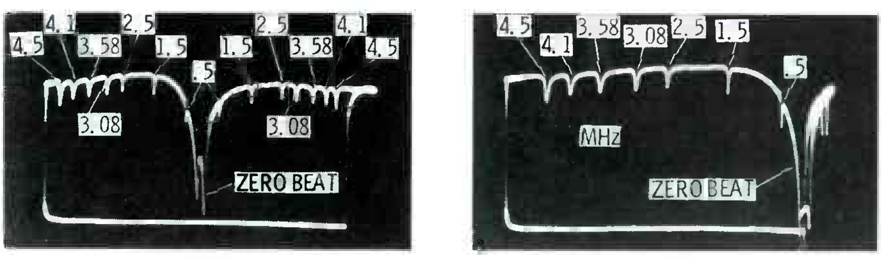
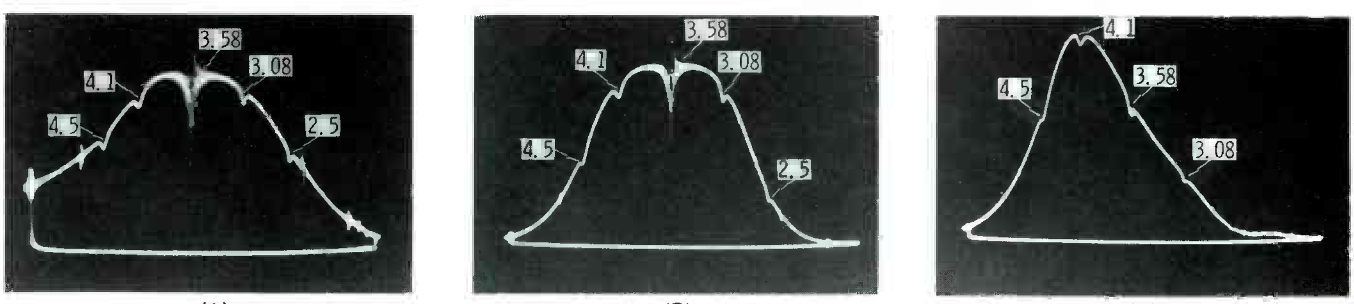


Fig. 15 Prepare the sweep generator as shown here.



(A) (B)

Fig. 16 A) Video sweep with absorption markers has a reversed curve on each side of zero beat. B) Adjust the sweep width and frequency to obtain a single curve.



(A) (B) (C)

Fig. 17 Preset controls to obtain approximation of expected curves in chroma circuit. A) T705 only. B) T705 and T701. C) T705, T701 and L701.

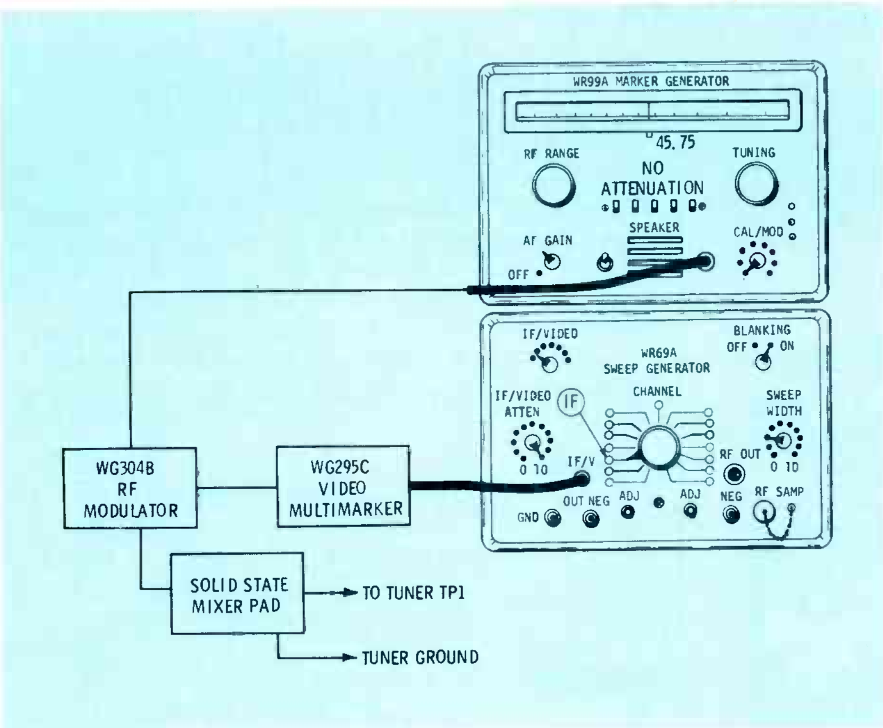


Fig. 18 For VSM overall alignment, prepare the marker and sweep generators as shown.

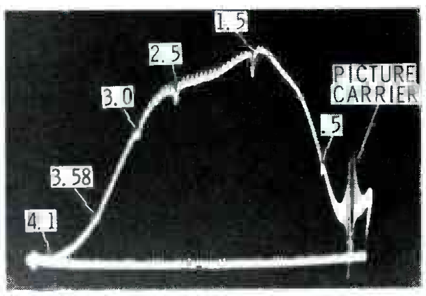
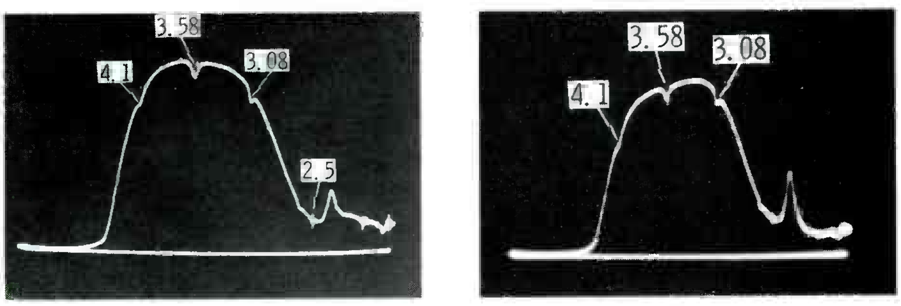
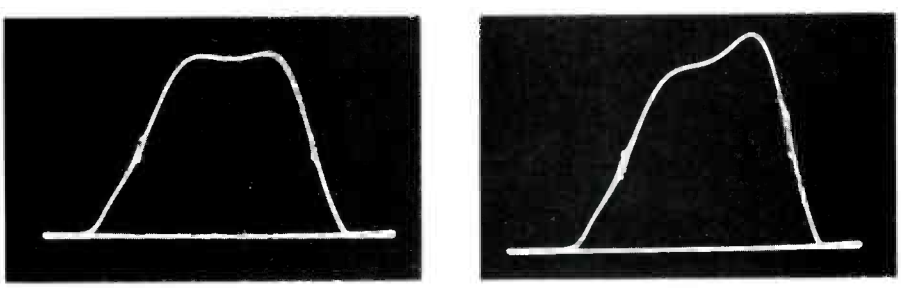


Fig. 19 A typical VSM curve viewed at the video detector of receiver. The "grass" is from the horizontal sweep.



(A) (B)

Fig. 20 A) A good overall VSM curve from tuner to chroma demodulators. B) This curve is not symmetrical, and 4.1-MHz marker is too far down the side.



(A) (B)

Fig. 21 The importance of the right mixer pad is shown here. A) Normal curve when the receiver is aligned with the "solid-state" pad. B) The tilted curve produced when the "tube" mixer pad is substituted.

if it must be adjusted to obtain the desired curve, it is likely that the color locking and tint adjustments cannot be offset enough to give good skin color on all channels. The IF alignment should be repeated if L701 and T701 will not produce the correct curve.

What If The Chassis Does Not Align?

The first probability is that the IF or chroma circuits need repairs. Did any one stage fail to respond normally when aligned? If so, check it first. Refer to last month's alignment article for suggestions about using the alignment curve for troubleshooting. Does the AGC bias applied to the base of Q206 match the emitter voltage? If not, a problem exists in the AGC stage.

Were the correct matching pads and rectifier probes used? Fig. 21 shows the change in curve that results when the IF's are aligned first with the correct "solid-state" pad and then with the "tube" pad. The curves show that a receiver aligned with the tube-type pad will have a response curve on which the color carrier side "droops". The two symptoms will be slightly weak color and not enough 4.1-MHz on the overall curve during VSM alignment.

Check for mistakes you may have made in connecting the equipment. Are the clips on the right lug? Is there a good connection? Any switches or controls misadjusted on a generator? If a clip will not hold onto a lug, solder a small piece of buss wire to the lug for the clip to grip. Did a pad or probe slip and fall across a terminal on which there is a power-supply voltage, thereby being destroyed?

If one of the curves is upside down, it can be turned right side up by using the polarity switch on the scope. The diode polarity of the probes described was chosen to produce a positive-going signal to match the positive-going video detector of the CTC38. If you use these probes on an older model with a negative-going video detector, the curves will be upside down.

Next

Future installments of this series will provide detailed, step-by-step procedures for aligning other popular color chassis using other makes of test equipment. ▲

photofact bulletin

PHOTOFACT BULLETIN lists new PHOTOFACT coverage issued during the last month for new TV chassis. This is another way ELECTRONIC SERVICING brings you the very latest facts you need to keep fully informed between regular issues of PHOTOFACT Index Supplements issued in March, June, and September. PHOTOFACT folders are available through your local parts distributor.

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Chassis 4H12, 4H1270-2, 4H1273-1/-4/-8/-9, 14H1279-1, 14H1282-1 1049-1
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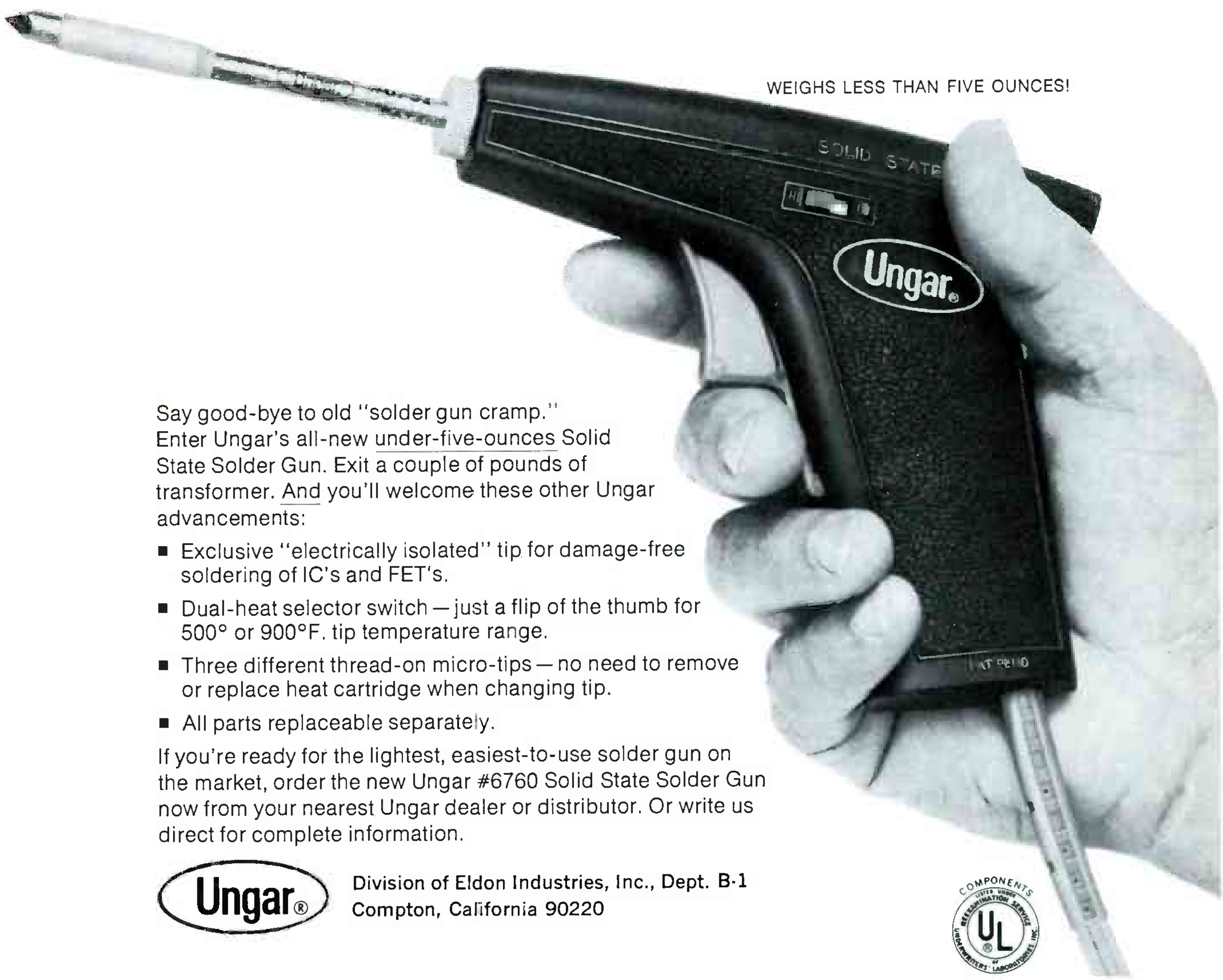

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Circle 26 on literature card

troubleshooter

Repeated Failure of Audio Output Transistor

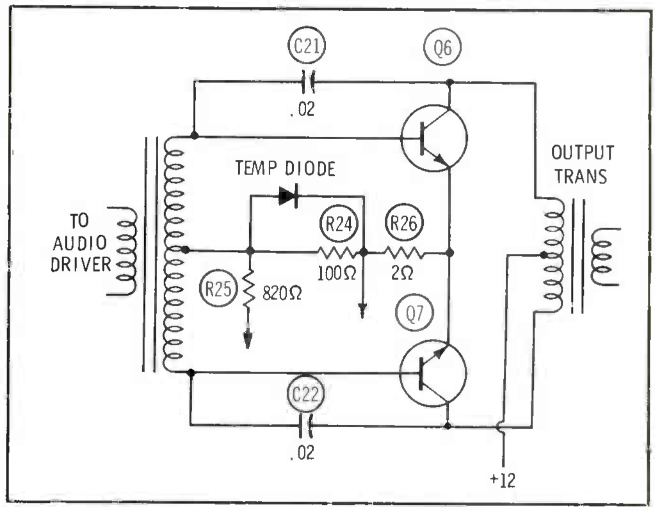
I have repaired the same fault on a 7-transistor Ranger Auto Radio (Model RR29PB) three times. It uses a push-pull audio output circuit. The same audio output transistor either opens or shorts between the emitter and collector. Also, the emitter resistor burns up. Can you tell me what is causing these same two components to fail?

Bernard Grupe
Barrington, Illinois

The 2-ohm emitter resistor burns up because of excessive transistor current and is unlikely to be the primary cause of the problem.

An open transistor could be just a defective replacement if the resistor did not burn up that time. After an overload of any kind, it is common for a transistor to have an emitter-collector short. This can be the cause of the failure, or it can be the result of another defect.

I would suggest that the transistors might have too much forward bias; this would make them run too hot and be susceptible to a thermal run-away. The forward bias should be just as low as possible without objectionable audio distortion; the old rule of ±10% is not strict enough for bias on transistors. Answering the following questions should help you isolate the trouble: Could R25, R24 or the heat-compensation diode across R24 be off tolerance? Is there any possibility that the 12-volt supply might occasionally be too



high? Perhaps the voltage regulator on the car is defective. Or does the customer run the radio at full volume? I suggest that *both* output transistors be replaced at the same time, even if only one is bad.

6LQ6/6JE6 Interchangeability

I was very interested in the letter from Bernard H. Serota (Feb. '69) concerning the 6LQ6/6JE6C tube. I have also had the same results, and the only cure was to use a straight 6JE6 tube. RCA should check further, as it will not work.

Horace H. Cox
Central Falls, R.I.

Since I worked for the RCA Distributing Corporation for many years as service manager, including the big problem period when the 6JE6's were averaging 30 days of use before failure, I was more than a little surprised at the report from you and Mr. Serota. None of the hundreds of Kansas and Missouri technicians that I know ever mentioned this problem to me. I have personally used dozens of 6LQ6 tubes as replacements, with no more than average subsequent failures.

To check my own experience, I called the local RCA Service Company branch, since they replace dozens of such tubes every day. Their service manager said they use the 6LQ6 in preference to the 6JE6 with no particular problems. According to the information RCA gave us, the 6LQ6 is only a more rugged 6JE6. 40 seconds of operation without drive is supposed to weaken the tube no more than a 6JE6 is weakened after only 10 seconds of operation without drive.

Most of my experience has been with new RCA tubes installed in nearly-new RCA color TV's, so there may be some special conditions I am not aware of. What brands of tubes and receivers were the ones you had the bad results with?

If you or any other readers could offer any information to help solve this mystery, it would be greatly appreciated. ▲

bookreview

Servicing the Solid-State Chassis: Homer L. Davidson, TAB Books, Blue Ridge Summit, Pa., 1969; 256 pages, 5⅞" x 8⅝", hardbound, $7.95; paperbound, $4.95.

This illustrated manual covers the repair and maintenance of consumer-type solid-state equipment—transistor TV, radios, multiband receivers, auto radio and tape players, portable phonos, stereo phonographs and amplifiers and home-type tape recorders.

Chapter 1 reviews the basics of isolating a defective transistor, with detailed instructions for removing and replacing transistors. Chapter 2 covers transistor TV and Chapter 3 covers portable transistor radio.

Chapter 4, 5 and 6 deal with AC and DC, AM-FM and multiband receivers, while Chapter 7 examines auto radio repair, with time-saving tips included. Chapter 8 covers audio tape players. Both simple and more elaborate stereo players and amplifiers are reviewed in Chapters 9 and 10, along with hi-fi amplifiers and IC units.

Chapter 11 deals with tape recorders and Chapter 12 covers printed-circuit servicing—how to repair broken boards, signal-tracing tips, locating breaks and intermittents, soldering, component replacement and general troubleshooting. ▲

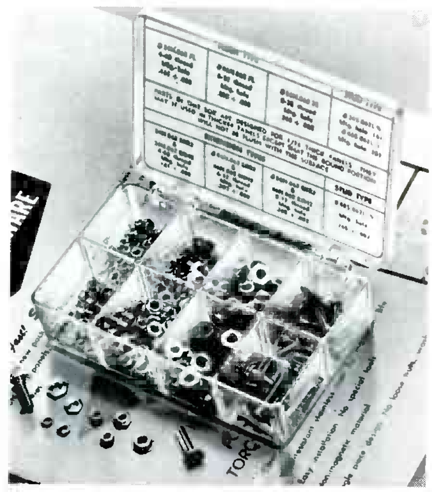
"First, let's test out that little ole picture tube."

productreport

for further information on any of the following items, circle the associated number on the reader service card.

Captive Nut and Stud Kit

Precision Metal Products Company has announced the availability of a new kit containing a series of Pressert captive nuts and studs which mount in brass, aluminum, and mild steel chassis or panels up to 5/16" thick. No special tool is required; Presserts can be installed in drilled or punched holes with an arbor press. Material displaced by the head cold flows into the Pressert's channel to form a lock that is designed to withstand hundreds of



pounds of push-pull pressure. The hex design of the head secures the Pressert against torque.

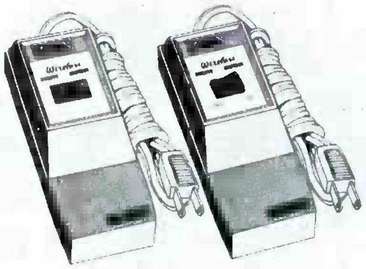
Presserts are made of 303 stainless steel that provides long life in applications requiring repeated fastenings without burring, cross-threading or stripping, according to the manufacturer.

The Pressert Design Kit contains 305 individual pieces, including flush- and extension-type nuts and a selection of studs. Kit parts are designed for 1/16" thick panels, but may be used in thicker materials. Threads included are 4-40, 6-32 and 8-32. Cost of the kit is $15.95.

Circle 56 on literature card

Wireless Switching System

A wireless control switching system has been introduced by Workman Electronic Products. Called



"REMO", Model No. SW-24 consists of a transmitter and a receiver, which will operate the on/off control of a television, stereo, tape recorder or any other home electrical appliance with a demand of up to 300 watts.

Operation of the equipment is dependent on the transmission of an inaudible, high-frequency signal which, when sensed by the receiver unit, closes the circuit of the AC receptacle and provides current to the device being used.

No installation is required. The TV or other appliance is plugged into the receiver, and the receiver is plugged into the house AC outlet. The transmitter is then plugged into a convenient AC outlet anywhere in the house, as long as it is on the same line as the receiver. By switching the transmitter control, the appliance can be turned on or off.

The price for the complete set, including receiver and transmitter, is $14.95.

Circle 57 on literature card

Commercial Loudspeaker

The Jensen 5 ¼-inch Model FX-52 super-low resonance FLEX-AIR® commercial sound loudspeaker uses grille screens with a diameter as small as 6 inches for distributed sound systems where extremely small baffles are desired.

The FX-52 also features a removable universal bracket, permitting end-transformer mounting for shallow spaces or back-transformer mounting for deep spaces with small diameters. According to the manufacturer, the speaker is completely weatherproof and can be used for indoor or exposed outdoor applications with a plastic diaphragm and a specially-protected moving system. In addition to super-low resonance, high sensitivity results from a large Syntox-6® magnetic structure.

The Jensen model FX-52, with 8-ohm voice coil, is also available with optional pre-integrated, contant-voltage transformers for 70-volt line or 25-volt line circuits. The FX-52 is priced at $24.95.

Circle 58 on literature card

Solder Designed for TV Servicemen

Multicore Sales Corporation has introduced the Ersin Multicore Ser-

viceman's Pak, especially designed for use by radio and television and bench technicians.

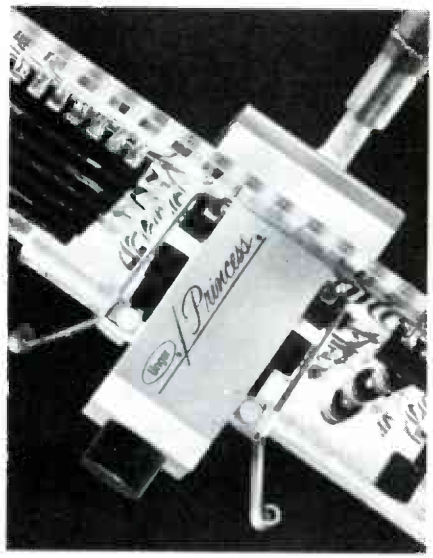
The Serviceman's Pak contains 40 feet of Ersin's 5-core solder in a flame-proof, reel-type dispenser which fits into any tool kit, tube caddy or pocket. The solder is the standard tin/alloy 60/40, with a diameter of 19 SWG (.040″).

Price is $1.00.

Circle 59 on literature card

Automatic Extractor

Ungar, Division of Eldon Industries, announces an automatic extractor, Model No. 6982, designed



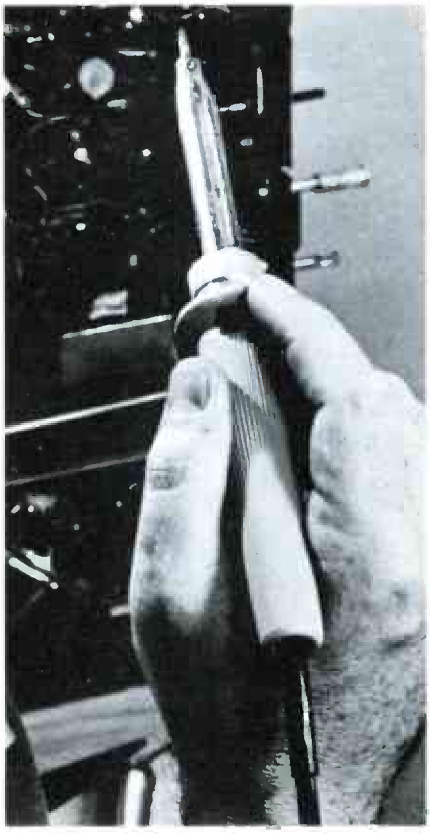
to facilitate removal of dual in-line integrated circuits. The package is released at the precise moment of solder melt to prevent heat damage to components, circuits and boards. A spring-loaded positive lock frees and protects the operators hands during desoldering. The unit price is $1.77 (quantities 1-9).

Circle 60 on literature card

Instant Soldering Iron

A slim, 3-oz. instant heat pencil iron that reportedly will do the work of much heavier pistol-type guns is being produced by Wall Manufacturing Company as its Model IDL.

The break-through in design came by using a dual heat element controlled by a thermal time-delay relay, making unnecessary a transformer that adds weight and bulk.



According to the manufacturer, a high-wattage element activated by a switch on the handle brings the tip temperature up to operating heat in seconds. The time-delay relay then cuts in a lower-wattage element that maintains the proper soldering heat, with no danger of overheating. The iron continues at the lower wattage until a higher heat is required, then the relay cuts in again for as long as needed. Initial input is 180 watts, and the iron normally operates at 40 watts. Heating elements may be quickly changed without tools.

The IDL's handle is molded of a polycarbonate, lightweight, unbreakable blue plastic. Iron-plated or regular 1/8-inch plug-in tips are inserted by loosening one set screw. Since any tip shape may be used and changed easily, the tip can be matched to the job.

Sufficient heat is provided by the IDL for use on miniature circuits or heavier jobs.

The price is $12.98.

Circle 61 on literature card

Special Crystal Pack

Shepherd Industries is now skin packing inter-station transmit and

receive crystals for Regency 500, Messenger III, Pace 200, Pearce Simpson and Cobra units, and many others. The crystals, for channels 9, 10, 12, 13, 14 and 23 have the standard lifetime guarantee. Each pack costs $18.95.

Circle 62 on literature card

Transistor Transformers and Reactors

Essex International, Inc., Controls Division, makes available the Stancor Pico Series of light-weight, miniature transformers and reactors for transistor circuits. The 242 basic units contain 900 configurations, range in size from a .215-inch cube to 1 3/16 inches and offer a wide-range frequency response. The units are priced from $7.00 to $12.00

Circle 63 on literature card

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advertisers' index

catalogs literature

ANTENNA SYSTEMS

100. *Garrett Electronics and Cable Co.*—A revised 36-page catalog that lists nine major wire product groups and related products is now available. The nine categories are: military hook-up wire; aircraft wire; coaxial cable; control and instrumentation cable; power and service cable; audio cable; heavy industrial cable; and shielded and braided wire and cable.

101. *JFD Electronics Corporation*—has introduced a new guide to master antenna TV (MATV) system products. Included in the new 16-page publication are antennas, preamplifiers, amplifiers, AGC units, filters, mixers, tapoffs, matching transformers, splitters, FM converters, traps, coaxial cable, connectors and terminators.

COMPONENTS

102. *Amphenol*—announces four fully illustrated bulletins, each on a line of Amphenol's sockets. Bulletin PB-001 covers the 77 Series SCR socket; Bulletin PB-002 describes tube and relay sockets designed for solderless wrap applications; the 78 Series miniature sockets are covered in PB-003; and Bulletin PB-004 describes Amphenol's standard tube and relay sockets with printed-circuit board terminations.

103. *Cornell-Dubilier*—has issued a new 12-page brochure containing information on all the units included in their new Re-Place (TM) capacitor replacement center. The Wide Range Miniature Electrolytics, Dipped Paper Mylar*, Ceramic Disc, Dipped Mica, Wax Filled capacitors, Wide Range twist prong and Wide Range tubular lines are covered.

TECHNICAL PUBLICATIONS

104. *Howard W. Sams*—Literature describes popular and informative publications on radio and TV servicing, communication, audio, hi-fi and industrial electronics, including 1969 catalog of technical books on every phase of electronics.*

TEST EQUIPMENT

105. *Bird Electronic Corp.* — 4-page short-form catalog SF-69 lists coaxial load resistors, absorption wattmeters and directional wattmeters stocked by Bird. Related accessories are also listed.

TOOLS

106. *Vaco* — 24-page illustrated catalog SD-76 describes tools for industry, production and assembly line, maintenance and service or home workshop use.

107. *Xcelite* — 4-page catalog No. 166 Supplement contains descriptions and specifications of tools added to the Xcelite line since publication of the latest general catalog.

*Check "Index to Advertisers" for additional information. ▲

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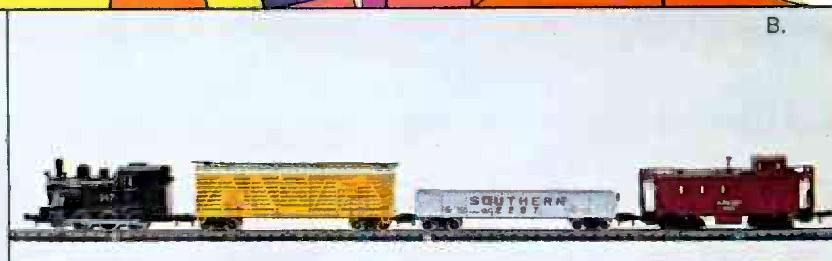

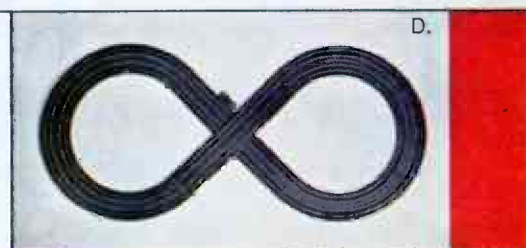

* 17 wondrous toys (only a few shown here) to light up the eyes of children of all ages!
* available with purchases of RCA Entertainment Receiving Tubes and Picture Tubes from your local participating RCA Tube Distributor.

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B. ATLAS N-GAUGE READY-TO-RUN TRAIN SET—TC-69364—complete
C. PLUSH DOG—TC-2262—cute-as-a-button beagle type
D. ATLAS ROAD RACING-SET—TC-1202—complete with power supply
E. PARKER "QUBIC" GAME—TC-400—3-dimensional Tic-Tac-Toe
F. COLLECTOR'S SET AMERICAN SPACE PROGRAM BY REVELL—TC-1839—3 ready-to-assemble models
G. HORSMAN "BABY BUTTERCUP" DOLL—TC-5301—drinks and wets
H. MIGHTY-TONKA DUMP TRUCK—TC-3900—a kid can ride it
I. HORSMAN "BABY TWEAKS"—TC-2570—18" tall, she "coos"

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