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A HOWARD W. SAMS PUBLICATION

Electronic Servicing

Using Pencil-Size Test Instruments, page 12

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Circle 1 on literature card

January, 1972 • Volume 22, No. 1

Electronic Servicing

TEST EQUIPMENT

TELEVISION (GENERAL)

COLOR TV

AUTO ELECTRONICS

GUIDES AND REFERENCES

DEPARTMENTS

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Where's the voltmeter?

New Scope Measures Peak-To-Peak Voltage with Cali-Brain®

You're looking at it in this solid state oscilloscope. The new B & K Precision 1465 is a triggered sweep oscilloscope with CALI-BRAIN – a built-in feature for measuring voltages, automatically without computation in seconds. CALI-BRAIN will measure peak-to-peak voltage on waveforms of any complexity – and at voltage levels from 10mV to 600 V. Only B & K scopes have CALI-BRAIN – a real advance in TV test equipment.

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The CALI-BRAIN system increases your efficiency because it lets you measure its peak-to-peak voltage without changing your test set-up. Now you can confirm the manufacturer's service data exactly – checking out typical waveforms and peak-to-peak voltage readings at various test points.

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Use CALI-BRAIN when you want to measure peak-to-peak voltage of the waveform displayed on the scope screen. Here's what happens when the CALI-BRAIN switch is activated:

A. The horizontal sweep collapses and the waveform under examination appears as a straight vertical line.
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C. A graduated scale on the graticule overlay is illuminated on either side of the scope screen. The scale corresponds to the full scale voltage indicator in the bezel.
D. The vertical waveform line on the CRT moves to either side of the screen, to align itself with the illuminated scale.

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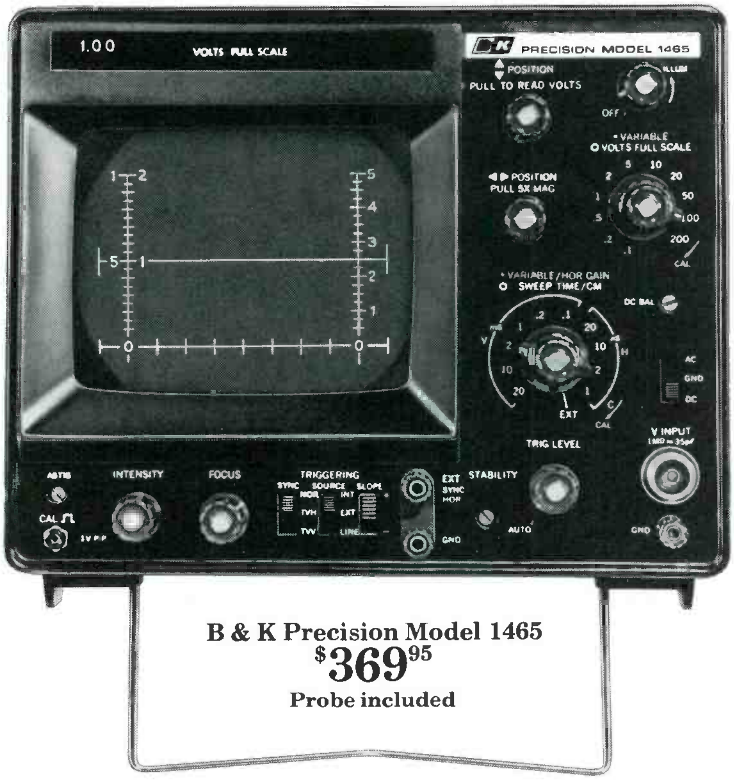

B & K Precision Model 1465
$369^{95}
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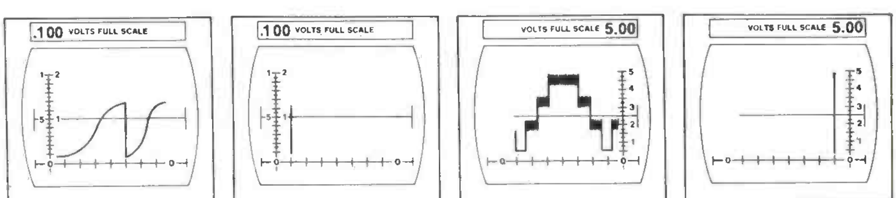

1 2 3 4

To read peak-to-peak voltages utilizing Cali-Brain, note the full scale voltage reading in the bezel above the screen (fig. 1–.100 volts full scale) (fig. 3–5.00 volts full scale). Pull out the Cali-Brain knob and you will notice that the 1st waveform in fig. 2. reads .067 volts P-P and the second waveform in fig. 4. reads 4.95 volts P-P.

See your local distributor or write us for more information

Circle 5 on literature card

B&K

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DYNASCAN CORPORATION
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electronic scanner

news of the industry

Massachusetts Issues New Consumer-Protection Regulations Which Establish Firm Service/Customer Procedures

A new Massachusetts regulation which reportedly standardizes appliance repair procedures became effective Nov. 1, according to a report in *Appliance Service News*.

The regulation reportedly requires repair services to supply in advance to all customers who request written estimates of the cost of servicing, including the total fees charged for parts and for labor and the estimated time for completion.

When the repaired appliance is returned to the customer, the serviceman reportedly must provide the customer an itemized list of the repairs accomplished and the reasons for the repairs. Replacement parts used and their condition—new, used or rebuilt—reportedly also must be included on the itemized repair bill, along with the hours of labor for which the customer was charged and the name of the technician who performed the service. The latter two items reportedly can be excluded if the customer is charged on a flat-rate basis.

Other stipulations of the new regulations reportedly also include the requirement that the home-service technician notify the customer in advance if the customer will be required to pay for the service call whether or not repairs are made.

Federally-Funded Crime Insurance Protection Now Available For Electronics Shop Owners

Electronics service shop owners and other metropolitan businessmen in many areas where crime insurance has been broadly unavailable, unaffordable or both, reportedly can now buy burglary, robbery and vandalism protection at reduced rates through a federally funded insurance program.

New federal policies provide up to $15,000 in commercial burglary, robbery and vandalism protection. Premium rates for the coverage are based on the gross receipts of the business and FBI crime statistics for each metropolitan area. A typical premium for $1,000 coverage on an electronics service shop with annual gross receipts of $150,000 in a medium risk area like Cleveland, Ohio would be $250. Premium for the same coverage on the same electronics shop in highest risk areas, such as New York City, would be $300.

Deductibles for the federal crime coverage hinge on the annual gross receipts of the business and can be either $100, $150 or $200. If a loss should

(continued on page 6)

(continued from page 4)

occur, the policyholder is responsible for the amount of his deductible or five percent of the loss, whichever is greater.

Businessmen wishing to qualify for the new federal crime insurance protection need only give the correct information on their applications and meet the program's minimum standards for protection devices. Any casualty/property agent in the participating areas can provide detailed information about the protection standards, assist in filling out applications properly and help in filing claims.

Recently, Aetna Life and Casualty began administering the federally funded program, which makes crime insurance protection available at affordable rates, in Connecticut, Massachusetts, Missouri, New York, Ohio and the District of Columbia.

Any businessman in these areas reportedly can buy the federal protection through Aetna regardless of previous insuring experience and without fear of cancellation based on the number or size of losses. The only grounds for cancellation will be violation of the terms of the contract or illegal conduct of the policyholder.

Aetna will assume the responsibility of processing the applications and providing claim service to all federal crime insurance policyholders in the six areas where the company is administering the program.

Sylvania Appoints More Parts Distributors

Sylvania has announced the addition of the following companies to its network of franchised parts distributors:

Dealers Electronics, Inc.
Ernest Caldwell, Manager
217 North Main St.
Temple, Texas

Rutland Electronic Distributors
Alan Milo, Manager
138 State St.
Rutland, Vermont

Houston Radio Supply Co.
Miss Frances Everage, Manager
2901 Telephone Rd.
Houston, Massachusetts

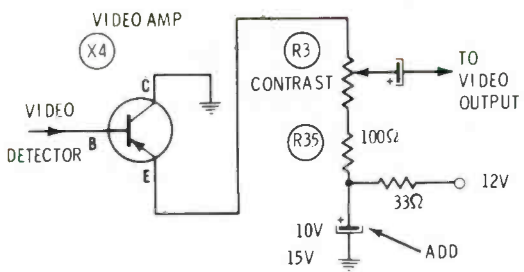
Fairway Electronics, Inc.
2500 Georgetown Rd.
Baltimore, Maryland
(new branch of existing Sylvania franchised distributor)

These new distributors reportedly will offer Sylvania's line of monochrome and color TV picture tubes, receiving tubes, replacement semiconductors and other Sylvania electronic components. ▲

symcure

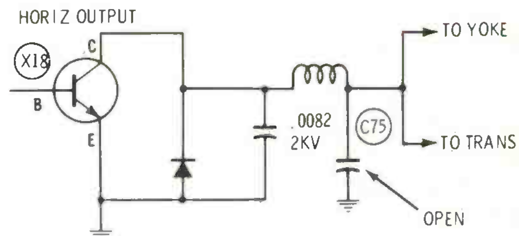
Symptoms and cures compiled from field reports of recurring troubles

Chassis—Magnavox T908/T915
PHOTOFACT folder—812-2



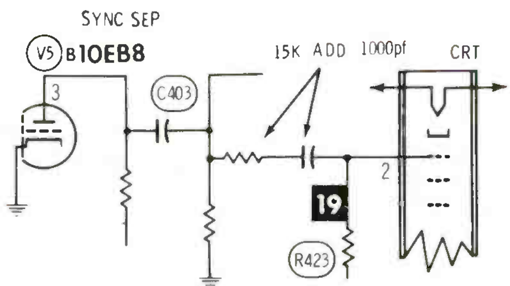
Symptom—black, vertical bars on left side of screen
Cure—add 33-ohm resistor and 10-mfd capacitor, as shown

Chassis—Magnavox T908/T915
PHOTOFACT folder—812-2



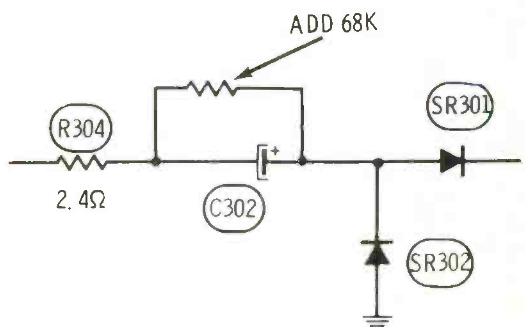
Symptom—repeated failure of the horizontal output transistor
Cure—check and replace C75 (.0082-mfd, 2KV capacitor)

Chassis—Magnavox T935
PHOTOFACT folder—1110-1



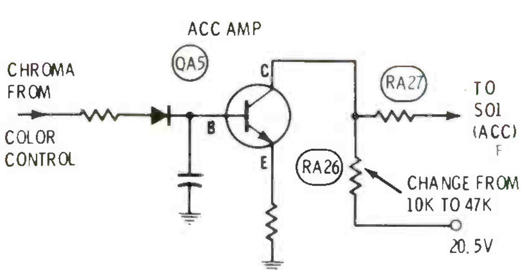
Symptom—white horizontal retrace on left side of screen
Cure—add 15K resistor and 1000-pf capacitor, as shown

Chassis—Magnavox T939
PHOTOFACT folder—1109-1



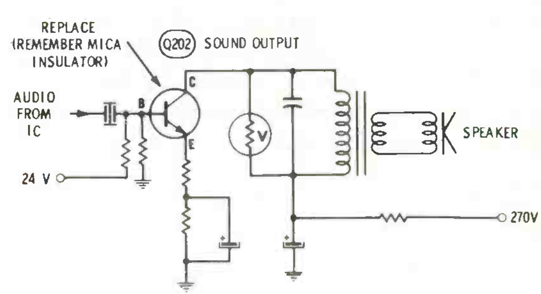
Symptom—purity becomes progressively worse
Cure—add 68K resistor across C302

Chassis—Magnavox T940
PHOTOFACT folder—1144-1

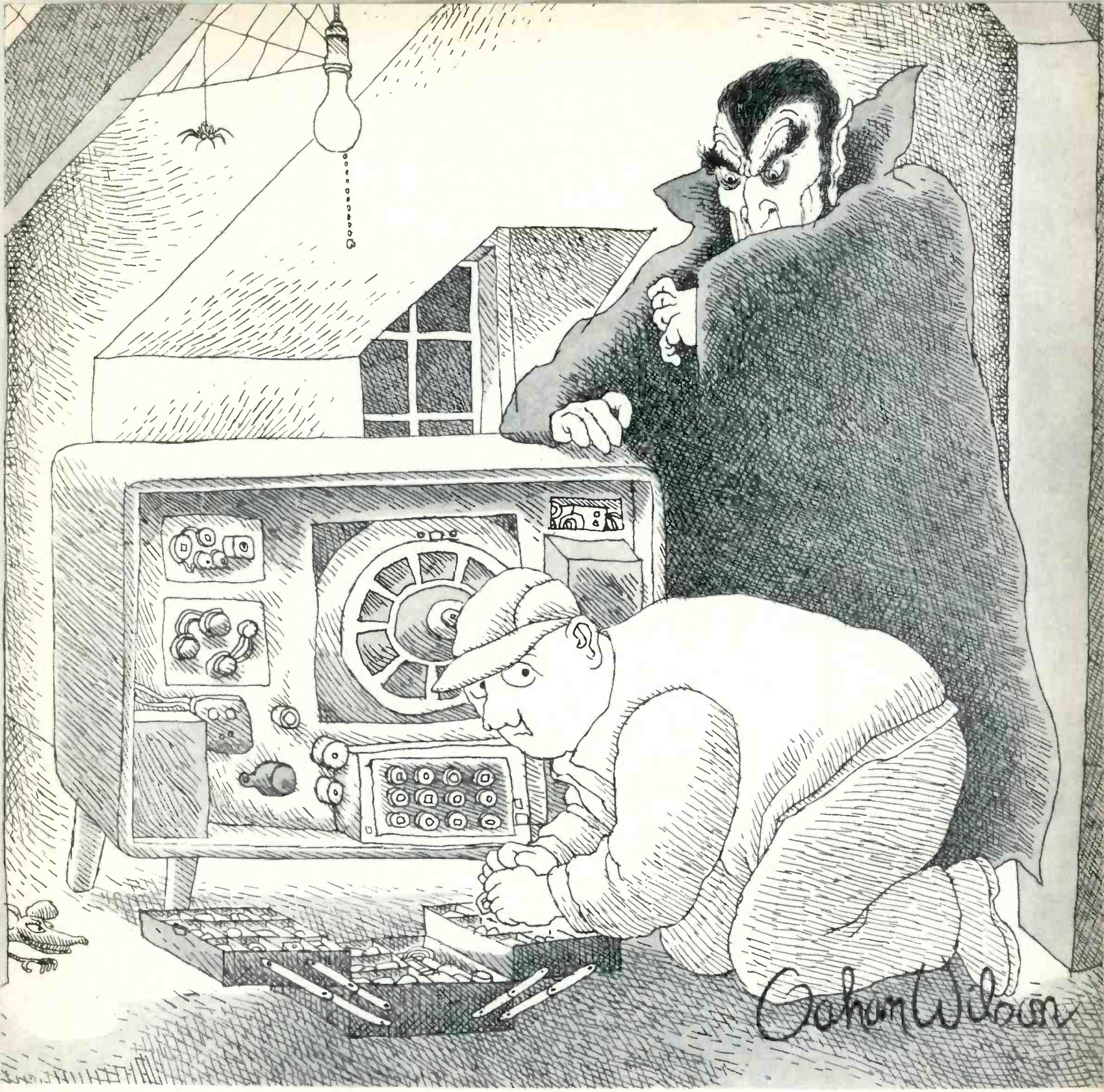


Symptom—insufficient ACC action on some stations
Cure—change RA26 from 10K to 47K

Chassis—Zenith 4B25C19
PHOTOFACT folder—Not completed yet



Symptom—crackling sound in the audio
Cure—replace Q202, the sound output transistor ▲



When you're in a hurry, it's nice to know GTE Sylvania has the parts.

Only 15 tubes and ECG solid-state components will solve practically all of your damper replacement problems.

And they're all available from your Sylvania distributor.

Because tubes are tubes, we can't promise to reduce the number you'll have to carry. But, with the Sylvania line, chances are your distributor will have the tube you need when you need it.

In semiconductors, the story is different. Just 124 ECG solid-state devices including transistors, diodes and integrated circuits will replace over 41,000 different types. In the damper section alone, only 3 ECG solid-state devices will take care of almost every job.

And they save a lot of space in your tube caddy.

When your distributor is stocked with Sylvania receiving tubes and ECG semiconductors you'll have the parts you need. And you'll get them fast.

It's like having a complete warehouse built into your telephone.

And that can save you from a real pain in the neck.

GTE SYLVANIA

servicebulletin

a digest of information from manufacturers

Substitution of high-voltage regulation tube
Magnavox color TV chassis

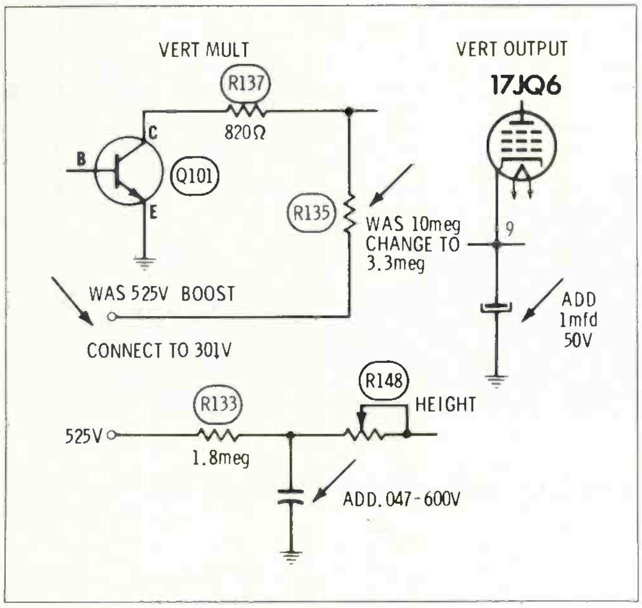
Magnavox recommends that 6EN4 high-voltage regulator tubes be used for replacement of 6BK4/6EL4 in all newer color chassis.

Do **NOT** use a 6EN4 to replace the 6BK4 in the T904 chassis or the 45 series chassis. The grid of the 6EN4 is connected internally to both pins 5 and 6. However, in the T904 and 45 series chassis, pin 6 is used as a cathode tie point. A 6EN4 plugged into these chassis would have its grid and cathode connected together. The resultant zero bias would cause the tube to draw excessive current, which would drastically reduce or eliminate the high voltage.

Vertical bounce or jitter
Magnavox T936 color TV chassis

Make the following changes to minimize vertical jitter or bounce:

- Change the value of R135 from the original 10 megohms to 3.3 megohms.
- Connect the B+ end of R135 to the +301-volt supply instead of to the B-boost supply.



- Connect a .047-mfd, 600-volt capacitor between the junction of R133 and the height control and ground.
- Connect a 1-mfd, 50-volt electrolytic capacitor between the cathode (pin 9) of the vertical-output tube and ground.

Yoke capacitor corona
Magnavox T931/T933 color TV chassis

The 470-pf capacitor in the deflection yoke might become defective because of corona breakdown, if the diameter of the capacitor is ½ inch or smaller.

Replace any such capacitors with a 470-pf, 3000-volt type that has a diameter larger than ½ inch. Magnavox supplies a replacement under part number 170903-1.

Impulse noise
Sony KV-1201, KV-1212 or KV-1710 color TV chassis

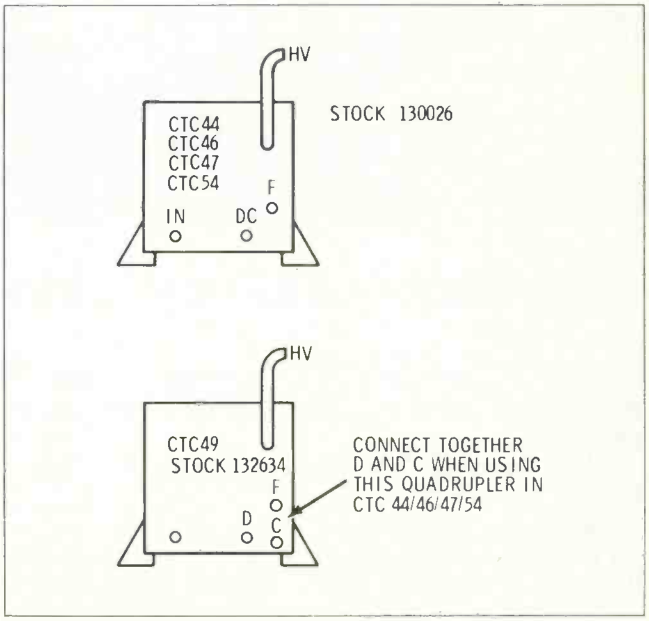
No vertical and horizontal sync, no picture or sound, or black streaks similar to that produced by high-voltage arcing can be caused by defective video IF transistors. The exact symptoms vary according to the severity of the defect.

To determine if the noise pulses originate internally turn the channel selector to a position between detents; the noise will continue if it is caused by the receiver.

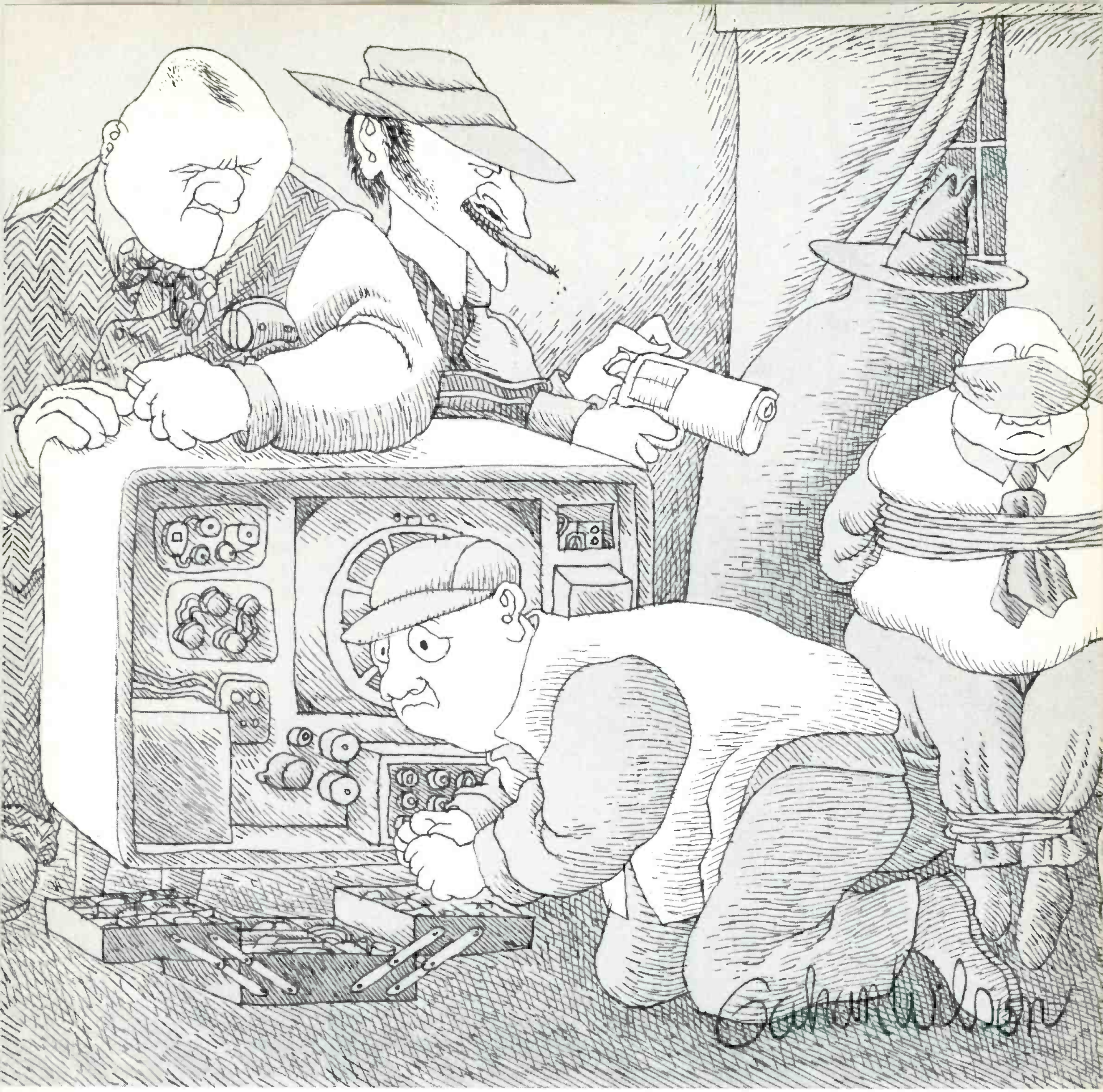
If the symptoms seem to originate internally, replace both the 1st IF (Q201) and 2nd IF (Q202) transistors with type number 2SC1129.

High-voltage quadrupler interchangeability
RCA CTC49 and CTC44/46/47/54 color TV chassis

The high-voltage quadrupler with stock number 132634, which is intended for use in the CTC49 chassis, can be used as a replacement in the CTC44/46/47/54 chassis, if a wire is connected between terminals "D" and "C". Use this point for the "DC" connection.



The quadrupler with stock number 130026 cannot be used in the CTC49 chassis. □



Pencil-size test instruments

by Forest H. Belt

Practical applications and limitations of small signal injectors and signal tracers.

Nowadays, because test equipment generally has grown big, complex, and expensive, you might be surprised to find versatile instruments selling under $25. But some are around. They generally fit into the "pocket-size" category.

Although most are signal injectors, at least two are signal tracers. Some can be described as miniature instruments, but are elaborate enough to sell for more than $25. Regardless of the price or shape, most are valid troubleshooting tools which you can slip into a pocket or drop into a toolbox and which can save time and boost income.

Pushing In a Signal

Technicians disagree about which is most convenient: the signal injector or the signal tracer. Either is effective in the hands of someone who knows the respective advantages and limitations. Injection better suits some servicing situations; others are solved quicker by signal tracing. It depends on what type of equipment you are troubleshooting and what the trouble symptom is. Fundamentally, both methods are very similar.

The injector pictured in Fig. 1 is a combination instrument. It puts out a pulse signal at around 300 Hz. The pulse offers advantages over a sine wave. A pulse waveform is made up of harmonics of its basic frequency. The sine wave has few or none. A square wave also contains many harmonics, but its higher-frequency harmonics contain comparatively little power.

Because of the inherent harmonics, an audio-frequency pulse can be used to drive IF and RF stages. A sine or square wave at the same audio frequency is suited only to drive audio stages. The pulse type of signal also exhibits some characteristics as if it were an RF signal modulated with the basic audio frequency. An injection instrument like this, with no RF-AF switching necessary, greatly simplifies many troubleshooting jobs.

Another phenomenon also contributes to the usefulness of audio-pulse injectors in IF and RF stages: The relatively sharp pulse shock-excites any tuned circuit it encounters. Self-oscillation takes place. The tuned circuit passes on a signal at the frequency of the tuned circuit, carrying modulation at the pulse frequency that shock-excited it in the first place.

The signal waveform produced by the instrument in Fig. 1 is shown in Fig. 2A. The pulse is negative-going because of the internal wiring of the pulse generator; a positive-going pulse (Fig. 2B) would be equally useful. The trailing edge of the pulse is sharply differentiated, with the overshoot and decay that looks like a sawtooth. This sharp voltage collapse is what excites a tuned circuit into sympathetic oscillation.

Fig. 2C and 2D shows another kind of pulse. The instrument it comes from is pictured in Fig. 3. The waveshape could be termed a pulsed wave train. Its repetition rate is approximately 1000 per second. But, because of its complex waveshape, this signal is passed by RF, IF, and audio stages with almost equal ease.

The waveform in Figs. 2C and 2D cannot be viewed easily on an ordinary service-type scope, for two reasons: One, its complex shape, which you can see more clearly in Fig. 2D, has several frequencies "inside" the basic pulse rate. The sync characteristic of a recurrent-sweep scope make it difficult to lock such a scope to this type of signal. Two, the lack of a ground lead from the hand-held instrument permits 60-Hz hum to be introduced also, altering the waveform and making synchronization even more difficult. For these reasons, Figs. 2C and 2D were obtained with a triggered-sweep scope.

The preceding two are not the only signal injectors available. A half-dozen companies offer them, in both small and large sizes. Some models fit in a shirt pocket. Some are in kit form, but most are already built. Electronics distributors carry them in stock, or you can find them listed in catalogs.

Troubleshooting By Signal Injection

For what can you use an injector? Any audio stage, of course. Technicians use injectors in small radios, in amplifiers, and in the sound sections of TV sets. If you prefer troubleshooting in the home whenever possible, an injector can help. A few models (but seldom the little units) can be used to drive a video stage in a TV receiver.

A signal injector lends itself directly to stage-by-stage analysis. The technique is illustrated in Fig. 4A. Start injecting as near the speaker as you can, usually right across it. If that checks okay, move back to the input of the audio output stage. Next, try the audio amplifier input, and then on back through all the stages. Each audio, IF and RF

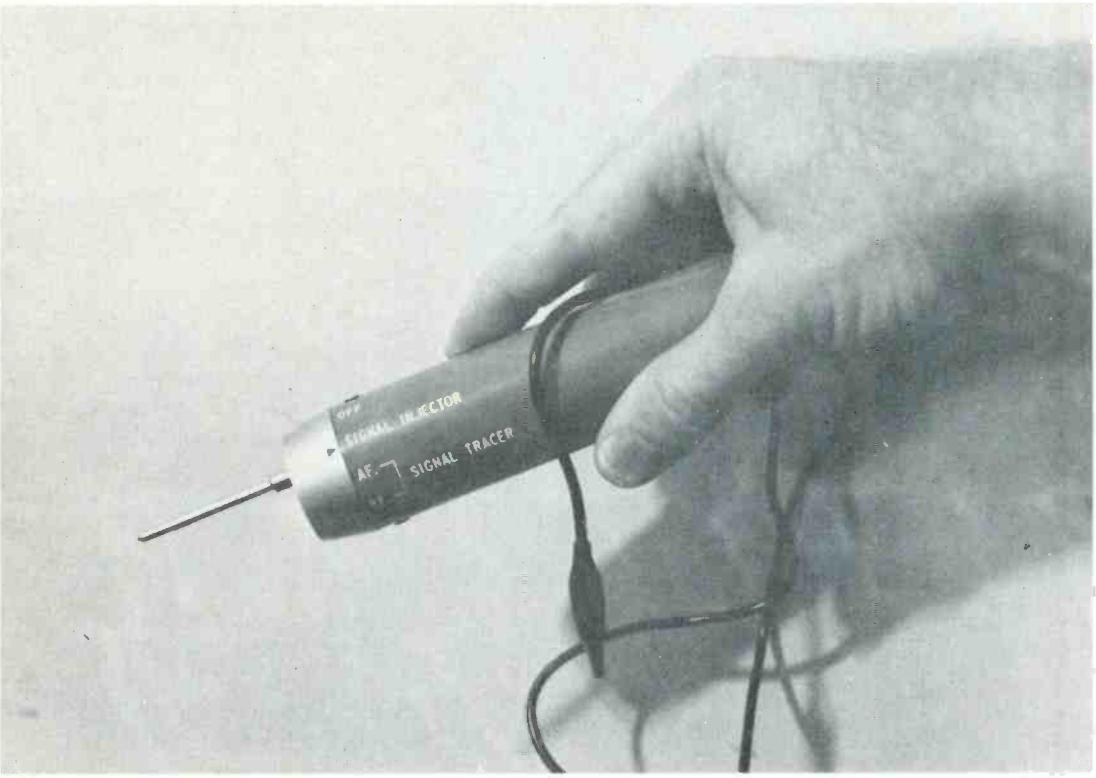


Fig. 1 The typical pulse-generating signal injector shown here produces a 300-Hz test signal. The pulse has so many harmonics it can excite—and pass through—IF and RF stages of most broadcast radios and some communications and CB receivers. This particular model also functions as a signal tracer.

stage should make the signal louder in the speaker. Remember, however, neither the detector nor the mixer amplify the signal, but they should pass it.

The technique works just as well inside each stage. Fig. 4B shows the test points in a typical audio-output stage.

Start at the speaker. If the injected signal is heard in the speaker, try injecting the signal at the top of the primary of the output transformer, which usually is the plate of the output tube or at the collector of the output transistor. In transformerless output stages of hi-fi amplifiers, the speaker might be connected directly to the emitters of the output transistors or to a collector and an emitter.

Next, move to the output tube grid, or the output transistor base(s). This stage of amplification should increase the volume level of the signal from the speaker. Moving to the other side of the input coupling capacitor

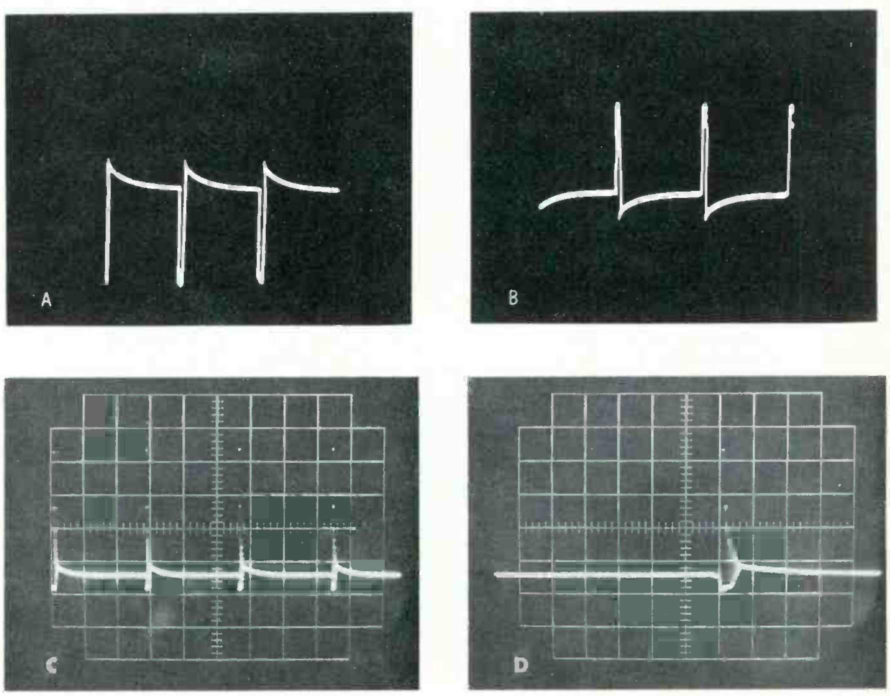


Fig. 2 Signal-injector outputs tend generally to pulse waveshapes. **(A)** shows a sharp-sided pulse on a service scope, and **(B)** is the same signal if the battery and transistor were the other polarity. Waveform **(C)** was taken on a triggered scope because it is a series of little bursts of oscillation and isn't easy to see on a regular scope. **(D)** is one pulse, considerably magnified by the triggered scope.

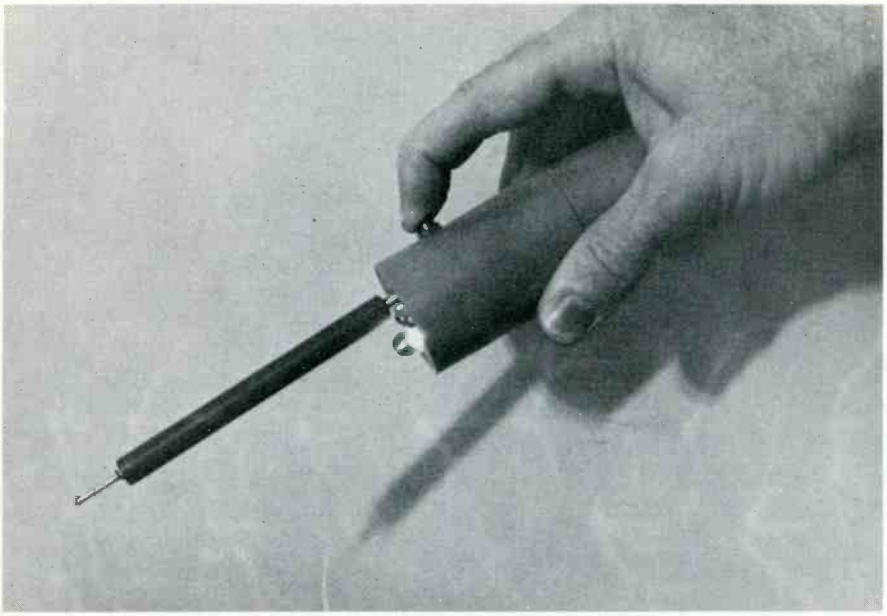


Fig. 3 Kit-form or factory-built, this imported injector puts out a pulse at audio frequency, but oscillatory harmonics extend far into IF and RF range. It requires no ground lead.

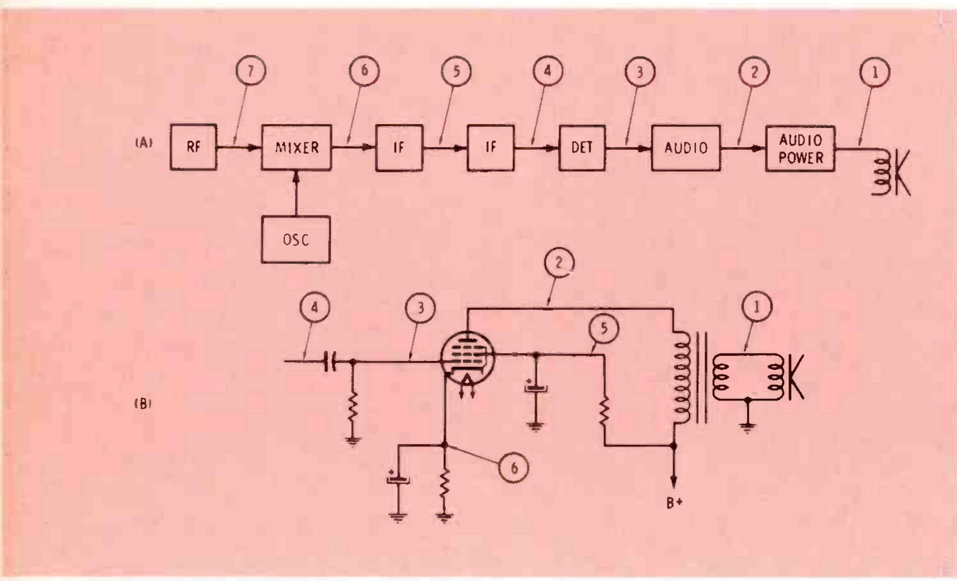


Fig. 4 Signal injection sequence. Follow it stage by stage. Trouble lies between the point where signal gets to speaker okay and the point where the symptom is reproduced.

should not reduce the volume of the signal at all. If it does, a defect exists.

Fig. 4B shows two other tests you can make with the signal injector. Most any signal injected across the screen bypass capacitor should be shunted to ground. The output from the speaker will sound weaker than when the signal was injected at the plate. It probably won't be completely eliminated, but definitely attenuated. The preceding also applies to bypassed cathode circuits.

If the cathode is unbypassed, touching the injector to it might produce a signal which is almost as strong as one produced by signal injection at the grid of that stage.

Don't be misled by stages that normally don't produce gain. For example, cathode followers and emitter followers add no voltage gain to signals. Consequently, they won't make an injected signal sound louder.

The pulse-type signal injector makes it possible to trace from the back to the front of the receiver without changing test instruments. You can test the IF sections of AM and FM radios, of CB rigs, in fact of almost any voice or music receiver. The high-order harmonics produced by most signal injectors are high enough to enable you to check the front ends of FM and communications radios. All signal injectors known by the author reach high enough to permit testing of the RF stages in AM broadcast radios.

The difference in gain between the stages of the IF section might not be as noticeable as that in other amplifying sections, but you can definitely find where a signal is blocked or drastically reduced. **Caution:** The harmonics of pulse waveforms find their way through IF sections without much regard to transformer tuning; however, although the injector signal might push on through an open IF transformer, it usually will be attenuated to some degree.

When signal injecting in the front end of a radio, remember that the signal injector ignores a dead oscillator. Nevertheless, try this: Feed the injector signal to the antenna loop or terminals. Rapidly tune the receiver dial from one end to the other. If you hear some whistles or abrupt "ups and downs" in volume, the oscillator is operating. A vague or indefinite change of volume means the oscillator is dead.

Quality vs Quantity

You seldom hear of a pulse-type signal injector being used for hi-fi servicing, but the instrument can be helpful, provided you recognize its limitations. The harmonics produced by the injector can test the high-end response of an amplifier, as demonstrated by the waveform photos in Fig. 5.

The shapes of the pulses in Fig. 5 are more meaningful than the size. Gain must be checked, but gain of the wrong kind is worse for hi-fi than no gain at all. Your wide-band scope, therefore, becomes a necessary complement to the injector.

You can inject stage by stage, working through the amplifier from back to front, with your scope across the speaker or dummy load. Or, you can feed the injector signal in at the input and trace from front to back with the scope. Either way is okay. When the shape of the pulse waveform is altered significantly, you've just passed a stage which is not properly amplifying the higher frequencies.

Unfortunately, the signal injector does not produce frequencies which are low enough to provide a reliable indication of the low-frequency response of the amplifier.

Don't trust your ear when signal injecting in a stereo amplifier. The scope is the only reliable indicator of some types of distortion. A little experience with your particular model of signal injector will familiarize you with which shapes are normal and which are abnormal. But the signal injector test should not be considered a substitute for a good square-wave test. Signal injection can help you isolate the causes of mid- and high-frequency troubles, but it cannot provide an accurate qualitative analysis of the overall frequency response.

The Tracing Technique

Some technicians prefer signal tracing to signal injection. A tracer includes a small amplifier, sometimes with a detector for tracing IF and RF. Starting at the front end of a radio, you trace stage by stage until you reach the point where the signal disappears

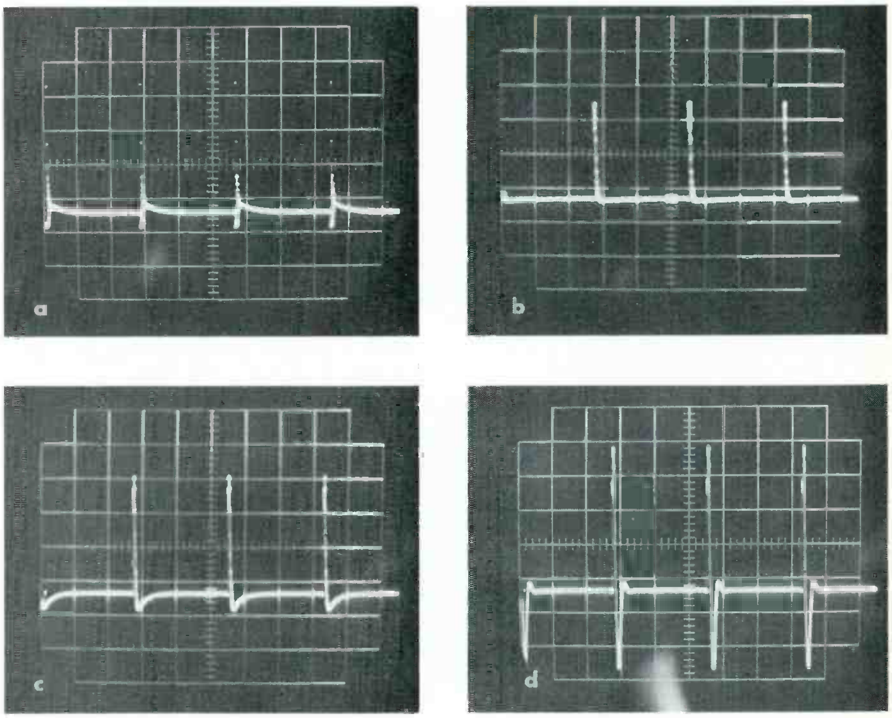


Fig. 5 Waveforms produced in hi-fi amplifier by pulse-type signal injector. **(A)** Input signal. **(B)** Excessive rolloff at high frequencies. **(C)** High frequencies overpeaked. **(D)** Extreme overpeaking at treble frequencies, and bass probably deficient.

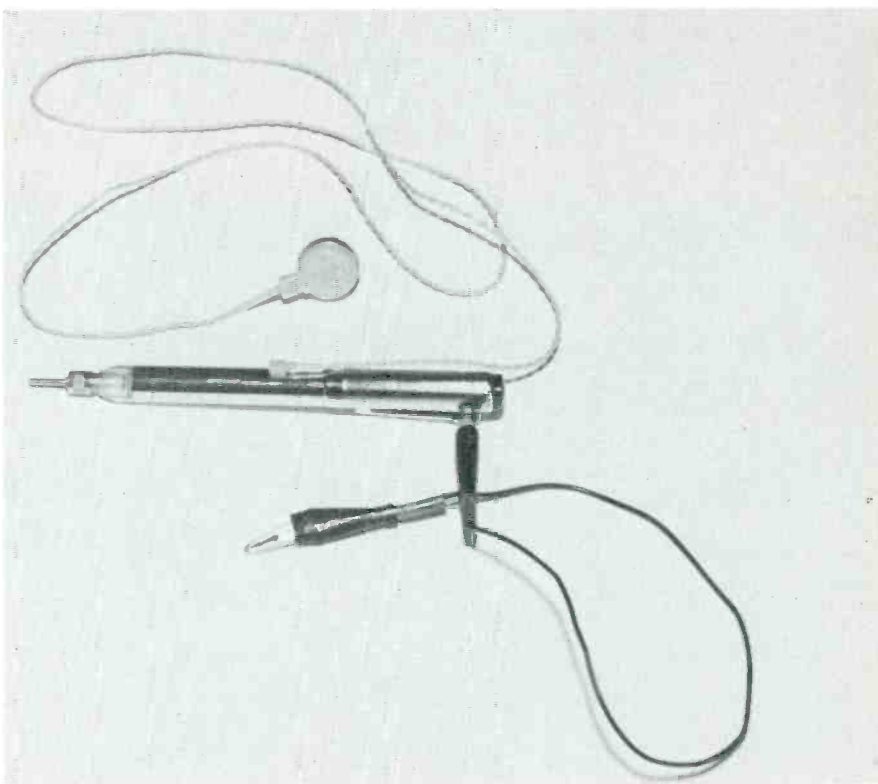


Fig. 6 Chip transistorization and integrated-circuit technology make signal tracers like this possible. The instrument in Fig. 1 also functions as a tracer, with AF and RF positions selected by a switch on the handle.

(or the distortion or other difficulty appears).

For tracing in a radio front end, you need a high-gain tracer amplifier. Modern IC and chip-transistor circuitry make high gain (1000X and 10,000X) possible in minute spaces. Such microminiaturization has made possible the pencil-size tracer shown in Fig. 6.

The basic method of signal tracing is illustrated in Fig. 7. You can see how closely it resembles the injection technique illustrated previously in Fig. 4. The numbers are merely reversed. You proceed from front to back instead of from back to front.

To signal trace in the front end and IF's, use the diode detector function. Once through the IF's and past the radio's own detector, only the bare amplifier is needed. For the front end of an FM radio or the sound-IF section of a TV (it uses FM), the regular diode detector that comes with the tracer does a fair job of "slope" demodulation.

Listening tests, such as signal tracing, can reveal only the most severe distortion. Almost all small tracers are limited by the frequency response of their tiny earphones. Shirt-pocket tracers like the one in Fig. 6 are okay for hi-fi troubleshooting only when a trouble symptom is readily evident. A dead or weak amplifier or one with bad distortion lends itself easily to this kind of simple tracing.

You should use caution in high-power stages. Keep the amplifier volume low or you'll overload, and maybe damage, the little tracer. However, with reasonable care, you can evaluate the gain and the quality of a signal in such stages, particularly with a voice-talking type of input signal. With music or a sine or square wave input, analysis might be more difficult—in most cases, beyond what you should expect of your ear.

The Best of Both

The instrument in Fig. 1 combines an injection pulse generator and a signal-tracing amplifier. Having both kinds of function at your fingertips offers a special advantage.

For example, consider the servicing of a tiny portable radio. You inject a signal at the speaker, output stage, driver, and audio amplifier. Each stage processes a normal signal through to the loudspeaker. However, injecting a signal in the IF proves fruitless—no signal is heard in the speaker. Before you jump in and troubleshoot the IF or detector, you should be able to determine if the front end of the radio is okay, because a cheap transistor radio with multiple troubles probably will not be worth wasting much diagnostic time on.

Switching to the tracer function of the tester, you signal trace through the mixer, 1st IF, and 2nd IF. If the signal is processed normally up to there, you know you have only one trouble to pinpoint—that in the IF. The set probably can be economically restored to normal operation.

Pencil-Size Testers for Television?

Yes, you can use these small injector and tracer instruments for some types of TV troubleshooting, but they're no substitute for conventional TV test equipment. However, in the home, they can save you some guesswork.

For example, although the small signal injectors are too weak for most video injection, when touched to the video detector output, the instrument puts noise on the screen—**if** the video amplifiers are okay. Injecting in the TV sound section, including the sound IF, is the same as in an FM radio.

Signal tracing in TV is possible, too. Outside the sound sections, you listen for vertical sync pulses. They come through as a crisp-sounding 60-Hz buzz. You can trace in the video IF's, if the station signal is strong enough. You can follow the sync buzz through the video stages right up to the picture tube. You can even track it to the sync and AGC stages. No vertical sync gets to the chroma section, so tracing there won't work. Experiment a bit with a working TV receiver and learn where you can follow video signal with your aural tracer. Obviously, a scope does the job better and easier, but the tracer can help when a scope isn't handy. □

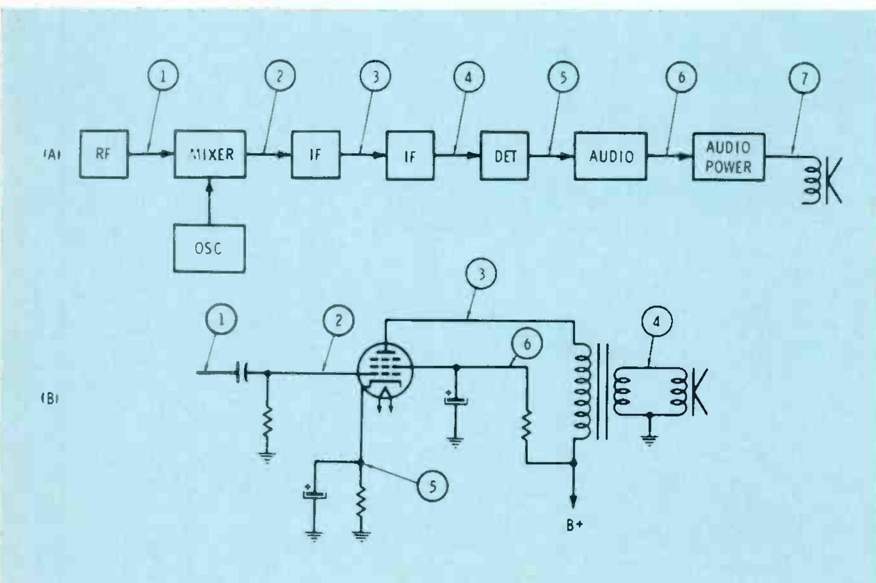


Fig. 7 Sequence for signal tracing. This procedure indicates that the trouble is between the point where the signal gets through okay and the point where the trouble symptom is reproduced.

Dale's service bench

by Allan Dale

Clearing up poor focus

☐ Good focus depends on correct picture-tube voltages. A color CRT needs several DC voltages. If they stray far from normal—particularly those at the focus element and high-voltage anode—focus deteriorates.

The best way to determine whether or not the focus is normal is by examining the raster lines. Some technicians, particularly beginners, mistake video smear for poor focus. Fig. 1A shows an extreme case of video smearing which might be mistaken at first glance for bad focus. To tell the difference, you have to look closely at the raster lines.

Fig. 1B shows the well defined lines of the raster you should see up close on a properly focused color set. (If you look really close, perhaps through a magnifying glass, you can see the triad phosphor dots.) The raster lines, with or without video, should be clear and sharp.

The closeup view in Fig. 1C shows the raster produced by the same set but with it out of focus. The raster lines have blended together. That's the primary sign of poor focus.

Voltages and CRT Elements

The side view of the electron gun of a typical monochrome picture tube is sketched in Fig. 2A. The focus lens unit concentrates the rather loose stream of electrons into a fine, round beam that strikes the phosphor screen with more energy and in a more limited area. The beam-focusing is accomplished by the potential difference between the focus anode and the 2nd, or high-voltage, anode.

Because of electron-gun improvements, the range of focus voltages which will provide acceptable focus is exceptionally broad in modern black-and-white picture tubes. Controls to adjust the voltage at the focus anode are unnecessary. However, some b-w sets are equipped with a tap which lets you pick ground, B-plus, or even boosted B-plus for the focus element of a particular CRT. Once set, however, any need for readjustment is rare.

The focusing of a color picture tube, however, is more sensitive. The gun structure of a typical color picture tube is shown in Fig. 2B. For proper focusing, the focus plates normally require a voltage equal to about 20 percent of that applied to the 2nd anode. For example, a typical color picture tube, the 2nd anode of which usually is supplied about 24 kV, normally has about 4.8 kV applied to the focus anode. This focus voltage usually can be varied throughout a range of from 4 kV to about 5 kV.

So, whatever the focus problem, three primary factors influence it: 1) the picture tube itself (that is, its gun structure), 2) the focus voltage, and 3) the high voltage. The latter two are the first you should consider when troubleshooting, but don't overlook a picture-tube defect as a possible cause of poor focus.

Outside the Focus Circuit

When you encounter a focus problem in a black-and-white receiver, you can't avoid suspecting the CRT. Usually, however, other symptoms show up first. Symptoms caused by weak emission or a gassy bulb usually become obvious before the focus suffers. Fig. 3 shows the sparkly, overdriven look of a weak or gassy picture tube. If you suspect either disorder, a CRT tester can quickly confirm your suspicion.

However, the CRT tester won't reveal focus-element "fatigue", which spoils the ability of the CRT gun to form a fine beam. You can evaluate this condition

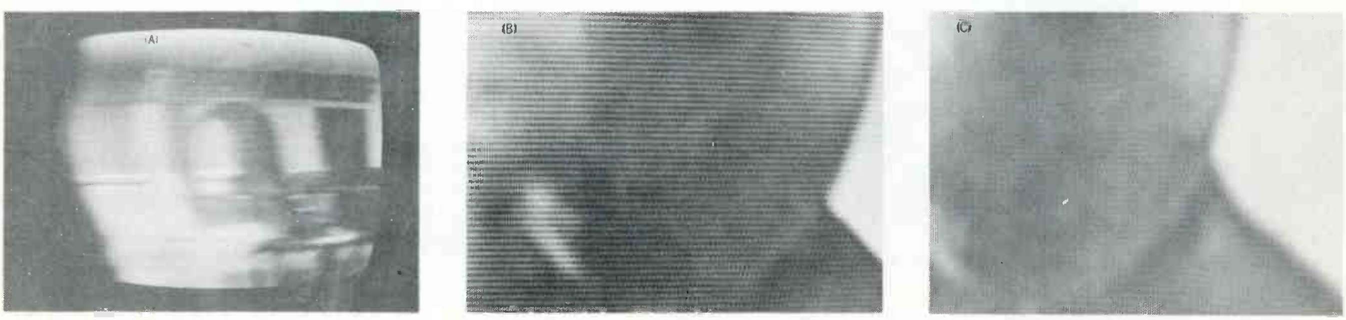


Fig. 1 Proper analysis of focus requires close-up examination of the raster. The blurred picture in **(A)** is actually caused by video smear, not by poor focus; you can tell the difference if you examine closely the raster lines, as in **(B)**, which shows how the raster lines should appear, if the set is properly focused. Actual out-of-focus raster exhibits raster lines which seem to blend together, as in **(C)**.

only by varying the focus-anode voltage while monitoring the effects, if any, it has on the raster.

One out-of-focus set I recently serviced had the focus tap connected to 175 volts B-plus. The focus had degenerated to a general haziness that aggravated the eye. Moving the tap to the boost terminal made no difference at all. Neither did grounding it. The high voltage was okay.

I connected the positive lead from a variable B-plus supply to the focus lead, and the negative lead to ground. Varying the supply from 550 volts DC down to zero caused a vaguely noticeable change, but didn't clear up the focus. On a hunch, I reversed the leads from the variable supply. About −200 volts thinned the raster lines. Because the brightness was still relatively normal (although the tube warmed a bit slowly), the customer chose to put up with the fuzziness rather than buy a new picture tube.

Reduced high voltage can produce poor focus in monochrome and color tubes—which might point to other troubles. For example, weak horizontal output usually lowers high voltage—sometimes, it reduces it a significant amount before you even notice the width narrowing.

Trouble in the low-voltage supply also can cause poor focus. Reduced G2 (accelerator grid) voltage broadens the width and reduces the velocity of the CRT beam. Reduced B-plus can, in turn, reduce the efficiency of the horizontal output, with the secondary effect of lowering high voltage. However, because of the broad focus tolerance of modern monochrome sets, the raster will shrink all around before the focus fails. Color screens, on the other hand, just as often, show focus deterioration first.

Conclusion: When the raster fuzzes up, first check the high voltage, then the low voltage, then the voltage on the focus anode. Check the picture tube as a last resort.

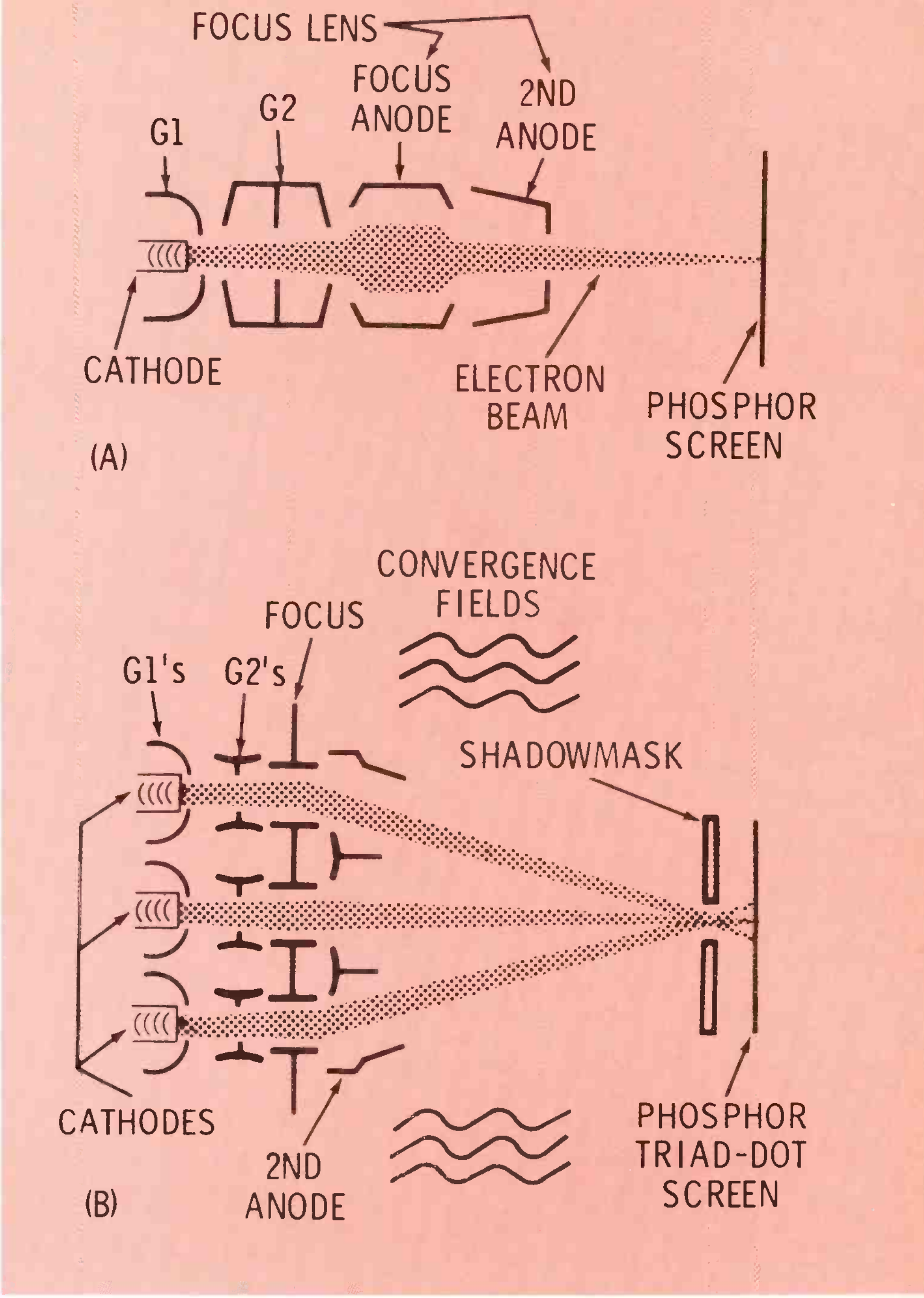


Fig. 2 Electron gun in monochrome picture tube (A) includes focus "lens" that, in modern CRT's, assures good focus over very wide range of focus-anode voltages, sometimes even at ground potential. Color CRT is shown in (B).

High-Voltage-Multiplier-Supplied Focus Circuit

Three basic types of focus circuits are used in modern color TV receivers. (Monochrome are sets focused without special stages.) The newest type, diagrammed in Fig. 4, also is about the simplest. A tap near the "low" end of a hermetically sealed, solid-state voltage multiplier provides a little over 8000 volts DC. A resistive divider drops this voltage to about 5200 volts at the top of the potentiometer and about 4000 volts at the bottom. This is an adequate range for a picture tube that requires 25 kV of second-anode voltage.

If a set equipped with this type of circuit displays poor focus, first make sure the high voltage and the low voltages—including boosted B-plus and boosted-boost-B-plus—are within 10 percent or so of normal. Then, check the divider in Fig. 4. A high-voltage probe and your FET VOM are good for this; the type of high-voltage probe with a built-in meter is not satisfactory in this case, because its low-scale accuracy probably will not be enough. Ohm's-law calculations will tell you what voltages should be at each junction of the divider. In Fig. 4 the voltage at the top of the 20 meg-ohm resistor should be 4 kV, the top of the pot should be 5.2 kV, and the voltage at the focus output of the multiplier should be 8.3 kV. Each of these voltages should be within 10 percent of normal, or slightly lower than normal if the high voltage happens to be a little less than 25 kV.

Next, put your meter probe on the slider terminal of the potentiometer. (If it is not readily accessible, you'll have to go to the associated pin in the picture-tube socket.) Twist the shaft of the pot and check for erratic voltage fluctuation. Also, listen for slight arcing, and feel for roughness in the control action.

Finally, pull the socket off the picture tube base. Inspect the focus pin (usually, pin 9) for blackening, the result of a poor contact arcing and smoking. If arcing has occurred, replace the socket. This might sound like a lot of trouble for one pin, but a permanent repair is more important than a few minutes saved, in this case. Also, polish the focus pin of the tube base.

Focus from Divider in the High-Voltage Stage

The circuit diagram of another simple focus circuit is shown in Fig. 5. For several reasons, this circuit, which involves a divider/bleeder in the cathode circuit of the high-voltage rectifier, is not used in many sets. A potentiometer at the bottom of the bleeder chain varies the DC voltage at the divider junction which supplies the focus pin of the CRT.

Ohm's law again will help you determine what voltage you normally should expect. The total resistance of the bleeder with the focus-control slider at ground is 170 megohms. The 25 kV of high voltage makes about 0.15 mA flow in the bleeder. Consequently, the voltage at the focus-voltage junction is about 5.5 kV. Moving the slider to the high end of the potentiometer element changes the divider ratios, and the voltage at the junction shifts to about 4.2 kV. Again, the range of voltage variation is plenty for any normal color CRT. Troubleshooting this kind of stage is a little different from the other. Check high voltage. If it's reduced, check the low voltage, boost, boosted boost, horizontal output, and so on. If the high voltage is okay, check the focus voltage divider in Fig. 5. Shut the set down, temporarily, clip a grounding jumper across the high voltage, to make sure all residual charge is drained off

Fig. 3 Slow warmup and "sparkly" overload at high brightness and contrast characterize CRT with weak emission or gas. Focus may get bad as symptoms progress, but the main sympton usually annoys the viewer first.

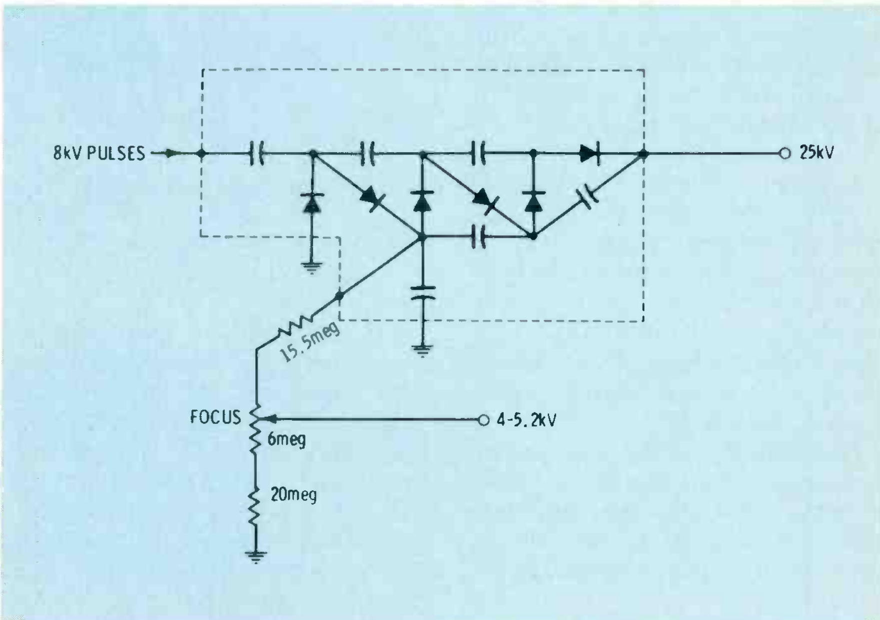
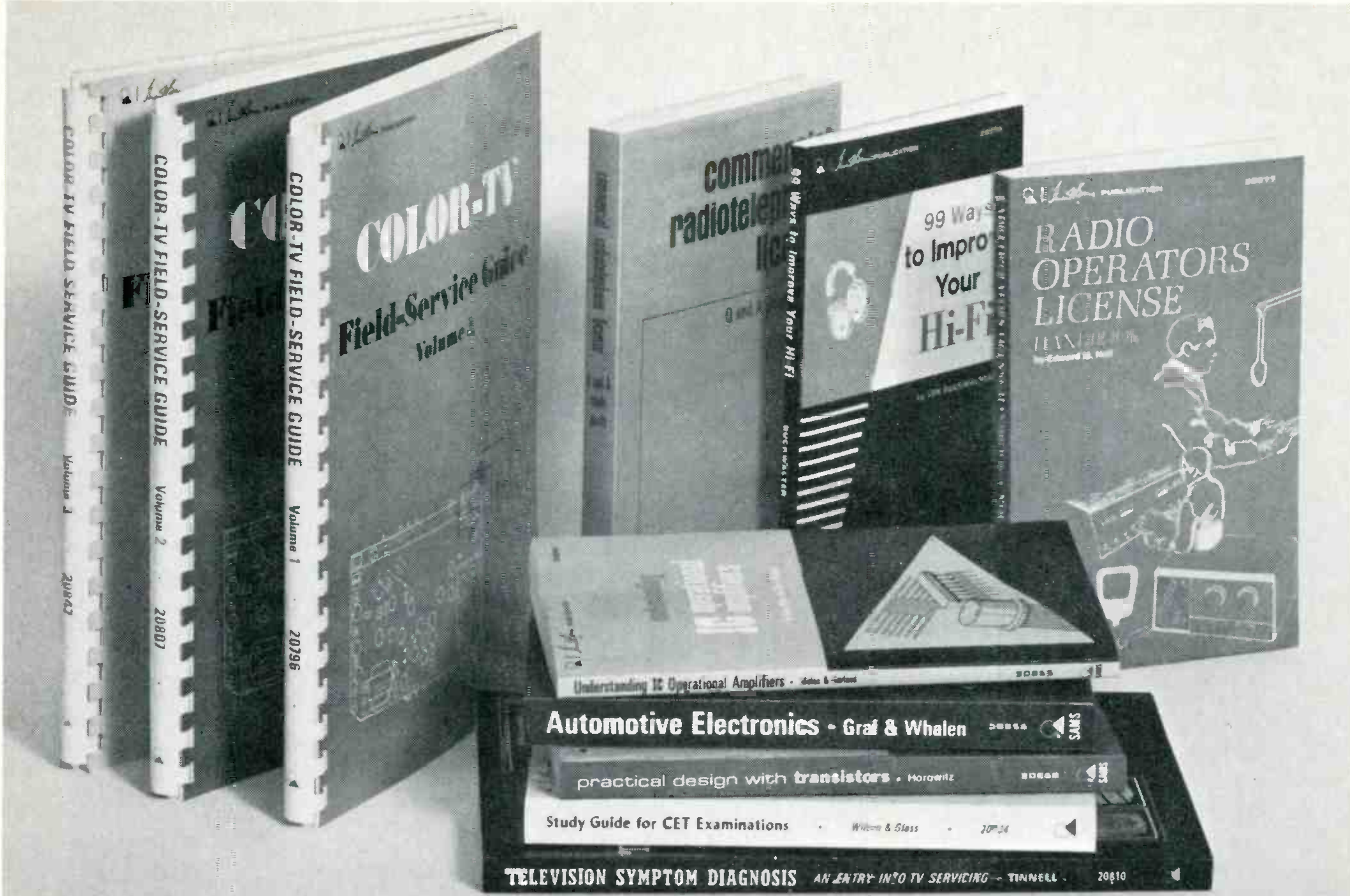


Fig. 4 High-voltage multiplier is the trend in color sets. It makes focus voltage easily accessible from a tap on the multiplier. Resistive divider steps down DC voltage to that needed by color CRT focus element.



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(in case the bleeder is open), and measure the divider resistors with your ohmmeter. Then check the focus pot and the CRT socket, as already described.

Inductive Focus Control

A few color chassis still use the focus stage in Fig. 6. The rectifier might be a tube, but the configuration will be about the same. Several "middle-age" sets use this system.

The heart of the circuit is a focus transformer. While the horizontal-output stage feeds a pulse signal directly to the focus-rectifier anode, the focus transformer feeds an out-of-phase pulse signal through the small-value capacitor to the cathode of the rectifier. Adjusting the core determines the amplitude and the phase of the signal applied to the cathode and, therefore, the amplitude of the focus voltage.

Don't be lured into using a scope in this kind of stage. The amplitudes of the pulses are too high. They'll "pop" the scope input capacitor and burn up the attenuator. Instead, concentrate on individual parts; there aren't many.

Check or substitute the focus rectifier. With power off, measure the resistances. Make sure the high voltage is sufficient. Reduced high voltage means the horizontal output pulses probably are low. Check B-plus and boosted B-plus. Tack a new focus-coupling capacitor in, just for a test; be sure it's a high-voltage type. Have a look at the CRT socket, as described previously, and make sure the wire from the socket back to the resistors (some sets omit one resistor or the other, or both) is continuous.

If all else seems okay, but the focus coil adjustment has little or no effect, concentrate on that. First make sure the core isn't broken off the adjustment slug. If the brass slug has a knob, be sure the knob isn't slipping and thus not turning a stuck core. Be sure the focus transformer hasn't been miswired to the flyback transformer by someone before you. Check the continuity of the focus transformer with it disconnected from the flyback.

Coming Soon

Looks like we're getting the **Service Bench** department back in gear again. Next month, I'll dig into high-voltage regulation for you. It's changed a lot since the old 6BK4 days—yet, many sets still use parallel regulators. I'll write about some of the effects of poor high-voltage regulation and what causes it. You might get a surprise or two. There's more to high-voltage regulation than just a load across the high-voltage output. □

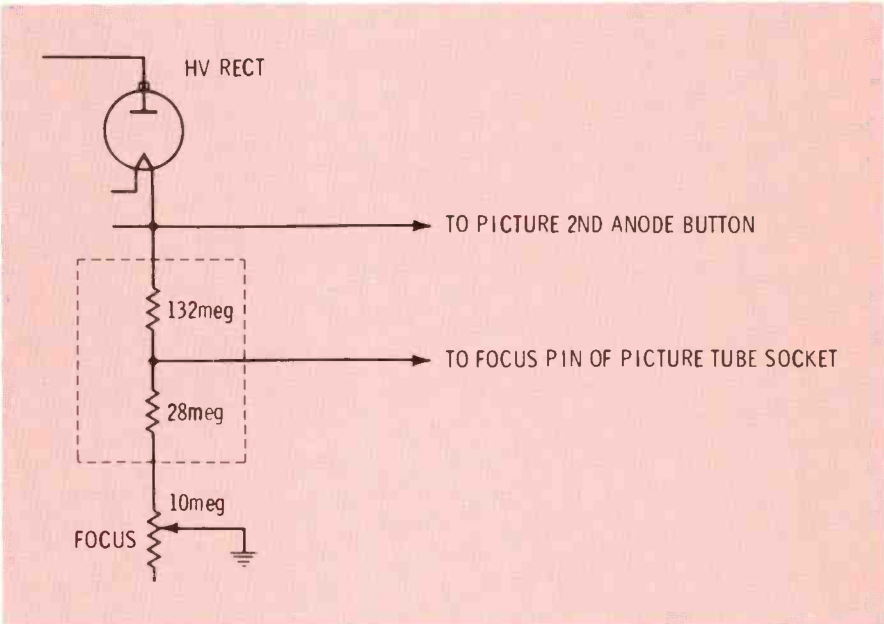

Fig. 5 Less-common focus system is supplied voltage from bleeder and divider across picture-tube high-voltage stage. Has same advantage as multiplier version: changes whenever high voltage changes.

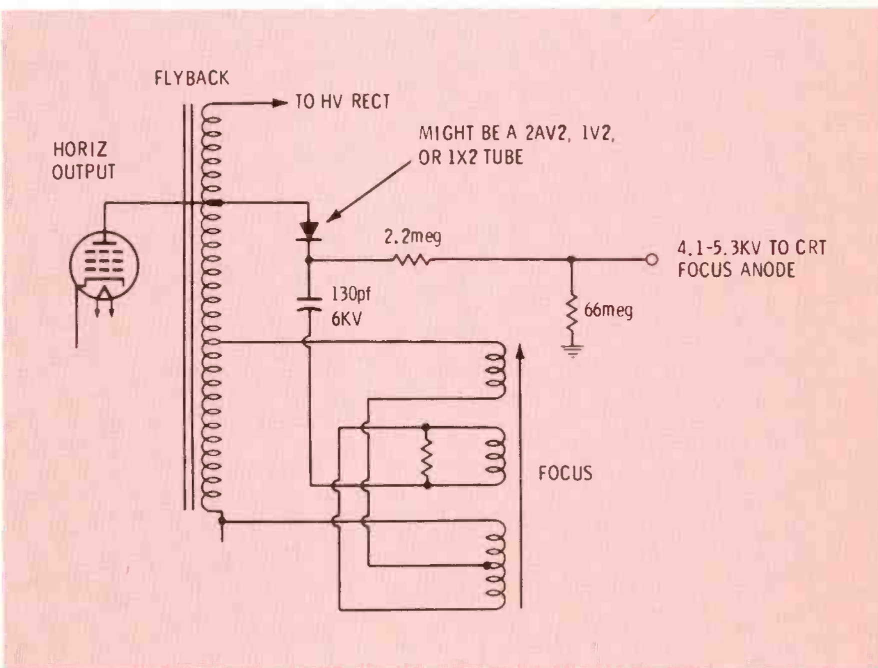

Fig. 6 Inductive focus control in this circuit is a transformer which applies an out-of-phase pulse at the opposite side of the focus rectifier. Moving the inductance core varies how much DC is applied to CRT focus anode.

Universal tap simplifies MATV design

by Bert Wolf
Manager Jerrold DSD/ECSD Division

Until now, MATV system design has been somewhat complex. You had to calculate losses in decibels and specify a fixed tap-off isolation value at each receiver location.

The new Jerrold OMNI-TAPs have changed all this. OMNI-TAPs are universal. That is, *any* OMNI-TAP can be used *anywhere* in *any* MATV system. The secret is adjustable isolation, which you can vary simply by turning a screwdriver after the system has been installed.

Aside from simplifying system design, OMNI-TAPs also reduce your inventory problems. Since OMNI-TAPs can be varied continuously over a 12 to 25 dB range, one type of OMNI-TAP replaces three types of conventional tap-offs.

Figure 1, for example, shows a typical 8 story apartment house, older school or hotel, with eight TV outlets per floor. OMNI-TAPs are used for every TV outlet. Because tap insertion loss is very low (average about 0.6 dB per tap at VHF), isolation is adjustable, and Jerrold CAC-6 cable loss is minimal, (3.2 dB/100' at VHF), your system calculations are greatly simplified. Just use a Jerrold Gibralter 3550 amplifier, fed by a Paralog Plus antenna. A new motel or school would be similar, except that trunklines would be run horizontally.

If your particular system is smaller, reduce the number of trunklines and tapoffs, but nothing else. The 3550 is economical enough even for small systems. If the system is bigger, add trunklines and tap-offs, but nothing else. The 3550 can easily handle up to 100 OMNI-TAPs. (For systems over 100 tap-offs, use the 3661 or 3880.)

Choose the antenna as you would an ordinary home TV antenna, except that it usually pays to choose the next larger model. If signals are weak, simply add a Powermate preamplifier.

Figure 1 is a VHF-only system. But adding UHF channels is no problem. Simply use a VU-FINDER PLUS antenna instead of the PARALOG PLUS, and a 4400 82 channel amplifier in place of the 3550. No other changes are required because the OMNI-TAPs, the splitters and the cable can handle UHF frequencies with no difficulty.

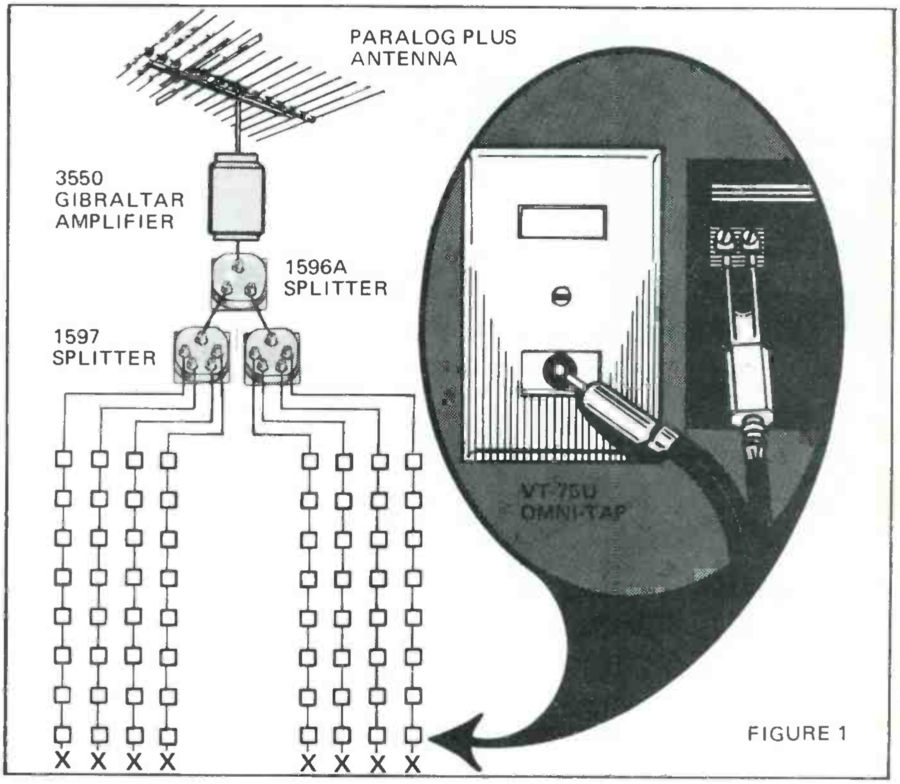

FIGURE 1

Adjusting Omni-Tap Isolation

Once the system is installed, you have to make sure it works properly. In many cases, no adjustments will be necessary. The OMNI-TAPs will work fine in the system just as you receive them.

In large systems, however, you will have to adjust the OMNI-TAPs so that they provide more isolation near the Head End amplifier than they do at the ends of the trunklines.

There are two ways to adjust OMNI-TAP isolation:

1. With a Field Strength Meter, such as the Jerrold 747. You should have a Field Strength Meter for MATV work anyhow, and this is the easiest way to adjust OMNI-TAP isolation.

Start by turning all of the OMNI-TAPs fully clockwise, for maximum attenuation. Then, go to a tap in the middle of the trunkline and make sure you can read at least 1000 microvolts of picture carrier signal on the highest channel the system carries. If the reading is less than 1000 microvolts, turn the OMNI-TAP counterclockwise until you get 1000 microvolts. Repeat for each tap until you get to the end of the line.

2. With an Ohmmeter. Connect the Ohmmeter between the arm of the OMNI-TAP potentiometer and the center conductor of the tap output. Set the first four OMNI-TAPs in each trunkline (nearest the Head End) to 700 ohms. Set the next two OMNI-TAPs in each trunkline to 500 ohms. Then, reduce each tap-off in the line by 100 ohms until you get to the end of the line.

For help in laying out a system or solving specific system problems, contact Jerrold via your local Jerrold distributor.

Or, for more information on MATV systems, write Jerrold Electronics, P.O. Box A, Philadelphia, Pa.

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Source Guide To Imported Products—Address Change

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All requests for service information and/or parts for Lear Jet Stereo 8 equipment should be directed to Jim McEwan, National Service Manager, at the above address. ■

Troubleshooter Topics

If troubleshooting a particular type of circuit or section in a TV or other consumer electronic product has always seemed unusually difficult for you, let the Troubleshooter know about it and he'll discuss it in the Troubleshooter department. Send your suggestions to: Troubleshooter, ELECTRONIC SERVICING, 1014 Wyandotte Street, Kansas City, Missouri 64105.

GEC1017A-27 1215-2
WEG2297A-27,
WEG2299A-27 1216-3

WARDS AIRLINE

GCI-1751A, GCI-17531A,
GCI-17541A, GCI-17551A .1201-2
GCI-17821A, B/841A,
B/851A, B, GCI-17921A,
B/941A, B/951A, B 1217-3
Remote Control 1217-3-A

ZENITH

Chassis 19CB36 1212-3
Chassis 19CC19 1215-3
Remote Control Receiver
S-86335, Transmitter
S-86500 .... 1215-3-A

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ADMIRAL

6047PC-M (Ch. 1K10-B) .. 1211-4

DUMONT

59T01WN, 59T02WN
(Ch. 120976A, 120984A) .. 1211-4

MOTOROLA

Chassis 22TS-599B 1205-3

PENNCREST

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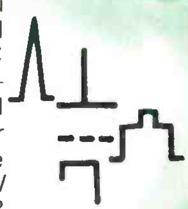
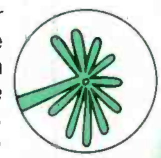
PS163 DUAL CHANNEL DUAL TRACE TRIGGERED OSCILLOSCOPE

How often have you dreamed that you could see the gated AGC plate pulse and control grid keying signal to determine whether they are arriving at the same time? *The dual trace, triggered PS163 will do it.*



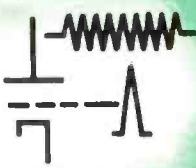
AGC KEYER

How often have you dreamed that you could view color vector waveforms from the front of the scope and have amplifiers on each axis so you would not be restricted from viewing vectors in low level circuits or when the circuit is defective? *The dual channel, triggered PS163 will do it.*



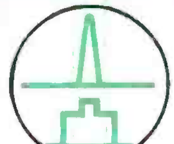
VECTORSCOPE

How often have you dreamed that you could see the flyback pulse and 9 cycle color burst at the same time to see if they are actually opening up the burst amplifier (gate)? *The dual trace, triggered PS163 will do it.*



BURST AMP

How often have you dreamed that you could own a dual channel, dual trace scope which would operate either triggered or free-running? And, have AC or DC coupled input with a bandwidth from DC to 8 MHz at 5 mv input sensitivity? And, a full sensitivity vectorscope with front connections? And, cost less than $500 and all-American made? *The dual channel, dual trace triggered PS163 fills your every desire.*



These are only a few of the many things you can do with the PS163. Don't keep on dreaming, the PS163 Dual Trace Triggered Oscilloscope will be at your favorite Sencore distributor in a few days. Why not get it on order first and be miles ahead of your competition? You can tell HIM that you own the Sencore Dual Channel, Dual Trace, Triggered or Free Running, Quality Made Oscilloscope. It will compare to lab scopes costing four times as much and he knows it.

Still in doubt? The December SENCORE NEWS explains the PS163 in detail. Also, shows you where it can be put to use. Your Sencore Distributor has the NEWS on his counter. Ask him for it.

SENCORE

3200 SENCORE DRIVE, SIOUX FALLS, SOUTH DAKOTA 57107

Circle 20 on literature card

Fundamentals of troubleshooting tint problems

Careful analysis of visual symptoms plus a quick look at the input and output waveforms of the section or stages related to the characteristic affected usually will pinpoint the circuit in which the defective component exists, or, in many cases, will pinpoint the defect itself.

by Bruce Anderson
ES Contributing Author

Analyzing the Visual Symptoms

One of the best test instruments available for TV troubleshooting is the one that looks out of the front of the TV cabinet. Before jumping to any conclusions, or digging into all the complicated circuitry inside the receiver, settle back for a couple of minutes and, by analyzing the trouble symptoms displayed on the screen of the receiver and by the effects of the various controls, decide exactly what is wrong with the color. This can save you an hour or so of diagnostic time.

While looking at the picture produced by the receiver, ask yourself a few pertinent questions:

- **First, is the color temperature, or gray scale, correct?** This should be obvious, but it can be overlooked. In some of the new models which have special circuits for enhancement of flesh colors, even a slight misadjustment of the screen and drive controls can seriously affect certain colors. These circuits inherently shift tints in the blue-cyan-green quadrant, and the symptoms of "blue grass and green sky" can sometimes be relieved simply by properly setting up the gray scale. And, be sure the purity is good. While checking the gray scale, notice if one screen control is set at or near its limit at either extreme, or if one drive control is positioned almost to the minimum setting. (One drive control normally will be maximum, and quite often two of them will be.) If the controls are "all over the place," it might be that they simply need readjustment, but it might mean that someone has readjusted them to mask a more serious fault.

- **What is the general quality of the picture, with and without color?** A generally poor-quality black-and-white picture leads to suspicion about the antenna, lead-in, tuner, and IF amplifier. It isn't always true, but troubles in this part of the receiver which cause color shifts usually also affect the picture in other ways: Strong ghosts can completely upset color fidelity; standing waves in the lead-in almost surely will

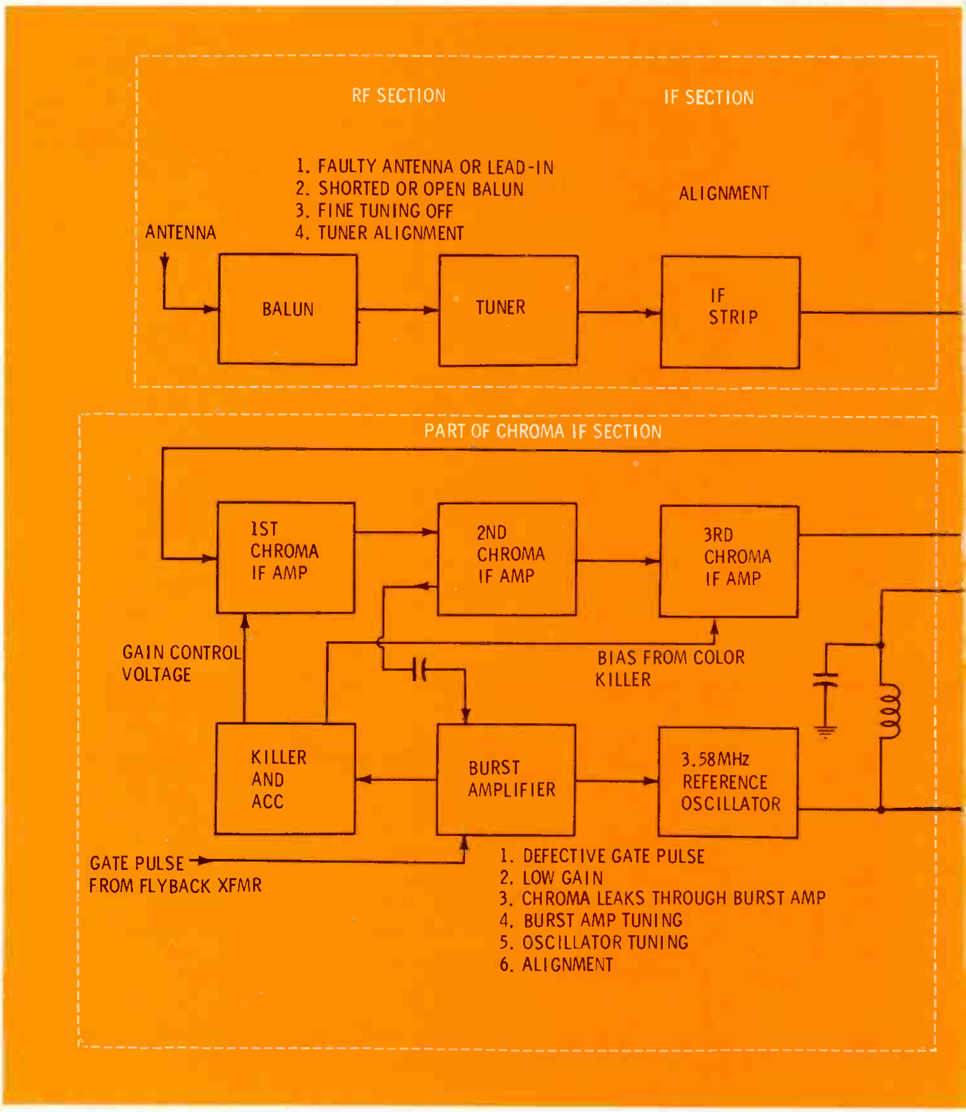


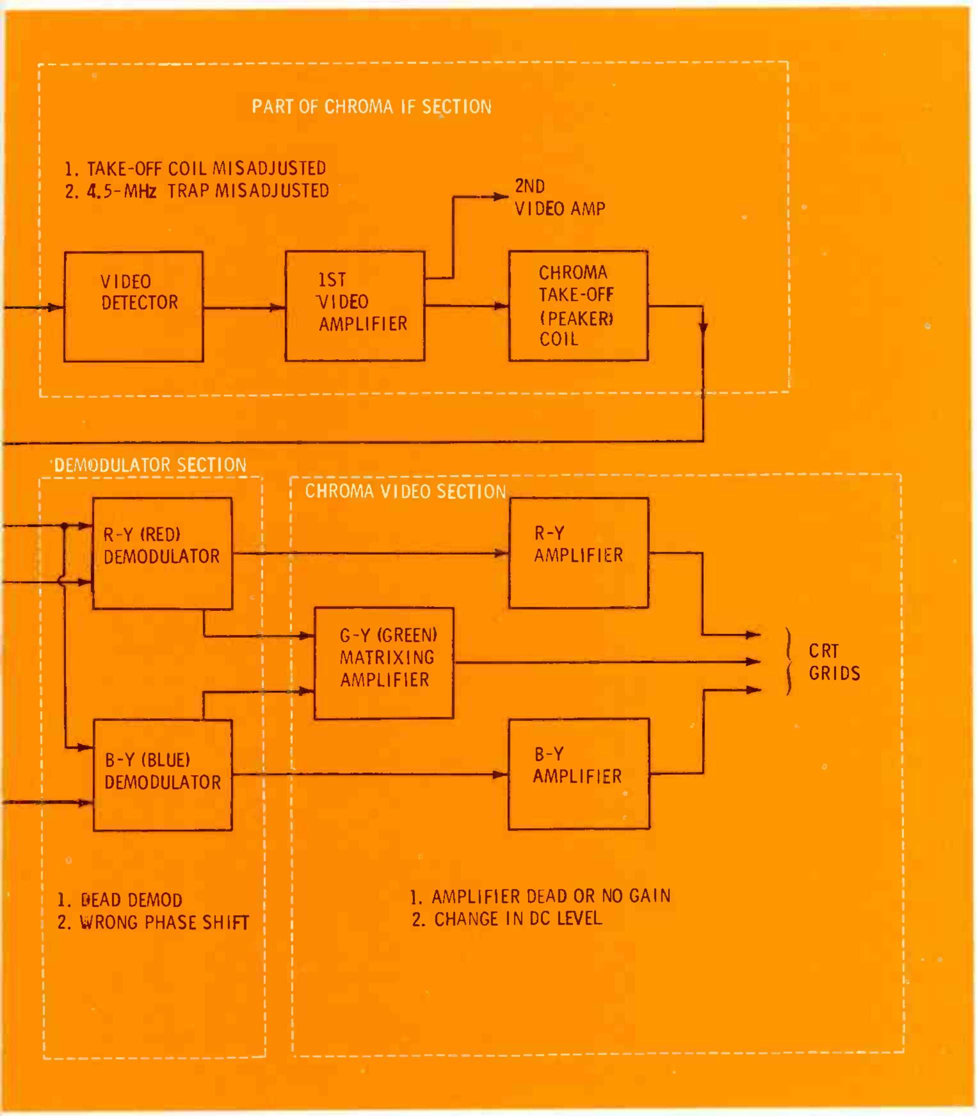
Fig. 1 Block diagram of a typical color TV showing the possible causes of incorrect tint in each section.

change the tint—but they also cause fringing. Remember, the misalignment or antenna trouble that causes smearing or ringing probably also will produce bad color.

- **Does the color control have to be tuned to near maximum to get sufficient color saturation?** If it does, there probably is a gain problem in the chroma bandpass amplifiers. Most receivers are designed so that excessive color is obtained at about the halfway point of the control. Unless you know that the model involved is different, be suspicious if the control has to be operated near maximum. Some of the newer models have restricted-range controls—"Instamatic Tuning," "Total Automatic Color," "AccuMatic," etc. In these, the user has only a limited range of color and tint control.

- **Does it appear that one of the color primaries is completely missing (no red, for example); or, are all the primaries there, but in the wrong places?** If some objects appear correctly in the picture (or some of the color bars are normal), it is safe to assume that the problem is in the demodulators or color-difference amplifiers. If all three primaries are visible somewhere in the picture, but all colors are wrong, the problem is most likely in the stages preceding the demodulators. (An exception: If one CRT control grid has a radically wrong DC level and the corresponding screen control has been reset to restore gray scale (usually not very successfully), it is unlikely that any primary color will be properly reproduced.)

- **What effect, if any, does varying the horizontal-hold control have on color?** Some receivers have the characteristic of changing hue or losing color completely when the horizontal-hold control is positioned near the point where the raster falls out of sync. Most receivers designed in the past five years do not display this trait, so if it appears in one of these, there might be a malfunction.



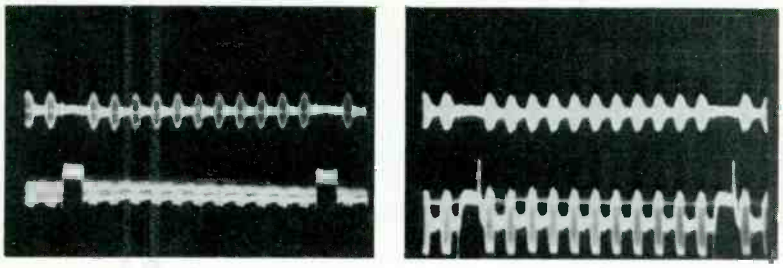
Troubleshooting Inside the Receiver

Fig. 1 shows a "composite" block diagram of a typical color TV receiving system, from antenna terminals to picture tube. For purposes of clarity, it has been divided into the following sections: RF, IF, chroma-IF (the 3.58-MHz section), the chroma-demodulator section, and the chroma-video (color-difference) section.

The burst-amplifier and 3.58-MHz reference oscillator are arbitrarily included in the chroma-IF section, although it would be just as reasonable to consider them as part of the demodulator section.

As pointed out earlier, the chroma-IF section should be suspected if the problem is a shift of **all** colors, rather than loss of a single primary. The reason is that, because the information for all three primary colors is contained in a single signal processed by the chroma IF section, a failure in it cannot normally discriminate against a single primary. Instead, all colors are affected equally.

Because space limitations in this article do not permit alignment problems to be discussed in detail, it will be assumed that the chroma-bandpass amplifiers



A B

Fig. 2 Output waveforms of video detector (bottom) and 2nd chroma-bandpass amplifier (top). **(A)** Normal waveform **(B)** Result of tuning toward sound.

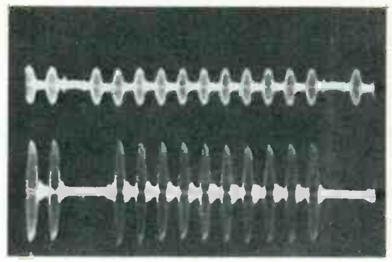
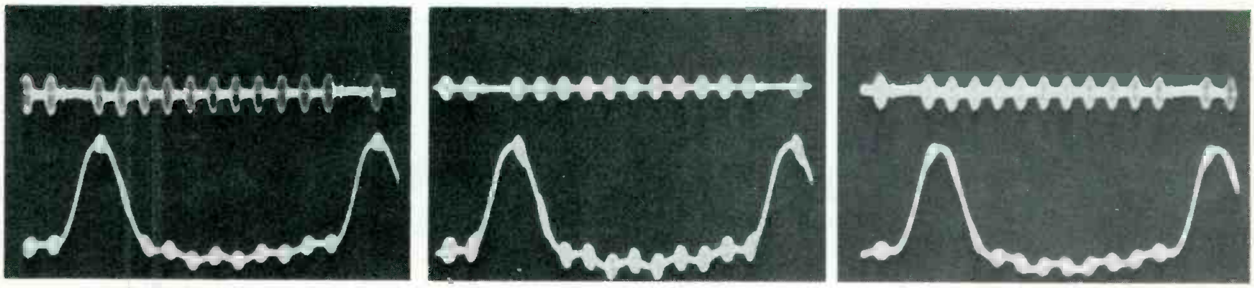


Fig. 3 Output of 2nd chroma amplifier (top) and 3rd chroma amplifier (bottom).



A B C

Fig. 4 Output of 2nd chroma amplifier (top) and input to burst amplifier (bottom). **(A)** Normal waveform **(B)** Gate pulse leads burst **(C)** Burst leads gate pulse.

are properly aligned. With this qualification, it is unlikely that a fault in the chroma-bandpass amplifiers will affect tint without also affecting color level. If the color amplitude is low, then these amplifiers probably are the trouble source. Signal tracing with the scope will confirm whether or not it is.

Servicing data might indicate the typical signal amplitudes at each of the chroma-bandpass amplifiers, but quite often they do not. In either case, it is possible to spot the trouble by observing at a few key points in the color circuits the signal produced by a color-bar generator. These waveform amplitudes will vary among different models of receivers, but, relative amplitudes and distortions of the **waveshapes** will tell the story.

When the receiver fine tuning is adjusted correctly, the waveform at the video detector or at the input to the chroma take-off coil should resemble the bottom one in Fig. 2A. The magnitude of the waveform might vary, depending on whether or not there is an amplifier between these two points, but the ratio of the sync pulses and the color bars should be nearly constant.

The bottom waveform in Fig. 2B shows the effect of fine tuning the receiver towards sound. This increases the amplitude of the color bars relative to that of the sync pulses. Tuning away from sound has the opposite effect.

Incidentally, the burst amplitudes produced at the video detector by the four TV channels available in the author's reception area often vary by a ratio of 2:1 or greater. For this reason, waveforms "off the air" are not included in this discussion.

The output of the 2nd chroma amplifier of the receiver is shown in the top waveforms of Fig. 2A and 2B. The output of the 1st chroma amplifier was too small to photograph well, even though the scope used has a sensitivity of 100 millivolts per centimeter. Notice that the amplitude of this waveform remained the same, regardless of the amplitude of the color-bar signal from the video detector. This indicates that the automatic gain system of the first chroma amplifier was operating normally.

The bottom waveform in Fig. 3 is the input to the demodulators. (The top waveform in Fig. 3 again is the output of the 2nd chroma amplifier, as in Fig. 2.) The color burst signal and associated color bar have been gated out of this waveform; otherwise, only the amplitude has changed. The 2nd chroma amplifier waveform is shifted slightly to the right in relation to that of the input to the demodulators, although this is hardly noticeable. It is caused by the delay imposed on the input signal by the 3rd chroma bandpass amplifier.

The input to the burst amplifier is the bottom waveforms in the photos in Fig. 4 and the output of the 2nd chroma amplifier is the top waveforms. Fig. 4A shows the proper time relationship between the burst and the burst-gate pulse from the horizontal-output transformer. Fig. 4B and 4C show mistiming produced by carefully setting the horizontal-hold control as far towards its limits as possible without upsetting the sync. In both instances, a shift in the tint produced on the screen was noted. A change in the value of a coupling component between the flyback transformer and the burst gate tube or transistor can upset this critical timing and shift the tint in the same manner.

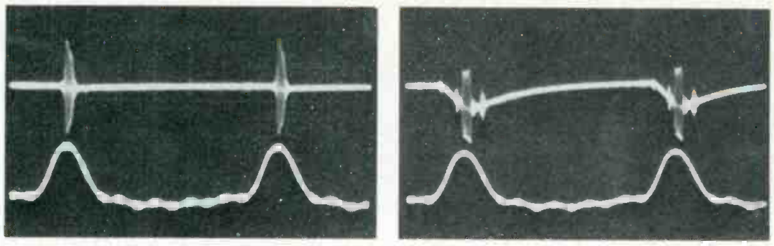
If the amplitude of the burst gate signal is barely sufficient to bring the burst amplifier into conduction, it also can shift the burst phase. Unless typical waveforms for the particular receiver are available, it is unlikely that this fault can be spotted directly; but any fault which attenuates the burst gate signal probably will also affect its timing—and waveform analysis will reveal this.

The output of the burst amplifier should contain nothing but the amplified burst signals. If any of the remaining chroma signal leaks through, it will "pull" the oscillator phase and produce wrong colors. If chroma is leaking through the gate, the most likely trouble is a leaky or below-value cathode-bypass (emitter-bypass) capacitor, or a below-value cathode (emitter) resistor.

The waveform photographs in Fig. 5A and 5B show normal and abnormal outputs from the burst amplifier. In each photograph, the lower waveform is the input. In Fig. 5B, the fault was induced by shunting the emitter resistor and bypass capacitor with a 6.8K-ohm resistor. The color bars are shifted about 60 degrees.

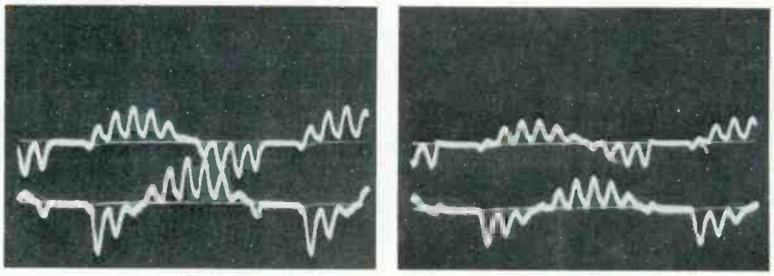
In almost every color receiver, the tint can be changed by "touching up" the tuned circuit which is the burst-amplifier plate (collector) load. If this circuit is mistuned, retune it to produce maximum amplitude of the output of the burst amplifier (top waveform in Fig. 5A). To keep the scope probe capacitance from shifting the tuning of the resonant circuit, use at least 100K of resistance between the probe and the plate (collector). This will isolate from the circuit the 10 pf or so of probe capacitance.

Fig. 6A shows the typical waveforms for the blue and red grids of the CRT. The blue grid waveform is at the bottom. The amplitudes are about equal, although in many receivers blue will be slightly larger. As shown, the sixth bar of the red (top) waveform would be null, and both the



A B

Fig. 5 Output of burst amplifier (top) and input to burst amplifier (bottom). **(A)** Normal waveform **(B)** Chroma leaking through amplifier distorts burst.



A B

Fig. 6 Outputs of B-Y and R-Y amplifiers (bottom and top respectively). **(A)** Normal waveform **(B)** Nulls shifted to right.

third and ninth bars of the blue (bottom) should null. The green waveform is not shown; its nulls should be on the first and seventh bars, and its amplitude normally is about one third that of red.

Fig. 6B shows the result of slight misadjustment of the tint control. The nulls fall somewhat to the right of their normal positions. This, of course, is easily corrected by adjusting the tint control—unless you "run out of control." If this happens, try adjusting the burst-amplifier tuned circuit, as described previously, with the tint control at the center of its range.

If it should happen that one of the CRT grid waveforms is correct, but the nulls are out of place on another, suspect the phase shifting network between the oscillator and one of the demodulators. This network can be electrically located in either demodulator input. If three demodulators are used, two of them will use phase-shifted oscillator inputs.

Loss of amplitude of one of the CRT inputs can be caused by the corresponding demodulator, or by the color-difference amplifier which follows it, if one is used. A simple job of circuit tracing with the scope should uncover the fault. Just bear in mind that each common emitter (or common cathode) amplifier inverts the signal, and should increase its amplitude. The one which doesn't is the source of the trouble.

Summary

To troubleshoot tint problems, first analyze what you see on the picture tube. It may not pinpoint the trouble, but it **can** get you started in the right direction. When you have decided in which general area or section the trouble probably exists, check from stage to stage and circuit to circuit with the scope until you spot the actual trouble or circuit in which the trouble exists.

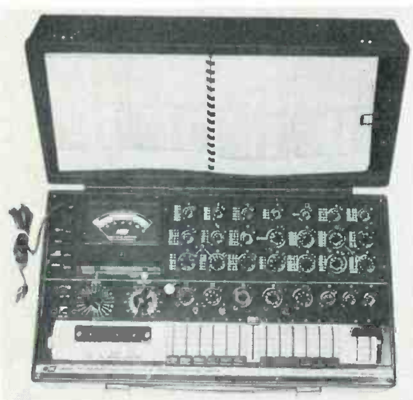
The servicing data available today for specific receivers probably is better than it has ever been, but the waveforms for each and every point in a receiver simply cannot be included in the space which is available. For this reason, the technician should acquire enough knowledge of basic circuits so that he can anticipate how each stage affects a signal and can predict what the output should look like. □

test equipment report

Mutual-Conductance Tube Tester

The B&K Division of Dynascan has added to their line the Model 747 "Dyna-Jet".

For fast tube testing, the Model 747 is said to have a "Jet Section" with 21 sockets pre-wired for the most often used tubes. Tube numbers are listed beside the sockets, and two switch settings; heater and sensitivity, are required according to the manufacturer.



The "Programmed Section" has 9 sockets for testing other tubes by operation of lever-action switches for each pin. A lever reportedly is provided to simultaneously clear the setting of all the switches.

Heater voltage is reduced by 10 percent for the LIFE test, and pushbuttons are provided for SHORTS and LEAKAGE tests. Pin straighteners and storage space are also provided.

The Model 747 measures 5 5/16 inches x 20½ inches x 11½ inches with a weight of 12 lbs.

Price of the Model 747 is $249.00.

Circle 50 on literature card

HI-LO Field-Effect Multimeter

Senior Hi-Lo Field Effect Multimeter Model FE160 has been introduced by Sencore. Pushbutton selection of all functions and ranges, including high/low voltage ohms scales, is featured. Eighteen pushbuttons are reported to select 112 different ranges.

DC volts function has 10 positive, 10 negative and 10 zero-center ranges with full-scale readings from .1 volt to 3000 volts. The input impedance is said to be 15 megohms shunted by 90 pf in the "norm" probe position or 10 pf in the 100K "Isolation" position.

AC volts function reportedly provides 9 rms ranges and 9 peak-to-peak ranges with full-scale readings fron .1 volt to 1000 volts rms and .28 volt to 2800 volts P-P. The input impedance is rated at 12 megohm shunted by 90 pf.

DC current function has 10 positive, 10 negative and 10 zero-center ranges with full-scale readings from 30 μa to 3 amps. The internal voltage drop is said to be .1 volt for all ranges.

AC current function reportedly has 10 rms ranges with full-scale readings from 30 μa to 3 amps. Internal voltage drop is .1 volt for all ranges.

The ohmmeter function has 8 "high-voltage" ranges which have a maximum voltage of 1.5 volts, and 8 "low-voltage" ranges which have a reported maximum voltage across the test leads of .08 volt, according to the manufacturer. Low ohmmeter voltages are said to permit accurate measurements in solid state circuits because the low voltage does not cause conduction in diodes or the junctions of transistors.

Power for the ohmmeter functions reportedly is supplied by an internal electronic source; no batteries are used.

The decibel function reportedly has 9 ranges referenced to 1 mw in 600 ohms with full-scale readings from −20 dB to 60 dB.

Other features include: a seven inch mirrored-scale meter, and ½ percent deposited-carbon multiplier resistors.

Model FE160 weighs 6 lbs. and measures 9 inches x 7½ inches x 6 inches.

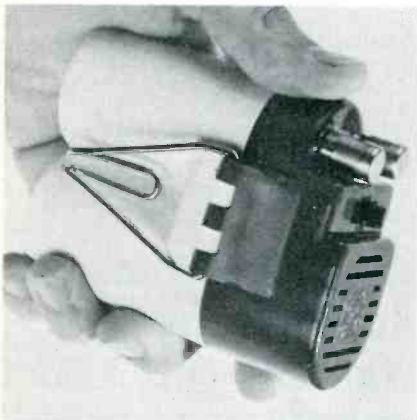
Price of the Model FE160 is $190.00. The accessory high voltage probe Model 39A30 is priced at $12.00.

Circle 51 on literature card

Portable Continuity Tester

A new, solid-state, portable circuit continuity tester is announced by Reliable Electric Co.

Applications of Model R81A include tone and DC continuity tests of communication lines. The tester reportedly can be used in conjunction with a lineman's telephone to identify a cable pair; or it can be



used by itself to generate a 400-Hz tone when continuity exists between the terminals under test.

The tester measures 4 inches x 3⅛ inches x 2 inches, is supplied with a folding belt clip and test-lead sets.

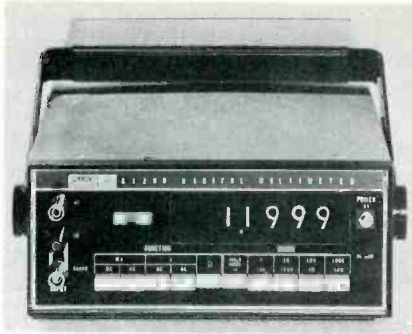
The R81A sells for $18.07. The test-lead sets, R81B, sell for $5.36.

Circle 52 on literature card

Digital Multimeter

A new, solid-state digital multimeter which features 25 ranges and modes has been introduced by John Fluke Mfg. Co., Inc.

Model 8102A features AC and DC voltage ranges from 100 millivolts to 1,000 volts, current ranges from 100 microamperes to 1 ampere, and resistance ranges from 1,000 ohms to 10 megohms. Over-



range on all ranges is 20 percent, according to the manufacturer.

Other features reportedly include guarded circuits, push-button convenience, field-installable options and single-mainframe option structure.

The Model 8102A 4½-digit multimeter sells for $795.00.

Circle 53 on literature card

Semiconductor Curve Tracer

The CT71 semiconductor curve tracer, reportedly designed for displaying on a 10 x 10 cm CRT, the characteristic curves of a wide range of transistor, FET and diode semiconductor devices, has been announced by Tektronix, Inc.

Specifications of the CT71 are:

Collector Supply

Voltage—0 to 1 kV; positive and negative polarity; twice line frequency or DC

Current—Peak to 2 amps (maximum 15 watts)

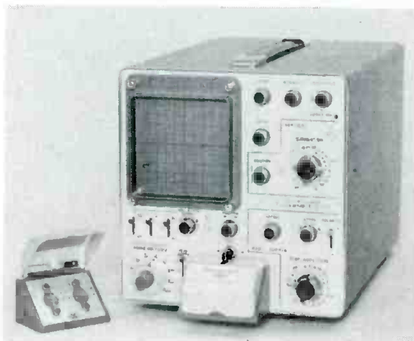
Series Resistances—0 ohms to 1.7 megohms in 11 steps

Base Step Generator

Current—0.2 μA to 20 mA in 16 steps

Voltage—0.1/V to 2 volts in 5 steps

Steps/Offset—Adjustable from 0 to 10 steps in positive or negative direction



Vertical Amplifier

Collector current range—5 nA/div to 0.2 A/div in 24 steps

Horizontal Amplifier

Collector voltage range—0.1 V/div to 100 V/div in 10 steps

Power requirements—voltage settings for 100-volts to 125-volts in 5-volt steps, 200-volts to 250-volts in 10-volt steps; 48-Hz to 63-Hz.

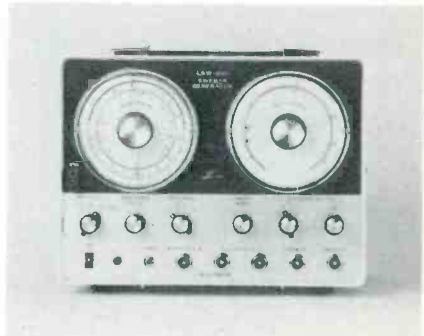
The CT71 sells for $795.00.

Circle 54 on literature card

TV/FM Sweep/Marker Generator

Model LSW-250 has been introduced by Leader Instruments for use in sweep-frequency testing of TV, CATV and FM products.

The sweep-frequency oscillator has a single range that is continuously variable from 2 MHz to 260 MHz and frequency deviation at 60 Hz up to a maximum of 20 MHz, according to the manufacturer.



A marker oscillator, said to be of the post-injection type, is employed, and a control is provided to vary the amplitude of the marker. The marker oscillator is continuously variable in 4 bands, and reportedly has provision for crystal-accuracy calibration by means of a crystal socket mounted on the front panel.

Model LSW-250 is priced, with accessories, at $299.50.

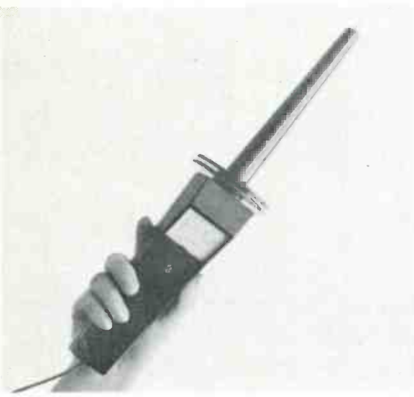
Circle 55 on literature card

High-Voltage Test Probe

Measurement of potentials up to 30,000 volts, and a sensitivity of 20,000 ohms per volt, reportedly are two features of the Model LHM-80 CRT high-voltage test probe manufactured by Leader Instruments Corp.

Complete with ground wire and heavy duty clip, the LHM-80 reportedly has a full-scale accuracy of ±3 per cent and is equipped with a 600-megohm multiplier resistor.

The LHM-80 is 14 inches long, weighs 1 pound, and is self-contained in a high-impact molded polystrene body.



The LHM-80 sells for $19.95

Circle 56 on literature card

Audio Oscillator

A low-frequency oscillator, Model ORC-27A, has been announced by Kikusui Electronics. This RC-type oscillator reportedly has a frequency coverage in 4 ranges from 18 Hz to 200 KHz with a calibration accuracy said to be ±2 percent +1 Hz.

A slide-rule type dial with mirrored-scale is provided to minimize parallax reading errors.

Three types of output waveforms are available: sine waves with a maximum output of 5 volts rms, square waves with an output of 10 volts P-P, or a complex wave with a minimum of 10 volts P-P.

Size of the oscillator is 11⅞ inches x 7¹⁄₁₆ inches x 7½ inches.

Price of the Model ORC-27A is $85.00. ▲

Circle 57 on literature card

For more information about above products use reader service card

Circle 24 on literature card

Circle 25 on literature card

Circle 26 on literature card

New In Color For 1972,

Part 2

by Carl Babcoke

Continuation of the analysis of new and changed circuitry in the color TV chassis offered this year. Part 1 was published in the December issue.

Philco Circuits

Double protection against excessive high voltage

Two regulators are used in the Philco 22ST80/81/91P color TV chassis, as shown in Fig. 1, to prevent excessive high voltage.

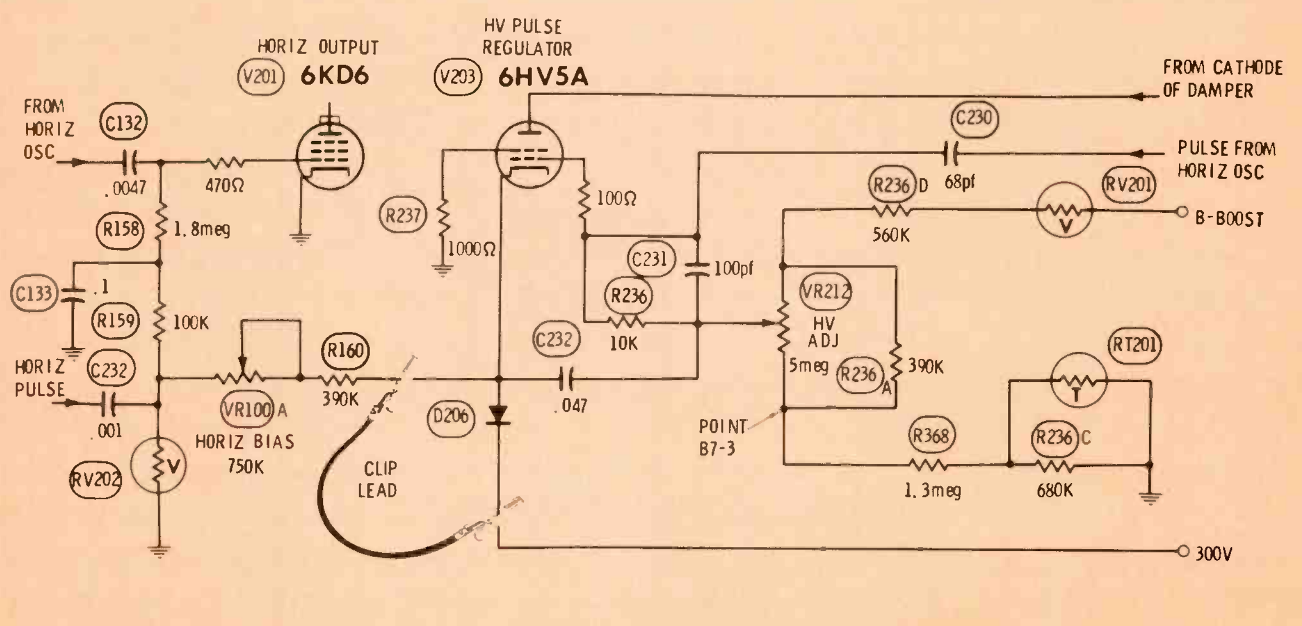
Pulse regulation, using a 6HV5A tube, is the primary method of high-voltage and sweep regulation. In addition, grid regulation of the 6KD6 horizontal-output tube, by rectification of horizontal pulses, is employed.

The third protective circuit consists of an interconnection between the two regulators. If current through diode D206 ceases, the diode becomes reverse biased (an open circuit). This causes a loss of the positive balancing voltage which normally enters the grid regulator circuit through R160 and RV100A, the HORIZ BIAS control. Without the positive voltage, excessive negative voltage is supplied to the grid of the output tube by rectification of pulses by RV202. The voltage at the output grid becomes too negative, and the width and high voltage are both drastically reduced.

Because each regulator has an adjustment control, a specific sequence of adjustment must be followed. The correct procedure, according to Philco, is to, first, disable the pulse regulator, then adjust the grid regulator, and, finally, adjust the pulse regulator. Use the following adjustment procedure:

- Connect a test lead across D206, ground point B7-3, and turn VR212 (HV ADJ) completely CCW.
- Turn down the brightness control, to produce a black raster, and connect a high-voltage probe and meter to the anode of the CRT.
- Adjust VR100A (HORIZ BIAS) to produce a meter reading of 29 kV.
- Remove both test leads and adjust VR212 for a meter reading of 26.5 kV.

Fig. 1 The Philco 22ST80/81/90P color TV chassis has two high voltage regulators. To adjust them, use the following procedure: **(1)** Point B7-3 should be grounded. **(2)** The HV ADJ control should be turned completely CCW, and a test lead connected across D206. **(3)** With the brightness turned down, adjust the HORIZ BIAS control for 29 kV, measured at the CRT. **(4)** Remove the two test leads and adjust the HV ADJ control for 26.5 kV.



Color indicator light

A bulb which lights when a color program is being received is a feature of the Philco 22LT45 color chassis. It is called a "Philcomatic Lite". A schematic of the circuit is shown in Fig. 2.

Resistor R129, the supply resistor for the collector of the 2nd chroma amplifier, has a voltage dropped across it when color is received (the color killer permits Q94 to conduct). This voltage drop forward biases Q97 into conduction, and the indicator bulb is lit by the collector current.

Improved DC coupling

More accurate color reproduction reportedly is produced by the DC coupling circuit used in Philco 22ST80/81 and 21ST91P color chassis. Part of the circuit is shown in Fig. 3.

Rectification of horizontal

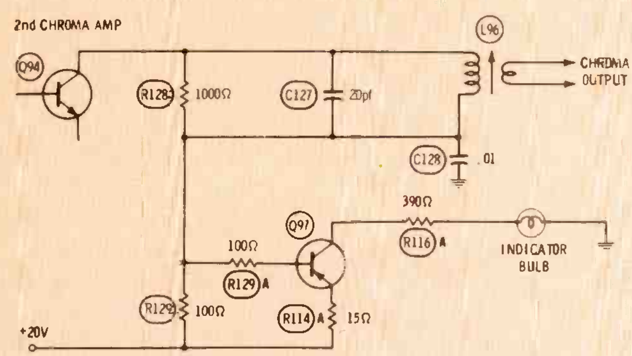


Fig. 2 Illumination of the Philcomatic Lite indicates that the color killer is inactivated and color should be received. When the 2nd chroma amplifier transistor conducts, the voltage dropped across supply resistor R129 forward biases Q97 into conducting, and the collector current lights the indicator bulb.

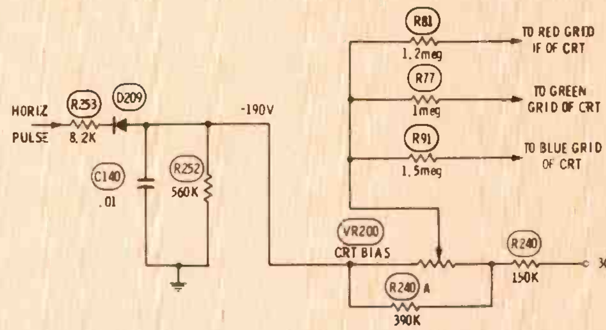


Fig. 3 Different ratios of DC coupling between the −Y amplifiers and the grids of the CRT are provided by this circuit in Philco 22ST80/81 and 21ST91P color TV chassis. Better reproduction of complementary colors is the primary function of this circuit.

Fig. 4 Use of a solid-state triac as an on/off switch in RCA CTC54 color TV chassis permits remote control of this function without relays. Current from the remote receiver lights the bulb inside the PM100 assembly, and the illumination reduces the resistance of the cadmium-sulfide cell. Because the cell is connected between the anode and the gate of the triac, reducing its resistance triggers on the triac, which conducts in both directions, thus applying power to the TV chassis.

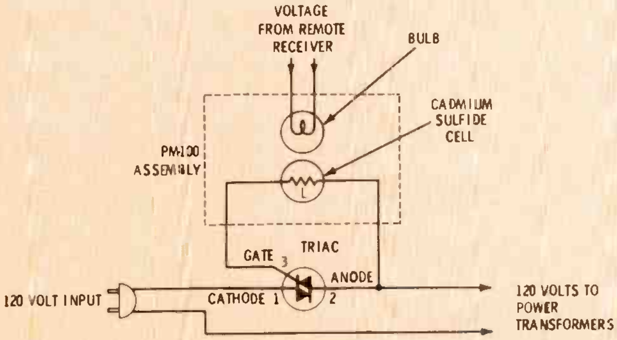
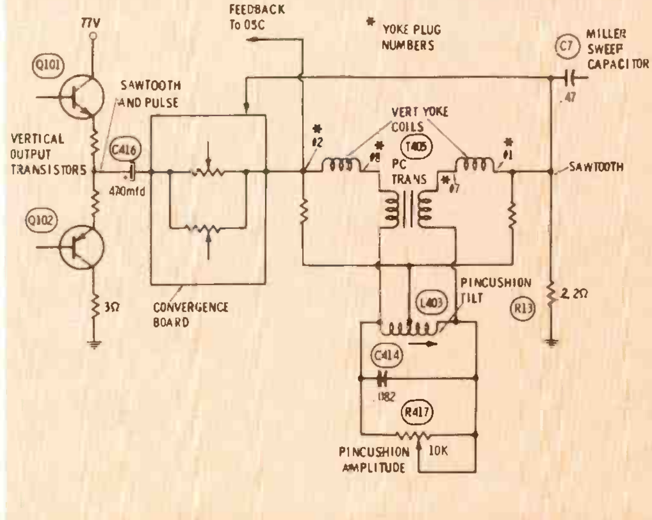


Fig. 5 The RCA CTC54 uses direct drive from the transistors, without a vertical-output transformer. Voltages for operation of the convergence circuit are obtained from series and parallel tapoffs of the sweep voltage and the yoke current. An open circuit in a winding of T405 or L403 will cause a trapezoidal picture, because one of the windings in the yoke will not receive current.



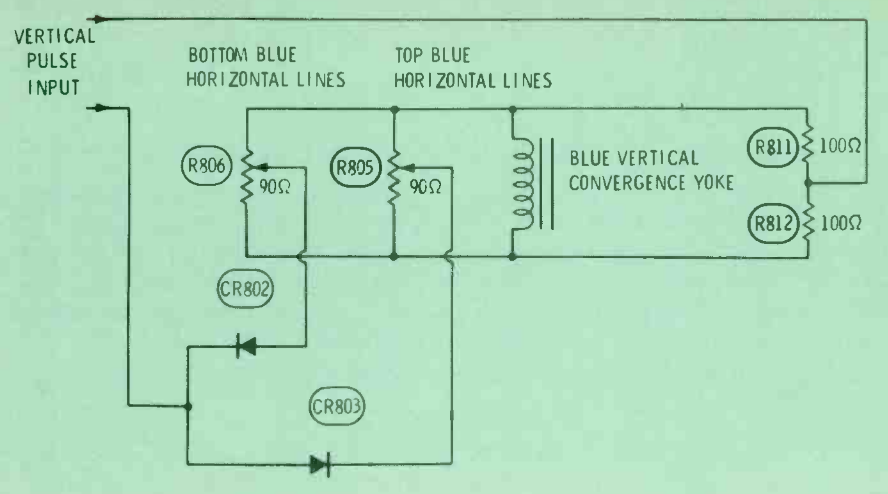


Fig. 6 The blue vertical convergence circuit varies both the amplitude and phase of the voltages applied to the blue vertical coil in the RCA CTC54 color TV chassis. The two diodes clip the deflection waveform into pulse and sawtooth, for correction of tilt and amplitude.

pulses by diode D209 produces about −190 volts, which is supplied to one end of the CRT BIAS control. Positive voltage is connected to the other end of the control. Three resistors, of different values, are connected from the center of the CRT bias control to the three control grids of the CRT. (These grids are also coupled through paralleled resistors and capacitors to the plates of the −Y amplifier tubes.) According to Philco, more natural complementary colors are reproduced by this unbalanced method of coupling.

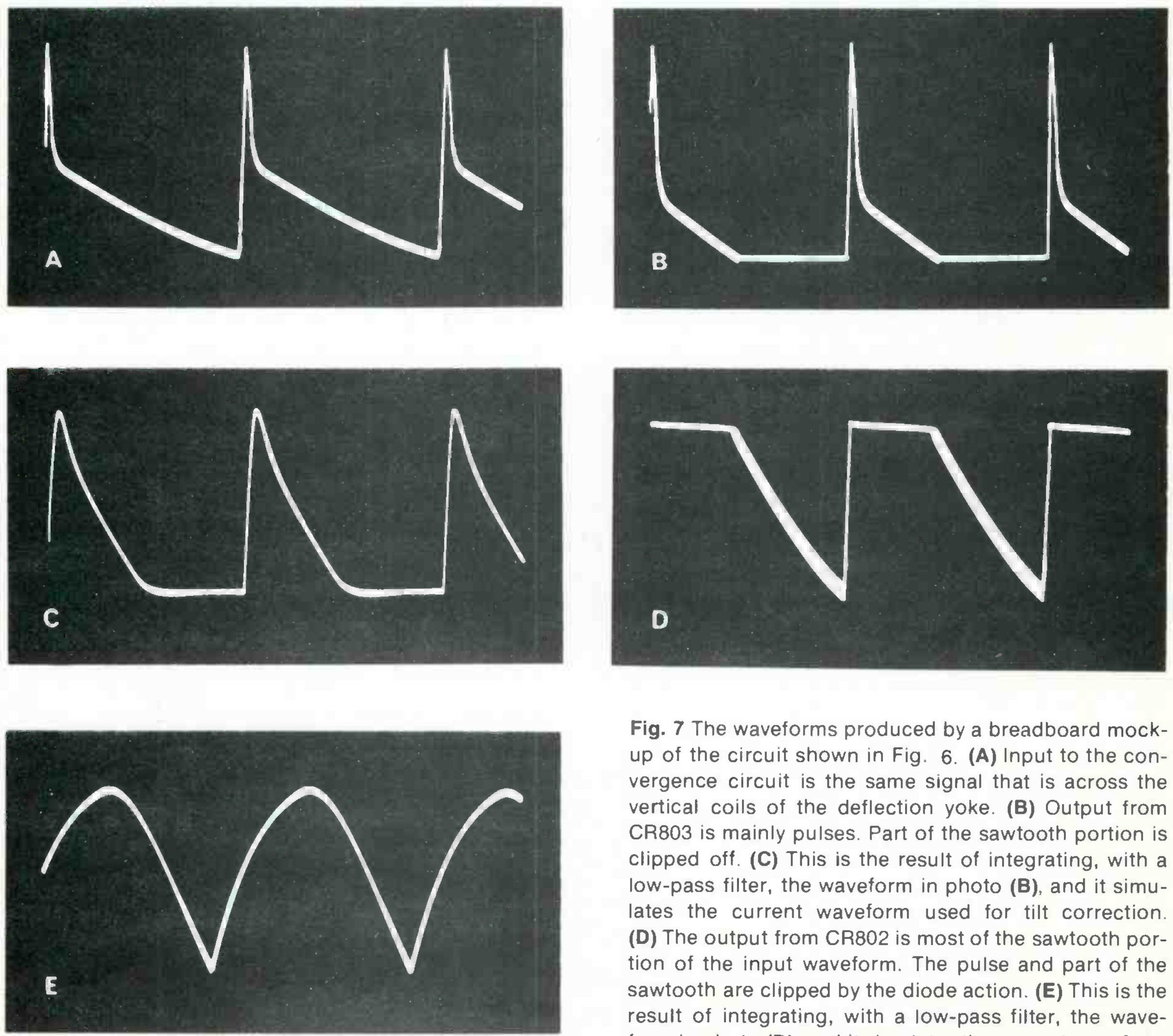


Fig. 7 The waveforms produced by a breadboard mock-up of the circuit shown in Fig. 6. **(A)** Input to the convergence circuit is the same signal that is across the vertical coils of the deflection yoke. **(B)** Output from CR803 is mainly pulses. Part of the sawtooth portion is clipped off. **(C)** This is the result of integrating, with a low-pass filter, the waveform in photo **(B)**, and it simulates the current waveform used for tilt correction. **(D)** The output from CR802 is most of the sawtooth portion of the input waveform. The pulse and part of the sawtooth are clipped by the diode action. **(E)** This is the result of integrating, with a low-pass filter, the waveform in photo **(D)**, and it simulates the current waveform necessary for amplitude convergence correction.

RCA

Solid-state power switch

The RCA CTC54 color chassis might be called the first TV receiver to be designed without an on/off switch. More accurately, the conventional on/off switch has been replaced with a triac, as shown in Fig. 4. (Triacs are similar to SCR's except that they will conduct in both directions when triggered.)

Current from a transistor in the remote-control circuit lights the bulb in the PM100 assembly. Light from the bulb causes the resistance of the cadmium-sulfide cell to decrease to a few hundred ohms. The low resistance of the cell triggers on the triac, which becomes a low resistance to current flow of both polarities, and power is applied to the TV receiver.

Convergence circuitry used with transformerless vertical outputs

RCA CTC49, CTC46 and CTC54 color chassis are equipped with a transformerless vertical-output stage. Two transistors are stacked in series across the 77-volt power supply, and the output is taken from the emitters, as shown in Fig. 5. This type of circuit has been used for years in stereo amplifiers, and undoubtedly will provide good drive for the vertical yoke coils.

However, in the past, extra windings on the vertical-output transformers were used to supply pulses of both polarities to give "tilt" to the convergence action. This source of convergence voltage is not available when the transformer is missing.

Fig. 5 shows part of RCA's solution to this problem. Some of the convergence controls are paralleled, and this total resistance is in series with the vertical coils in the deflection yoke. The current in such a series circuit is a sawtooth, because the yoke current is a sawtooth. The voltages dropped across the convergence controls connected in series with the yoke are also sawtooths. However, the current in the convergence yoke coils, produced by the sawtooth voltage across the coils, is a parabola. A parabola is nearly the ideal current for correction of dynamic misconvergence.

Tilt correction also is needed, and the voltage dropped across the vertical coils of the deflection yoke is used for that function.

Blue vertical convergence is achieved by a different circuit (shown in Fig. 6) than that used for the red-green convergence. The waveshape of the voltage used in this circuit is shown in Fig. 7A.

When R805 and R806 are both at the center of their resistances, the circuit is balanced and no current flows in the blue convergence yoke (there is no correction of the blue vertical misconvergence). Adjustment of either control away from the center position progressively increases the amplitude of signal applied to the convergence coil by the respective diode. Adjustment on one side of the center gives a positive-going waveform, and adjustment on the opposite side gives a negative-going waveform. Consequently, both the phases and the amplitudes of the voltages from the two diodes are adjustable.

The waveform of the voltage at the cathode of CR803, shown in Fig. 7B, consists mainly of pulses, because the half-wave rectification by the diode has clipped off the bottom of the waveform. Because of the inductance of the convergence coil, these pulses integrate into approximate sawteeth of current, as shown in Fig. 7C. A sawtooth of current corrects for "tilt".

The waveform of the voltage at the anode of CR802, shown in Fig. 7D, consists mainly of sawteeth, because of rectification by the diode. Because of the inductance of the convergence coil, these pulses integrate into parabolic waveforms of current, as shown in Fig. 7E. A parabola of current corrects for "amplitude".

Horizontal oscillator disabling

Another trend is to circuits which disable some vital function of the color receiver in the event the high voltage becomes excessive. The oscillator-disable circuit of the RCA CTC54 chassis (Fig. 8) is one example of such a protective circuit. When the

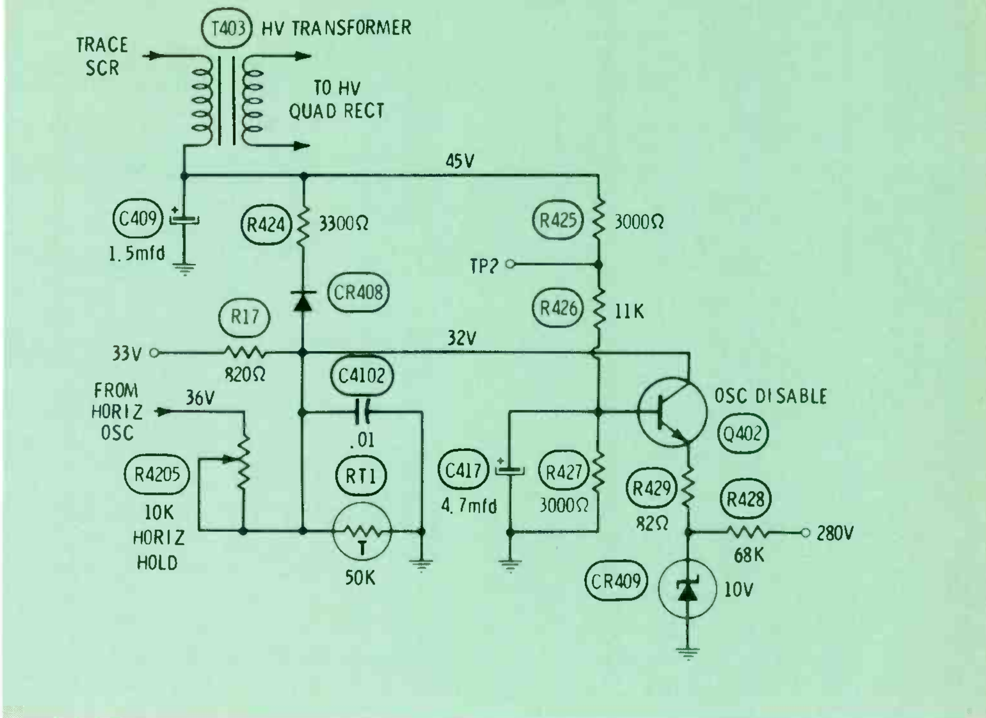


Fig. 8 In the event of excessive high voltage in the RCA CTC54 chassis, the oscillator disable circuit forces the horizontal oscillator far off frequency. This is accomplished by Q402, which, when the high voltags is too high, conducts and reduces the 32 volts at one end of the horizontal-hold control to about 10 volts. See text for a more detailed explanation of the circuit operation.

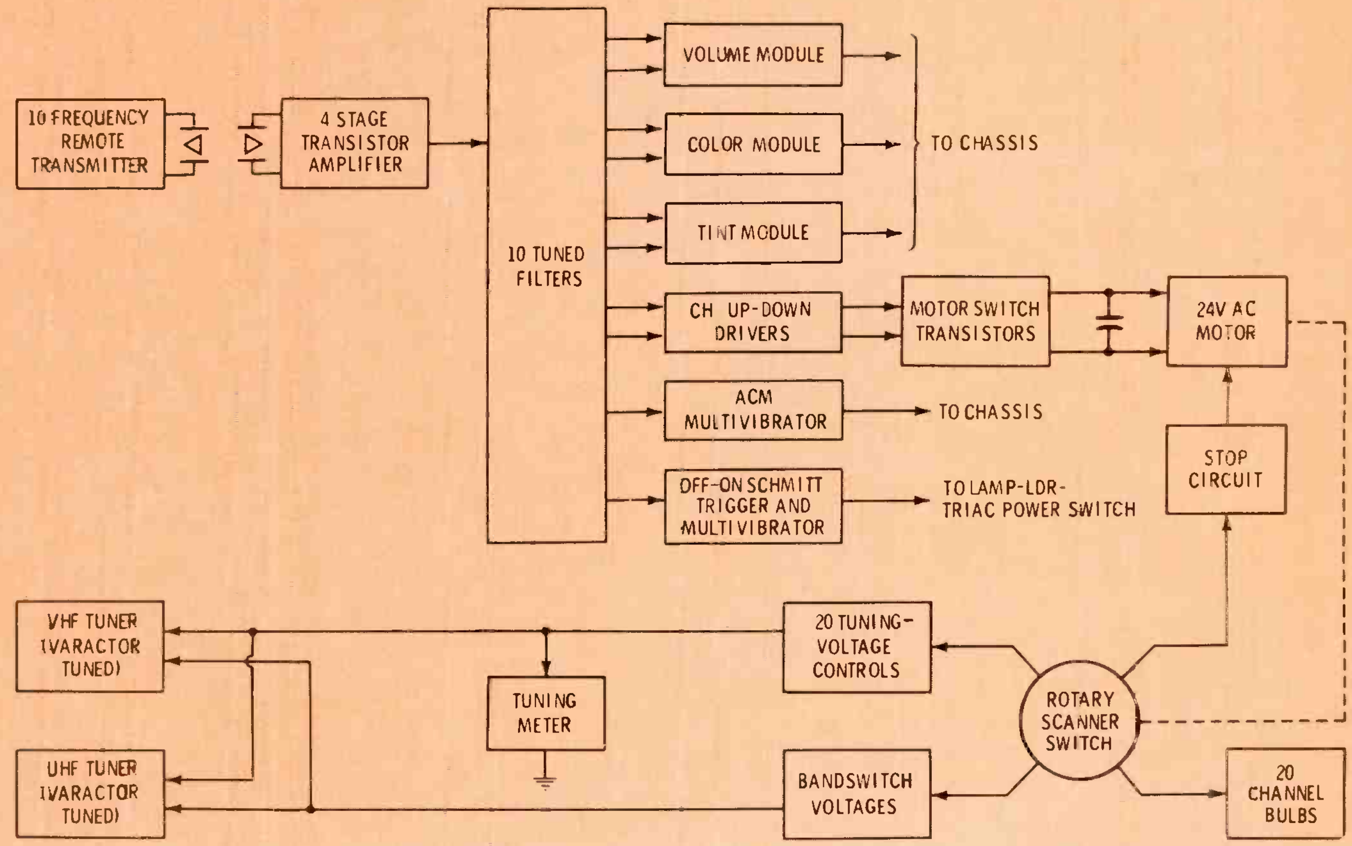
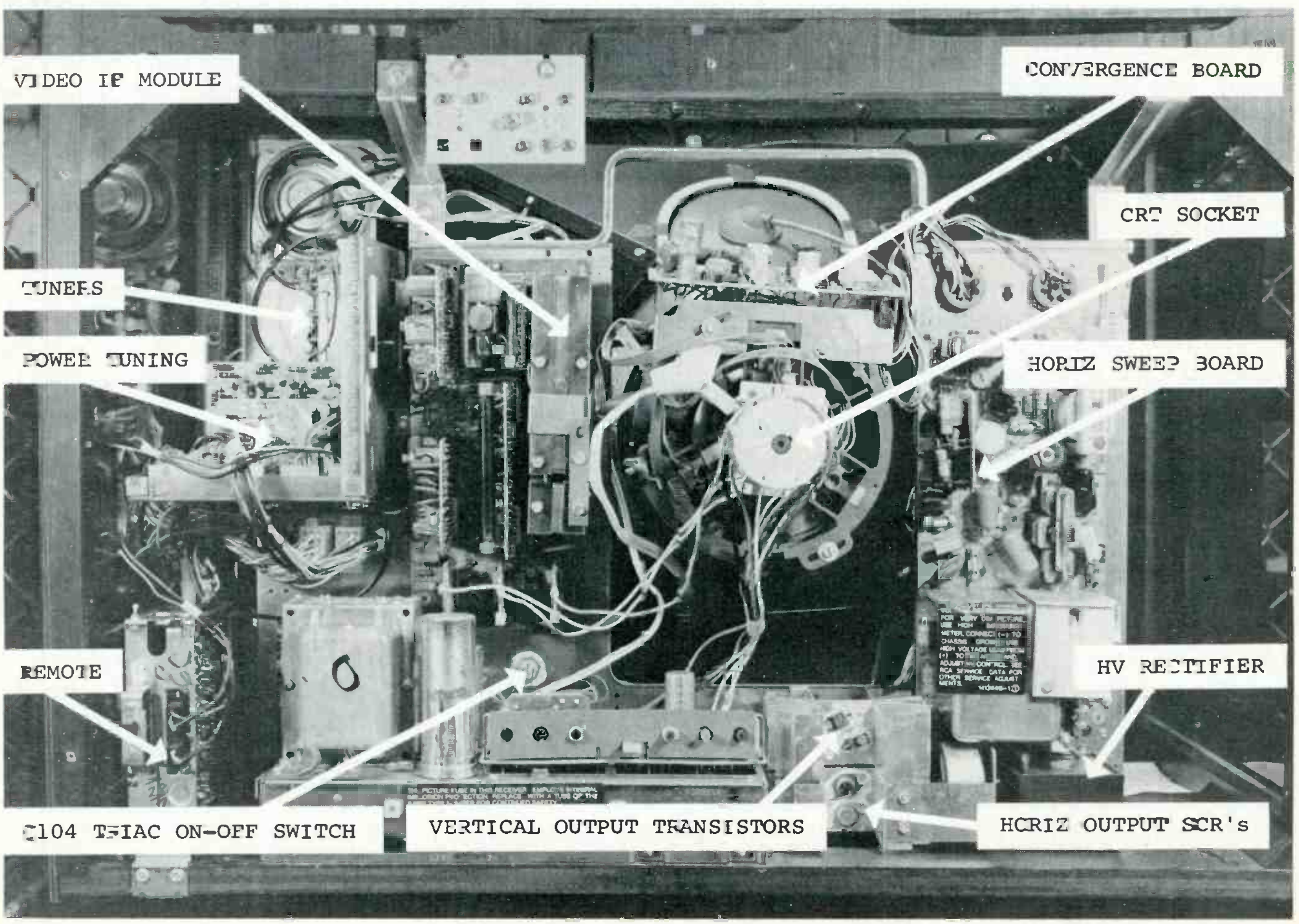


Fig. 10 Major components, modules, tuners and remote-control chassis on the RCA CTC54 chassis are pointed out here.



sweep and high voltage are excessive, the horizontal oscillator is driven off frequency.

The DC voltage on the emitter of Q402, the oscillator-disable transistor, is maintained at a fixed value by R428 and the zener diode, CR409. The DC voltage for the base of Q402 is obtained from a winding of the high-voltage transformer, the other end of which is connected to the trace SCR and diode. This voltage supply becomes more positive when there is more sweep and more high voltage.

Conduction of Q402 occurs when the base voltage, which is determined by the voltage divider consisting of R425, R426 and R427, becomes more positive than the fixed voltage of the emitter. Conduction of Q402 reduces the DC voltage at one end of the horizontal-hold control from the original +32 volts to slightly above +10. Such a drastic voltage change drives the oscillator so far off frequency that adjustment of the horizontal-hold control cannot bring it back. Because the color receiver is out of horizontal lock and cannot be adjusted back, the customer will turn it off and will call a technician. There is no reset provision included in the design. When the

Fig. 9 Block diagram of the remote-control system used in the RCA CTC54 color TV chassis. The volume, color and tint modules each store in a capacitor the control voltage for the gate of a MOSFET transistor. The DC output voltage from the MOSFET controls the corresponding function in the chassis. A tiny relay in each module cancels the remote-control information when the receiver is turned on and when the AccuMatic function is turned on. DC voltages, selected by the scanner switch, bias diodes on or off, to select low-band VHF, high-band VHF or UHF. Tuning of the four stages in the VHF tuner is by varactor diodes. Precision potentiometers supply the tuning voltage for each programmed channel. AFT voltage is added to the tuning voltage. A tuning meter is provided to indicate the approximate channel selected during the adjustment process.

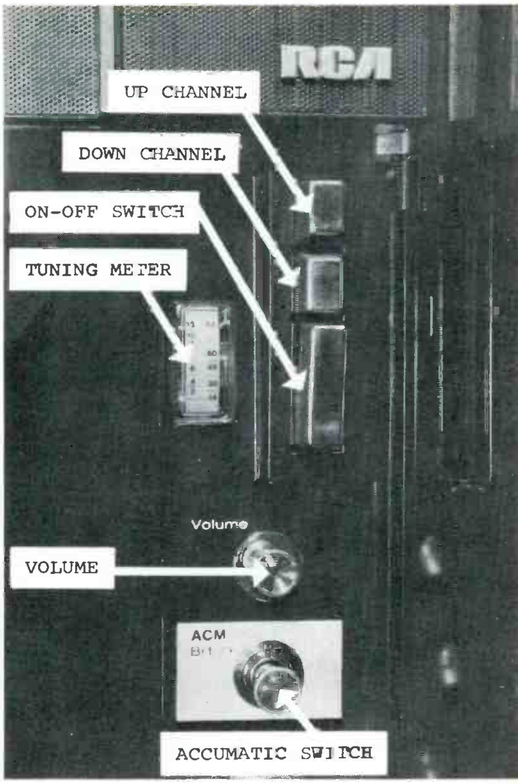
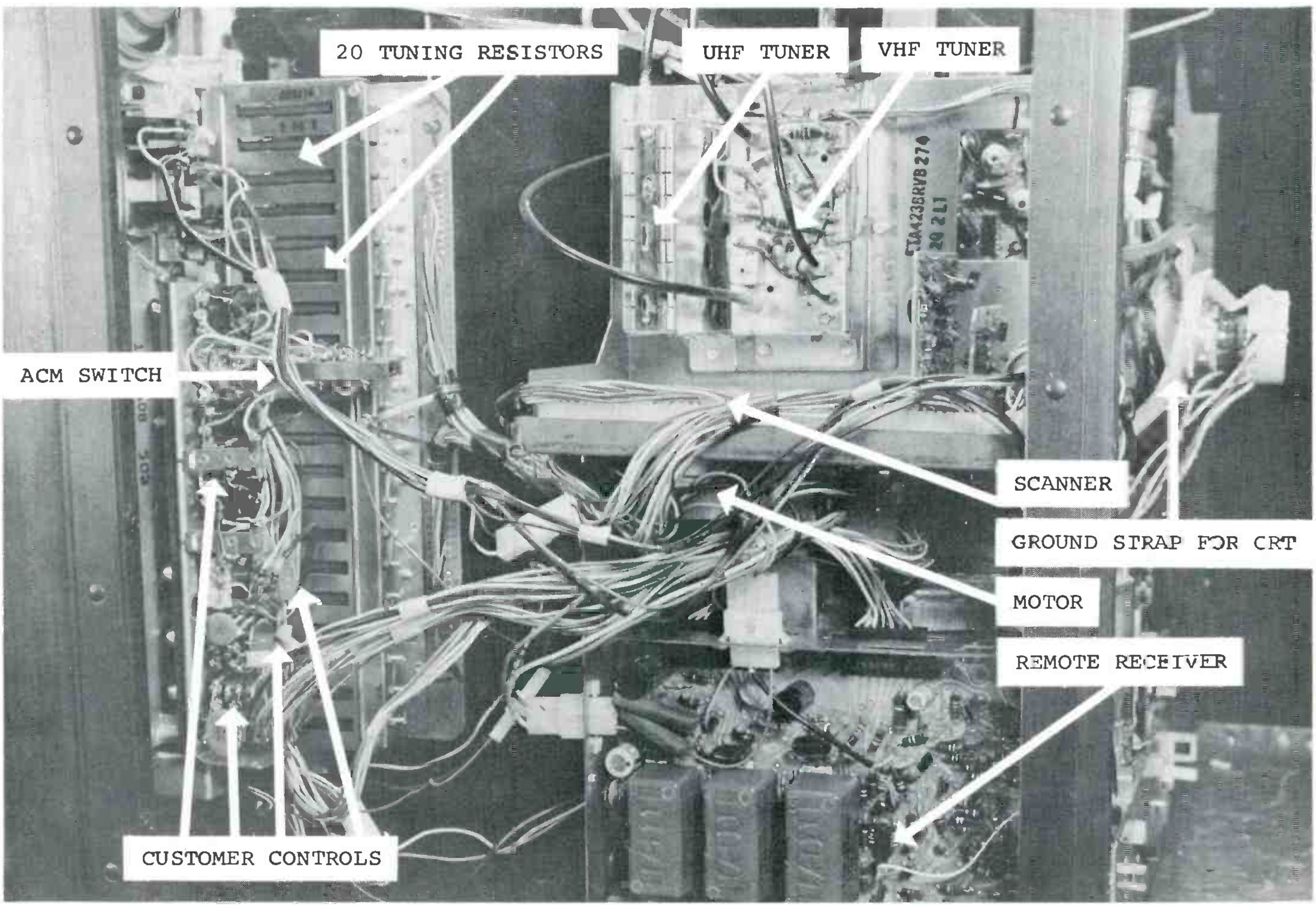


Fig 11 View of the top part of the front-panel controls on the RCA CTC54 chassis.

Fig. 12 Side view of a display sample of the RCA CTC54 chassis showing locations of the major components in the remote-control and tuner system.



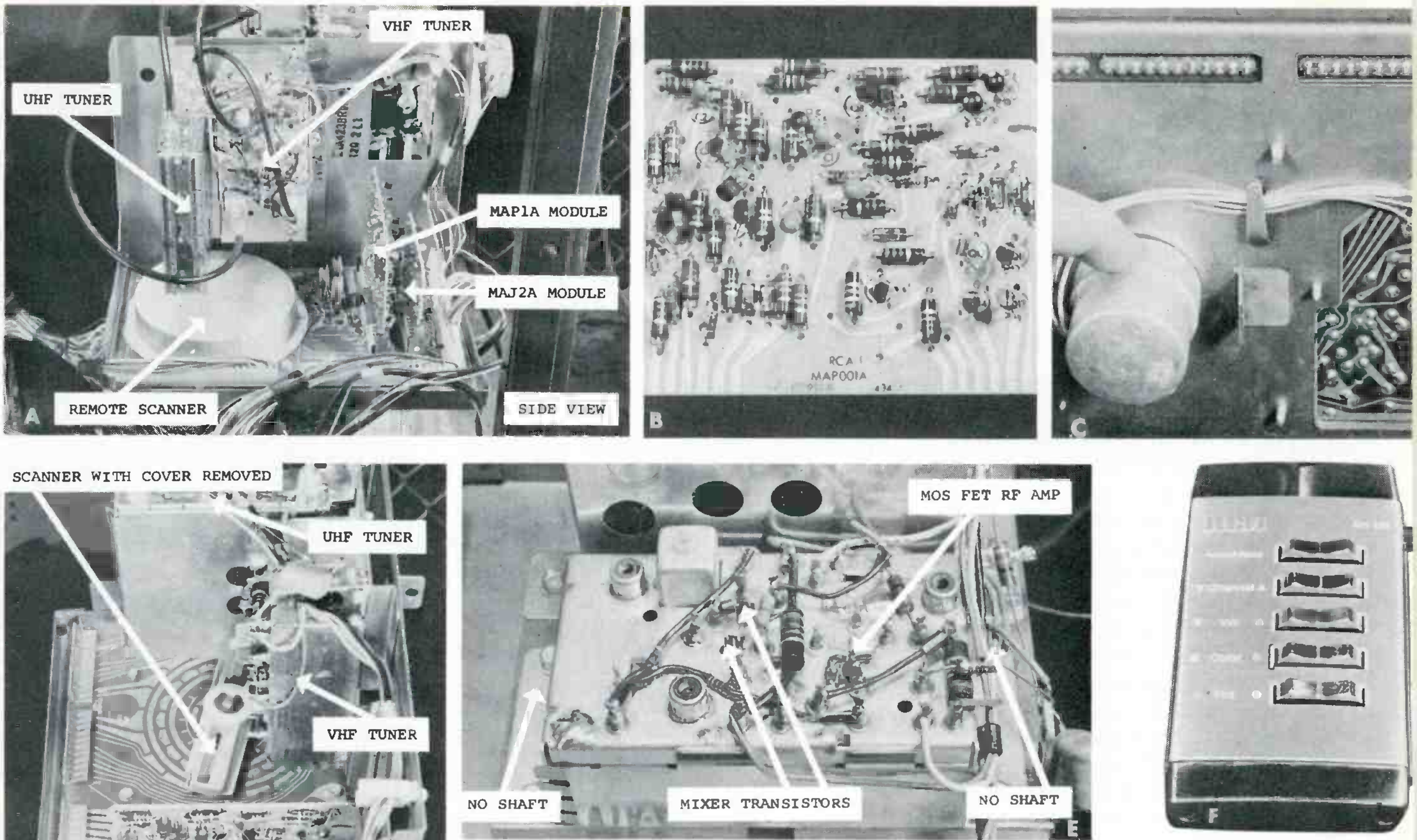


Fig. 13 Closeup views of various parts of the tuner and remote-control system in the RCA CTC54 chassis. **(A)** Subchassis containing both tuners, the scanning switch (under the dust cover) and two plug-in modules of the motor-control circuit. **(B)** The MAP001A motor-control module removed from the chassis. **(C)** Small size of the motor is apparent in this comparison with a human hand. **(D)** Internal details of the scanner switch are shown with the dust cover removed. **(E)** No shafts or other moving components are used in the VHF tuner. **(F)** The ten-function remote-control transmitter used with the RCA CTC54 chassis.

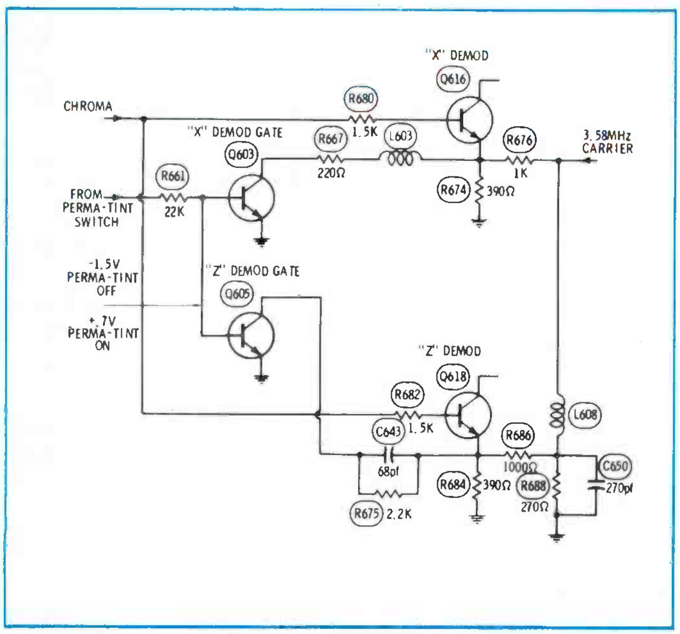


Fig. 14 Transistors Q603 and Q605, shown here, are used as switches in the Sylvania E01 color chassis, to add L603 and C643 to the circuit which determines the phase difference between the two demodulators.

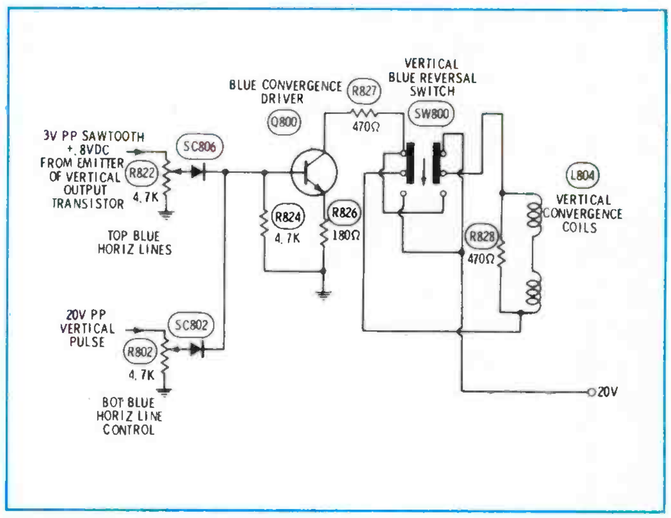


Fig. 15 Three transistors are employed on the convergence board of the Sylvania D19 color chassis. They are amplifiers of the vertical convergence voltages. The schematic here shows the blue vertical convergence circuit. The amplitudes of the sawteeth and the pulse voltages are adjusted by R822 and R802, respectively. The combined signal is amplified by Q800 and is applied through a polarity reversing switch to the blue vertical convergence coil. Red and green convergence is accomplished in a similar way.

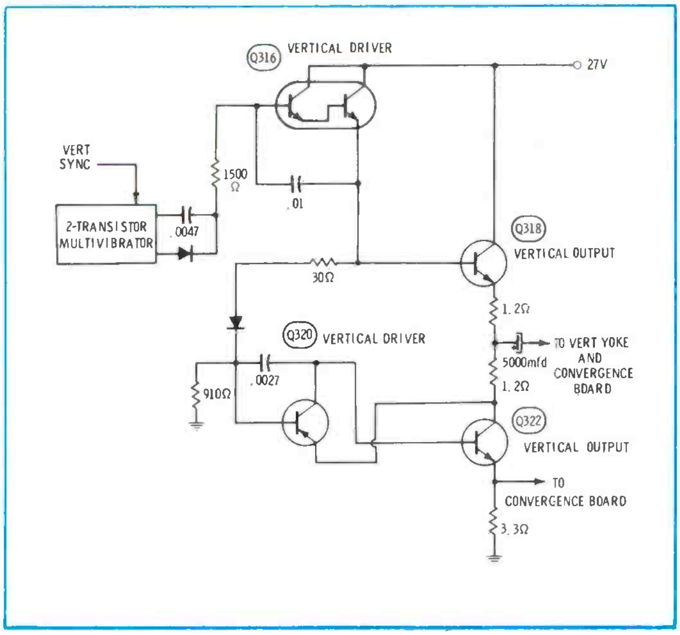


Fig. 16 No vertical-output transformer is used in the Sylvania D19 color chassis. A Darlington-type transistor, Q316, is the driver for Q318, the vertical-output transistor. Q320 is phase inverter and driver for the other vertical-output transistor, Q322. Output to the vertical coils of the deflection yoke is through a 5,000-mfd coupling capacitor. An unbypassed 3.3-ohm resistor, in the emitter circuit of Q322, supplies the small sawtooth voltage needed by the convergence circuit.

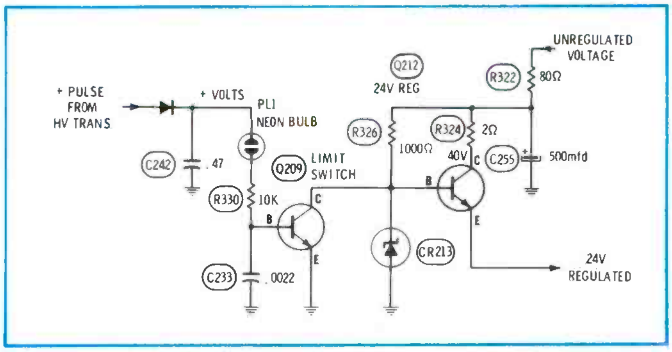


Fig. 17 Excessive high voltage and horizontal sweep in the Zenith 25CC55 color chassis activates a "limit switch" circuit which eliminates both video and sound. Thus, before the set can be operated service will be required to restore the high voltage to normal.

cause of the excessive high voltage is eliminated, the frequency of the oscillator will return to normal.

Varactor tuners with motor-driven presets

Both the VHF and UHF tuners in the RCA CTC54 chassis are tuned by varactor (variable-capacitance) diodes and the frequency bands are selected by switching diodes. These features are combined with motorized tuning, which can be operated from the console or by remote control. A block diagram of the tuners and the remote control is shown in Fig. 9.

The design of the remote receiver combines some of the features of the old types that used relays and motors to turn the shafts, and the CTC47 which had no motors or relays. One tiny motor, shown in Fig. 13C, is included in the CTC54, to rotate the scanning switch unit, and a small relay is included in each of the memory modules, to discharge the control capacitors when the AccuMatic functions are selected and each time the receiver is turned on.

A rear view of an RCA color receiver which uses the CTC54 chassis is shown in Fig. 10. Close-ups of various features of the remote control and the tuners used with the CTC54 are shown in Figs. 11 through 13.

Sylvania

Transistor switches for perma-tint feature

Widening the phase angle between the X and Z demodulators in the all-solid-state Sylvania E01 chassis is accomplished by switching transistors, as shown in Fig. 14.

When a positive voltage from the Perma-Tint switch is applied to the base of Q603, the X demodulator gate transistor, it grounds phase-leading coil L603, and Q605, the Z demodulator gate transistor, which is also forwarded-biased by the positive voltage, grounds phase-lagging capacitor C643.

Transistors help convergence

Three transistors are used on the convergence board of the Sylvania D19 chassis. This is another color TV chassis which does not have a vertical-output transformer. Sawtooth voltages for "amplitude" convergence correction are obtained from across a low-value resistor between the emitter of the vertical-output transistor and ground. The same pulses that are found across the vertical coils of the yoke are used for "tilt" correction.

These sawtooth and pulse voltages are varied by potentiometers, to obtain the needed amplitudes, and then are applied, through diodes used for waveshaping and isolation, to the base of the transistors, as shown in the diagram of the blue vertical circuit in Fig. 15. A reversing switch is used also in the blue channel, for those receivers which might require correction voltage of opposite polarity.

Transformerless vertical sweep

As stated previously, no output transformer is used in the vertical-output stage of the Sylvania D19 color chassis; instead, it is

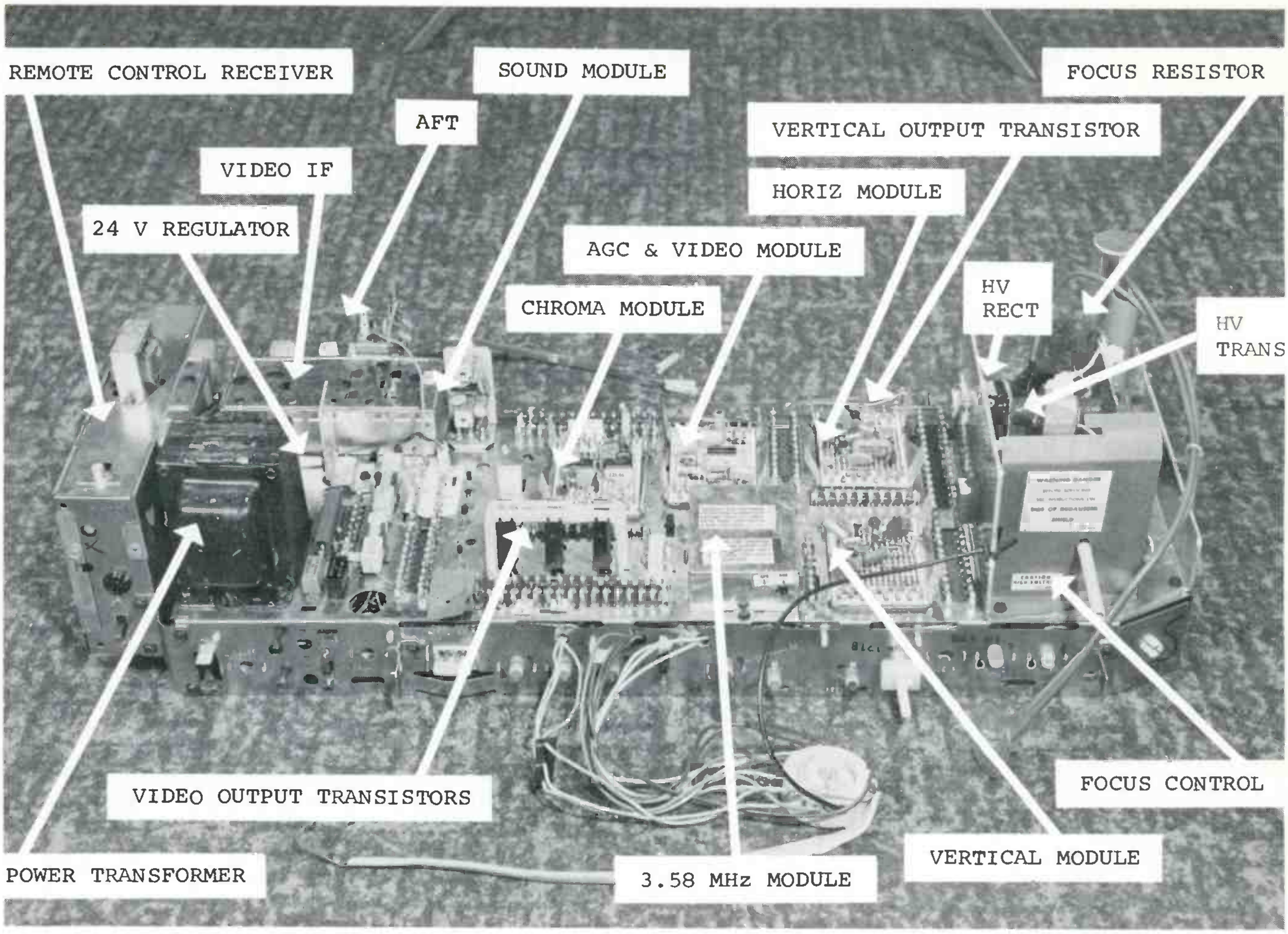
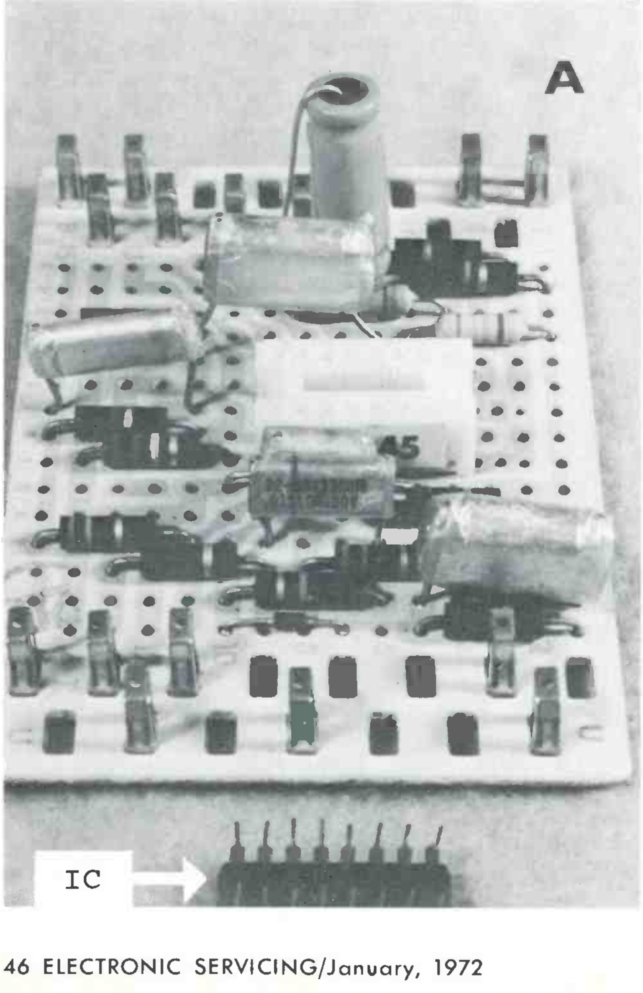


Fig. 18 Shown are the locations of the Duramodules and other major parts on the Zenith 25CC55 color receiver chassis.



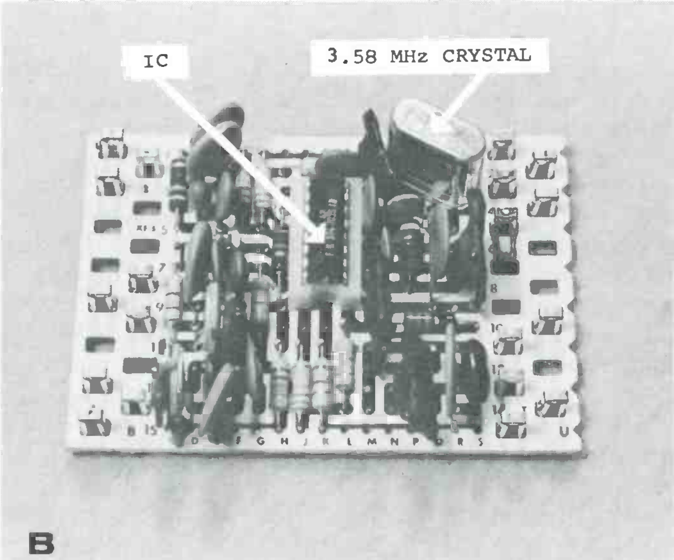


Fig. 19 Two of the Duramodules used in the Zenith 25CC55 color chassis. (A) One IC is used on the video and AGC module. (B) One plug-in IC is the only solid-state device used on the 3.58-MHz carrier module.

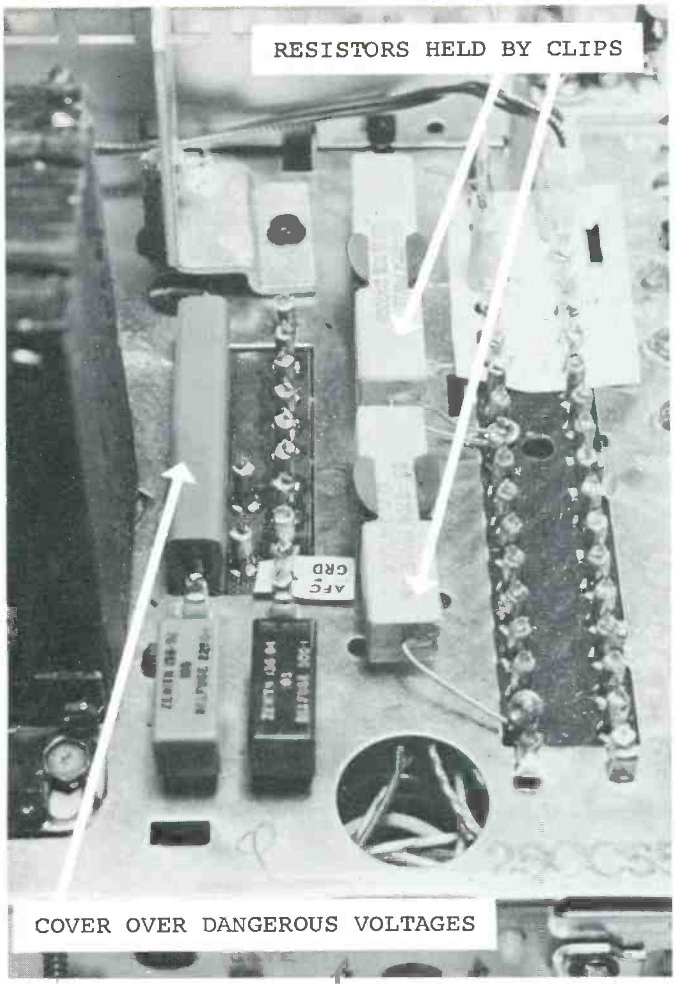


Fig. 20 Large resistors held by spring clips and an insulating cover over terminals having dangerous voltages are two safety and serviceability features of the Zenith 25CC55 color chassis.

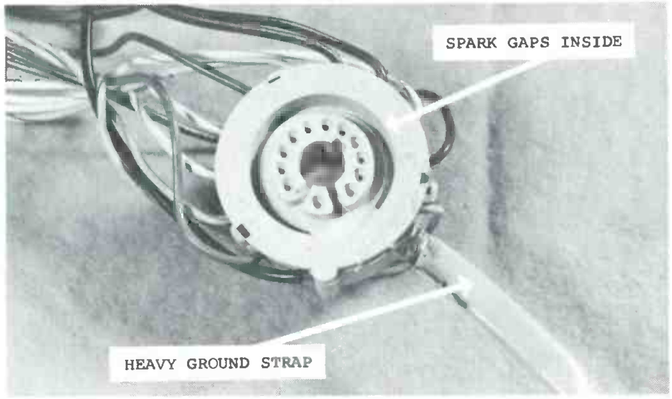


Fig. 21 Spark gaps are often included in the CRT sockets of new TV's. This Zenith socket has a large, insulated, flat-ribbon ground strap.

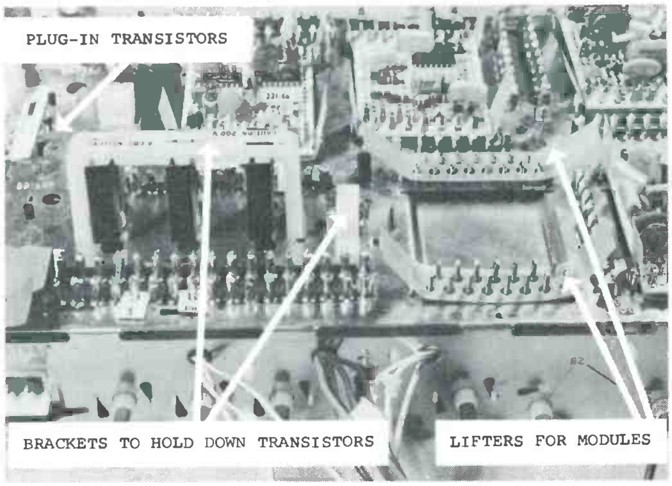


Fig. 22 The larger transistors on the Zenith 25CC55 color chassis are held in their sockets by plastic hold-down brackets. Plastic strips are installed under the terminals at each end of the modules. Lifting up on the plastic strips safely removes the modules.

equipped with a circuit similar to that used in the output stages of many stereo amplifiers. Such a circuit makes a transformer unnecessary.

As shown in Fig. 16, a two-transistor vertical multivibrator supplies Q316, the vertical driver (a Darlington dual-transistor type), which, in turn, drives the vertical-output transistor Q318. A phase inverter, Q320, inverts the phase of the signal 180 degrees before it is applied to the base of the other output transistor, Q322. The 3.3-ohm resistor in the emitter circuit of Q322 provides stabilization and, also, a 3-volt PP sawtooth voltage, for the convergence circuit.

Zenith

Limit switch protects against excessive high voltage

Excessive sweep and high voltage triggers into conduction transistor Q209, called a "Limit Switch". Conduction of Q209 reduces the 24-volt supply to near zero and eliminates both sound and picture, which, hopefully, will prompt the set owner to call a technician.

The circuit, shown in Fig. 17, functions in the following manner: A pulse voltage from one of the windings of the high-voltage transformer is rectified by a peak-reading rectifier circuit consisting of diode CR210, and capacitor C242. A voltage exists at the junction of these two components during normal operation, but it is not sufficient to trigger the neon bulb. The higher voltage produced by abnormal operation ionizes the neon bulb, NL1, which conducts and passes positive voltage to R330 and the base of Q209. The positive voltage at the base of Q209 causes conduction of sufficient current through the collector circuit of this transistor to reduce the voltage at the base of Q212, the 24-volt regulator. This, in turn, reverse biases Q212, reducing the voltage supplied by the 24-volt supply, so that the picture and the sound both are eliminated.

If the excessive high voltage exists for only a short time, the set should be switched off for a few seconds and then can be switched back on. During the short time the set is switched off, the neon bulb de-ionizes and normal operation is restored.

Two factors prevent this protective circuit from interfering with normal operation: 1) the neon bulb is an open circuit until it is ionized, and 2) the zener diode, CR213, attempts to maintain the nominal 24 volts at the base of Q212 until the current through it drops below its ava-

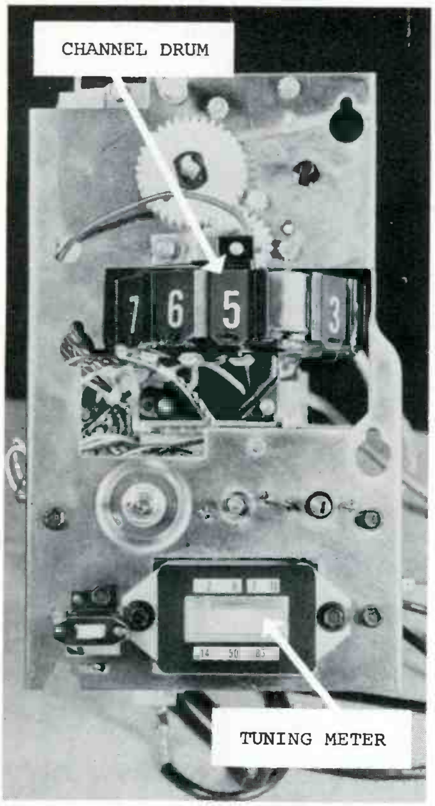


Fig. 23 The front of the varactor tuning assembly has a conventional-appearing drum. However, the drum is not connected to the tuner. The tuning meter reads the tuning voltage, to estimate the channel in use during the setup procedure.

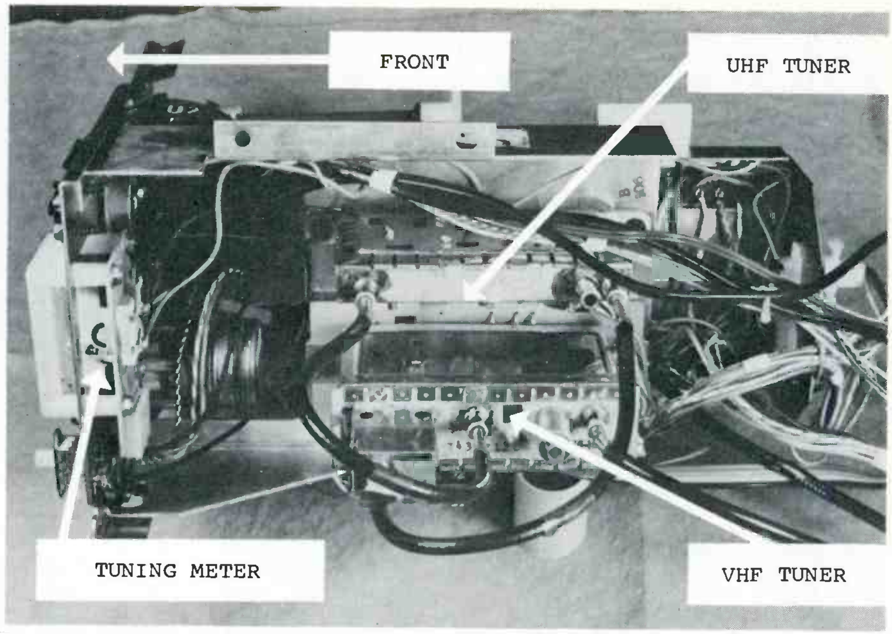


Fig. 25 Both tuners are mounted on the bottom side of the tuning assembly. There are no shafts or other moving parts on the tuners.

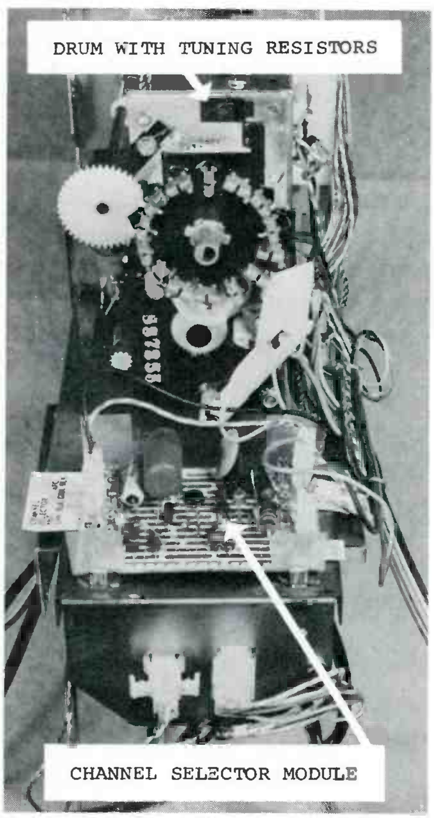


Fig. 24 This rear view of the tuner assembly shows the box containing the precision tuning resistors, and the channel-selector module.

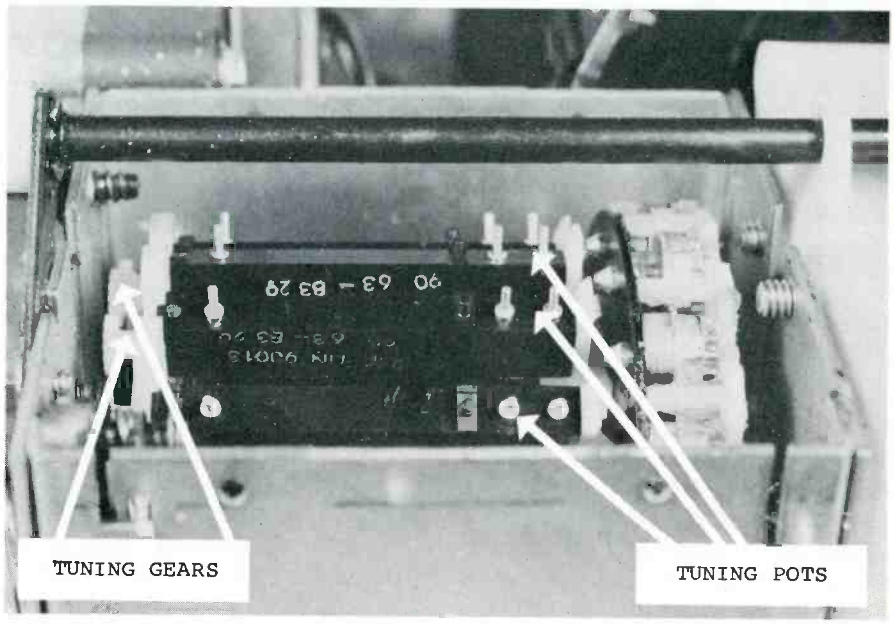


Fig. 26 The dust cover is removed here, to show the precision tuning potentiometers, which resemble the coil strips in some other tuners.

lanche point, at which time the voltage drops rapidly, because the zener action is lost.

An easy test for any of these chassis which exhibit a trouble symptom of no picture and no sound, is to look at the neon bulb. If it is lighted, the limit-switch protective circuit is operating, to protect against excessive high voltage and the excessive radiation.

Varactor tuner

The Zenith 25CC55 is an all-solid-state color TV chassis which is the successor to the 40BC50 that didn't quite get off the launching pad last year. Many features of the varactor tuner were given in an article which begins on page 63 of the February, 1971 issue of ELECTRONIC SERVICING. For details about the tuner, please refer to that article.

The locations of the modules and major parts on the Zenith 25CC55 chassis are shown in Fig. 18. Pictures of various features of the chassis and the varactor tuners are shown in Figs. 19 through 26. □

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audio systems report

Audio Connectors

Two new audio connectors which accept cables with outside diameters of ¼ inch and larger have been introduced by Switchcraft, Inc.

Two straight and two right-angle connectors (two male, and two female) reportedly have been designed to accept cables with outside diameters from .250 to .328-inches, providing strain relief for reduced wear at the cable entry point.

Two machine screws and two pressure plates immobilize the cable,

preventing pulling and twisting actions from being transmitted to the terminals, according to the manufacturer.

The new audio connectors reportedly offer: 100-percent grounding/shielding through the connector; a provision for additional circuit through the ground contactor; and a "captive-design" insert screw.

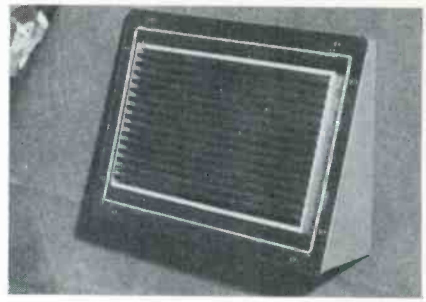
Prices for the audio connectors start at $2.25.

Circle 60 on literature card

Auto Hi-Fi Speaker

A quick-mount high-fidelity speaker designed for automobile sound systems has been introduced by the Magitran Company.

The new Model A500 Poly-Planar speaker features a "super-thin" design characteristic which reportedly requires only ⅞-inch mounting depth, making it ideal for custom flush mounting in the car ceiling, kick-panel or rear of seat and door. Brackets are provided which reportedly require no cutout of the mounting surface; the brackets themselves form a natural sound



chamber for richer tone, according to the manufacturer.

The Poly-Planar has a power-handling capability of 5 watts, with a frequency response from 60 Hz to 20 KHz. The overall grille size is 6 inches X 10 inches.

Price is $11.00.

Circle 61 on literature card

Attache Case Public-Address System

The Diplomat II, an Ampli-Vox battery-operated public-address system in an attache case, is now produced by Chamberlain Manufacturing Corp.

Designed for indoor/outdoor public-address systems, the Diplomat II reportedly covers groups of up to 500 people. The 40-watt (peak), all-transistor amplifier can be removed from its case, to serve as a microphone stand for table or lectern use. Removing the amplifier from the case enables the user to

place the loud-speaker farther from the microphone, reducing the possibility of feedback problems according to the manufacturer.

The Diplomat II reportedly can be used with extra speakers, tape recorders, radios, phonographs, and audience participation kits.

Diplomat II weighs 16½ lbs. and sells for $139.95.

Circle 62 on literature card

Universal Tape Player Motor

A universal AC hysteresis synchronous motor, for use in tape players such as Pioneer, Toshiba, Columbia of Japan, Mecca, Bettex and Motorola Stellarsonic, has been introduced by Weltron.

Designated the 70-911, the single-phase motor reportedly can be operated on AC voltages from 107 to 127 volts or 90 to 110 volts. The 70-911 sells for $15.42. ▲

Circle 63 on literature card

bookreview

RCA Receiving Tube Manual
(Technical Series RC-28)
Author: RCA Commercial Engineering Staff
Publisher: RCA Electronic Components, Harrison, N.J.
Size: 5¼ inches x 8 inches, 784 pages
Price: Softcover, $2.50.

This completely revised and updated edition covers over 1600 tube types, including, for the first time, technical data on over 190 RCA industrial receiving tubes. Also included are data for more than 75 new RCA entertainment-type receiving tubes. Data about RCA black-and-white and color TV picture tubes are presented in chart form.

A thoroughly cross-referenced listing of multibranded types simplifies data access and an alphabetic listing of imported types shows the RCA domestic equivalent type for replacement purposes.

In addition to descriptive data about specific tube types, this manual also contains general information about the characteristics, construction, applications and testing of generic types.

Contents: Electrons, Electrodes, and Electron Tubes—Electron Tube Characteristics—Electron Tube Applications—Electron Tube Installation—Safety Precautions—Interpretation of Tube Date—Electron Tube Testing—Application Guide For RCA Receiving Tubes—Technical Data For RCA Tube Types—RCA Types For Replacement Use—Terminal Diagrams For RCA Replacement And Discontinued Types—Picture Tube Characteristics Chart—Terminal Diagrams For RCA Picture Tubes—Resistance-Coupled Amplifiers—Circuits—Outlines—Index ■

carr electronics

by Joseph J. Carr/ES Auto Electronics Editor

Auto FM — peculiar characteristics and troubles which affect operation and servicing

FM and Stereo FM are current hot movers in the automobile radio field. All car manufacturers as well as both foreign and domestic radio manufacturers have offerings that range from deluxe AM/FM/Stereo FM radio/tape combos down to low-cost FM-to-AM converters that mount beneath the dash board.

One headache that all of this activity has generated for technicians is the sometimes optimistic expectations of both customers and salesmen. There is no doubt that FM is, in many ways, superior to AM in automotive use. There are, however, certain peculiarities about FM of which the service technician must be aware so that he can accurately determine whether or not a problem really exists in any given system.

Noise Rejection

One claim frequently made by advertising and sales people is that FM is noise free. Without some qualification, this claim cannot be considered true. The truth is that FM is more free of noise than AM, but only under certain specific conditions can it be considered virtually noise free. It definitely is not true that the customer will never be bothered by noise. The FM receiver's limiter circuit is the key to this phenomena.

Fig. 1 illustrates graphically how an FM receiver reduces or eliminates noises. Notice that when a strong signal is passed through the limiter stage, it's amplitude peaks are clipped. Because most man-made and natural types of static amplitude-modulate the signal (true FM noise exists, but it is rare), it is removed along with the signal peaks. Under such conditions, during which the signal is subject to maximum limiting, little or no noise will get through to the detector.

Fig. 2 illustrates a situation in which noise will get through. Suppose the receiver is tuned to either a very low-power or distant station the signal of which is incapable of producing a strong signal across the antenna input terminals of the receiver. If the received signal is below the limit sensitivity of the particular receiver, the limiter circuit will have no effect. (A practical measure of limit sensitivity is the minimum signal strength, applied to the antenna terminals, which is necessary to begin clipping. It is usually stated as the signal strength, expressed in microvolts, required to produce a specific level or limiting, depressed

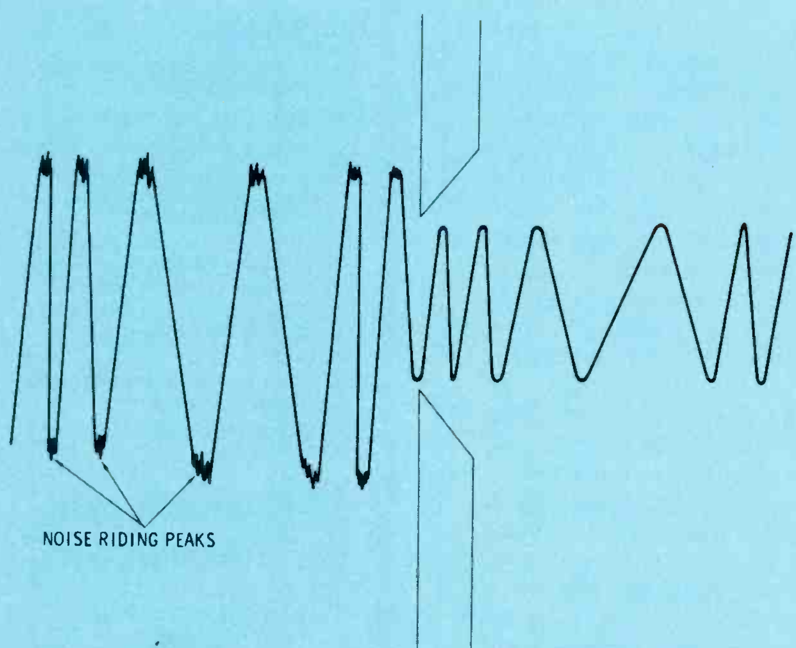


Fig. 1 Man-made and natural types of static amplitude-modulate both AM and FM signals, as shown here. The limiter stage employed before the detector in most FM receivers effectively cuts off such noise peaks, provided the receiver signal strength is sufficient to produce adequate limiting action.

in dB.) When a signal is tuned in and has a strength less than this critical value, the limiter will simply fail to act or will function as another stage of IF amplification. Those noisy signal peaks will pass through the detector to the audio amplifiers.

Even when inadequate or no limiting occurs, the noise produced by an FM receiver may be less severe than that produced by an AM receiver. This is attributable to several factors which aid in reducing any noise which gets by the limiter. One such factor is the 75 microsecond de-emphasis network, which is usually connected between the detector and the audio amplifiers. This network acts on high audio frequencies in much the same manner as the scratch filters in phonograph amplifiers. Another factor is that the detector is more sensitive to frequency variations than to amplitude variations. Certain types of detectors have their own built-in AM suppression. The well-known ratio detector, for example, employs a relatively large-value capacitor for this purpose (see Fig. 3). Many receivers do not employ a limiter stage if such a detector is in use. Most of the better receivers, however, employ a limiter regardless of whether or not the detector is equipped for AM suppression. The Delco quadrature detector is a case where an IC is used to provide an exceptional degree of limiting even though the quadrature-type detector is considered to have a good degree of AM suppression.

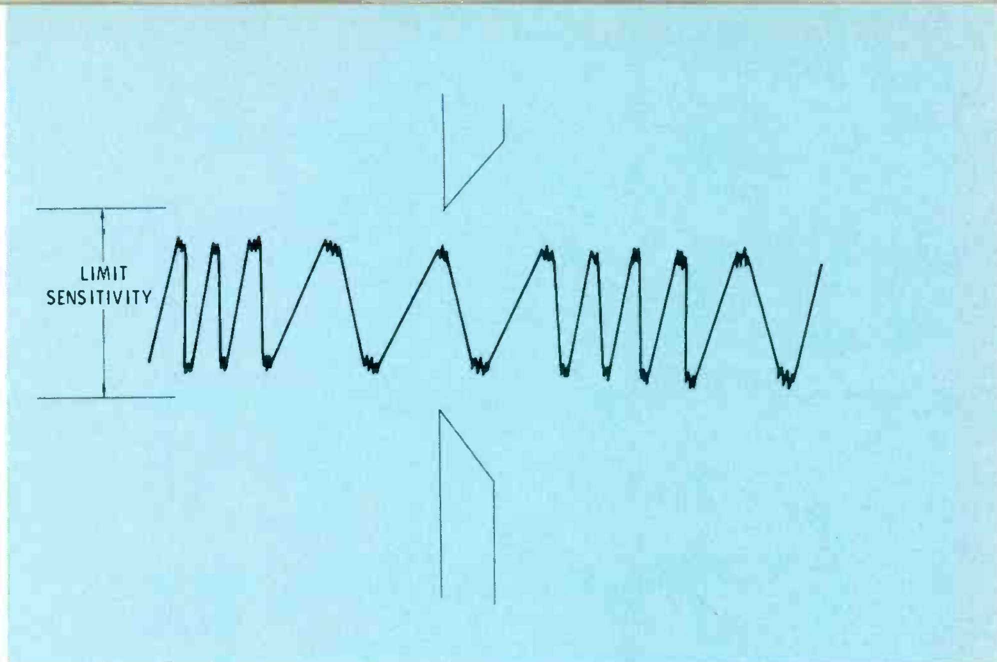


Fig. 2 Externally generated noise, such as static caused by lightning, can get through the limiter of the FM receiver if the received signal is too weak to produce adequate limiting. The minimum signal strength required to produce adequate limiting action is called "limit sensitivity". See text for a more detailed explanation.

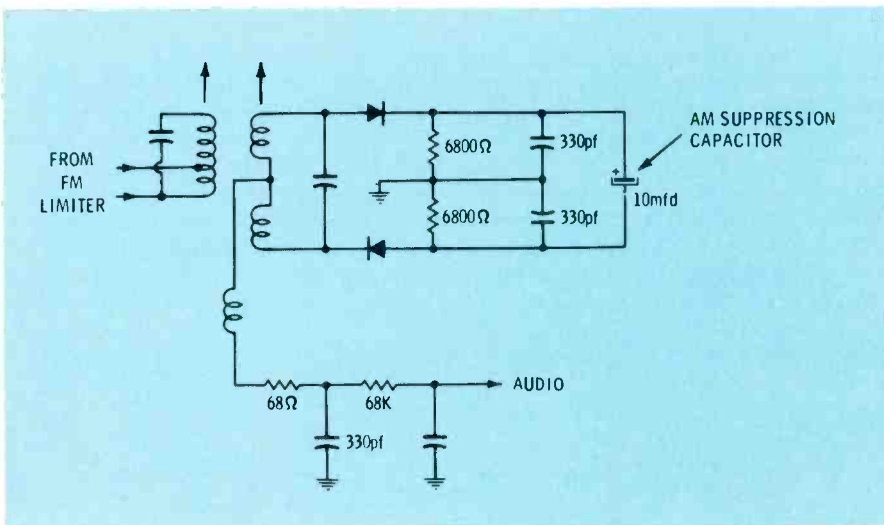


Fig. 3 Some FM receivers employ other noise-suppressing circuitry in addition to the limiter stage. For example, the ratio detector circuit shown here is equipped with a 10-mfd capacitor, to suppress, or filter out, noise impressed on the signal by amplitude modulation.

Sensitivity

Inability of an FM receiver to receive distant signals is a problem that pops up on a regular basis in many car-radio shops. One of the author's recent customers, for example, had been told that he could easily listen to a favorite classical-music stereo-FM station located in a city some forty odd miles distant, if he would buy the FM Stereo car radio offered by that particular dealership. The fellow naturally was upset when he discovered that his super, two-hundred-dollar receiver simply was incapable of giving him "local" performance on signals received from a distance of forty miles.

The reliable range of most FM car radios is about twenty to thirty miles on monaural stations and fifteen to twenty-five miles on stereo. One reason advanced to explain this difference is that the 19-KHz pilot and L-R encoded stereo signals modulate the FM transmitter only 10 percent each. Also, these "extra" signals associated with stereo FM do not have de-emphasis.

Mono FM reception is limited to such a relatively short distance because the VHF frequency spectrum used by FM is limited to "line of sight". At lower fre-

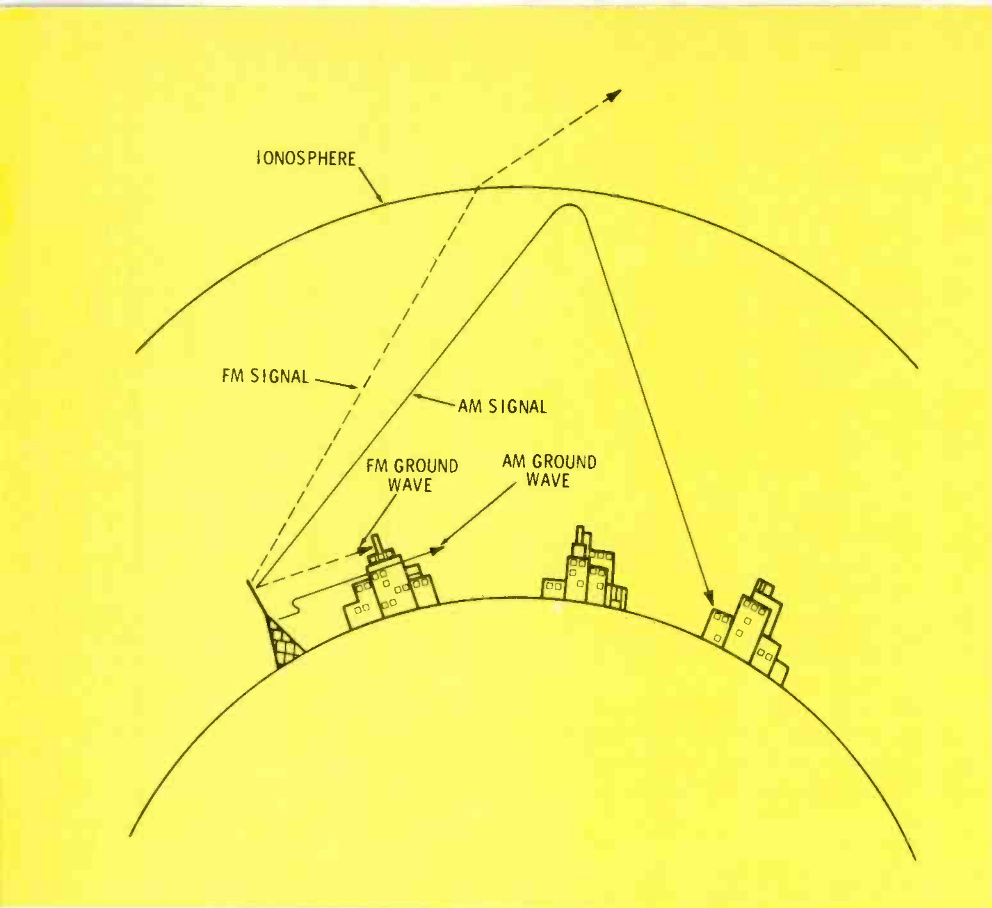


Fig. 4 The distances over which AM and FM signals typically can be received with adequate signal strength is dependent, in part, on the effects of the ionosphere on the frequencies at which they are transmitted. The degree of refraction imposed on the relatively lower frequencies at which AM signals are broadcasted is sufficient to bend them back toward earth, as illustrated here. However, the relatively higher frequencies (VHF) at which FM signals are broadcasted are not refracted a sufficient amount to bend them back to earth. Consequently, only the "ground waves" propagated by the FM transmitting antenna are useful for transmitting from one point on the surface of the earth to another point on the surface.

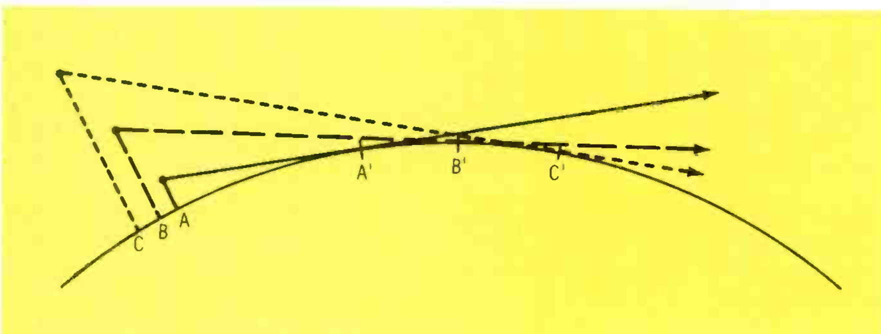


Fig. 5 How increasing the height of the transmitting (or receiving, or both) antenna increases the "line of sight" of the radio.

quencies, such as those occupied by the AM broadcast band, the ionosphere will bend the radio-frequency wave enough to reflect it back to earth some distance from the transmitter. VHF waves undergo the same type of refraction in the ionosphere as do the lower frequencies, but the degree of refraction is insufficient to reflect them back to earth. These waves, instead, travel on out into space. In the VHF spectrum, only the groundwave is useful for broadcasting. Fig. 4 illustrates these characteristics.

Because the useful propagation of FM signals is limited to the groundwave, the horizon effectively is the greatest distance that FM signals will travel. This is line-of-sight propagation, although the term itself is a little misleading. All of us know of stations beyond the line of sight which are audible on a relatively regular basis. Line of sight doesn't necessarily mean line of optical sight but line of **radio** sight. Fig. 5 illustrates how VHF signals frequently can be received at distances greater than actual line of sight. It is a function of antenna height. If the receiver and the transmitter antenna both are above ground level, then the actual distance that can be covered will be much greater than if one or both were lower. A rule of thumb is that if the antenna can "see" each other, good reception is possible.

Because most automobile antennas are close to ground level, reception of FM signals by a radio in an automobile requires a higher antenna at the transmitting station. Customers who have both an excellent home Stereo FM setup and a Stereo FM car radio often ask why the car radio is less sensitive than the home radio. Their home FM antenna probably is an elaborate, high-gain unit mounted 50 feet in the air while the car radio must depend on that little quarter-wavelength whip antenna just a few feet off the ground. Very few people care to have a super-high-gain FM array attached to their car via a fifty foot crank-up tower. (Don't laugh, I installed such an array on a customer's Dodge mobile home.)

A fair improvement in auto radio performance can be realized if the whip is tuned somewhere close to resonance. Fig. 6 shows a typical car radio antenna set to 32 inches, the optimum antenna length for the middle of the FM broadcast band. Some customers pull the telescoping antenna out to its full length. Although it works best that way on AM, the best overall performance on FM will be when the antenna length is approximately 32 inches. Optimizing for one extreme of the FM band is all right, if the user wishes to listen to a weak station in that range; the antenna should be slightly shortened for high-end reception and slightly lengthened for low-end reception. In any event, do not extend it too far from the limits of 30 to 34 inches.

Fading

One of the most popular claims for FM is that it will not fade in tunnels and in the downtown sections of large cities. The fact is that FM will fade as bad as AM, if the tunnel is long enough. The FM radio, however, usually will continue to play for a considerable distance after the AM radio has faded away. The downtown areas of big cities can disrupt any kind of radio or TV reception. TV technicians, for example, are only too familiar with dead zones and multipath reception, both of which are common in urban areas. (Multipath is a prime cause of ghosting in TV reception.)

A dead zone is an area where little or no signal exists. It can be caused by either multipath cancellation or by a phenomena known as "shadowing". One type of shadowing is shown in Fig. 7. If an omnidirectional transmitting antenna were located at point X, the radio waves would travel outward from point X in ever-expanding, concentric circles. The longer waves in the AM broadcast band can bend around any obstructions. The short waves of the FM band, however, cannot. An obstruction, such as a tall building, therefore, would create a shadow zone for the FM signal. The shadow zone will be on the side of the building that is opposite the radio station. There can exist thousands of such zones in any downtown area.

Unfortunately, shadow zones tend to increase as the angle between the receiving and the transmitting antennas is reduced. This is similar to the effect of the setting sun on your own shadow. With the sun directly over head at noontime, there is little or no shadow. However, as the sun sets, your shadow tends to become both deeper and longer. Likewise, in a radio system, the shadow zones will become more severe as the distance between the transmitting and receiving antennas increases or the antenna heights decrease.

Multipath reception is illustrated in Fig. 8. It occurs when a signal bounces off an obstruction, such as a building or water tower, and arrives at the receiver antenna a few microseconds later than the direct signal. Because this late-arriving signal is out of phase with the direct signal, there is at least partial cancellation of both signals, and the listener hears a "fffft fffft fffft" sound as the car moves from one multipath zone to another. The audible symptom is very similar to the "picket fencing" caused by defects in the automatic frequency control (AFC) circuit. When such a symptom is encountered, the technician should satisfy himself that the AFC is operating properly before assuming that the symptom is caused by multipath.

Multipath conditions occur most often in cities and in built-up suburban areas, in which there exist tall structures off which VHF signals readily "bounce". Although this bouncing does give FM the edge over AM in downtown areas, it also leads to the intermittent operation described previously. The author knows of one main artery into a big eastern city which has so much multipath that FM is useless. An irate owner who just picked up his very first FM stereo car radio will find such conditions difficult to understand and accept.

Although most multipath and shadow zones are in what some people call over-civilized areas, it isn't unusual to encounter them in open countryside. The obstruction that causes either a "bounce" or a "shadow" can be located many miles from where the reflected and direct signals recombine at a receiver. Either type of zone can be located anywhere and might be only a few inches across. Police and other experienced users of VHF FM are familiar with these problems. On several occasions when local police responded to alarms at a bank near the shop, I have heard the officers ask for a radio check while they moved the patrol car a few feet to a more desirable radio zone. Apparently, a zone which is "dead" for VHF FM reception exists in the area of the parking lot of the bank. It is amazing how much difference a few feet can make.

Problems Caused by Weak Signals

A symptom which is sometimes called "popping" is frequently mistaken for picket-fencing or multipath reception. It occurs when a signal is very weak, well

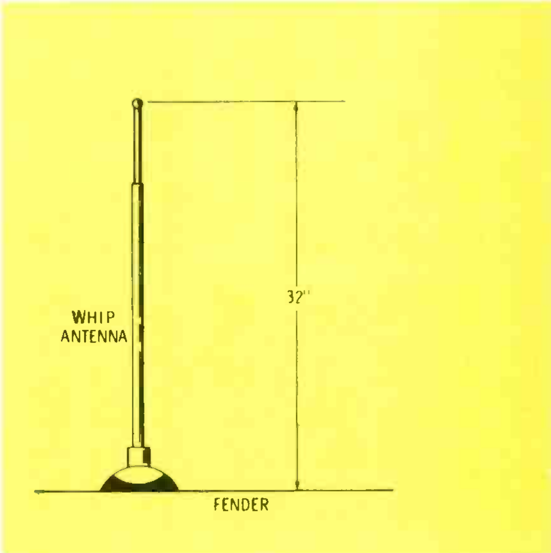


Fig. 6 For acceptable reception throughout the FM band, the auto whip antenna should be extended to about 32 inches. If the customer desires to receive a station or stations at the low end of the band, the antenna should be lengthened to about 34 to 35 inches; however, it should be remembered that "tuning" the antenna to either extreme of the band probably will compromise the signal strength at the middle and other extreme of the band. Improved reception on the high-end of the band can usually be achieved by decreasing the length of the whip, but, again, at the expense of the mid and low-band signals.

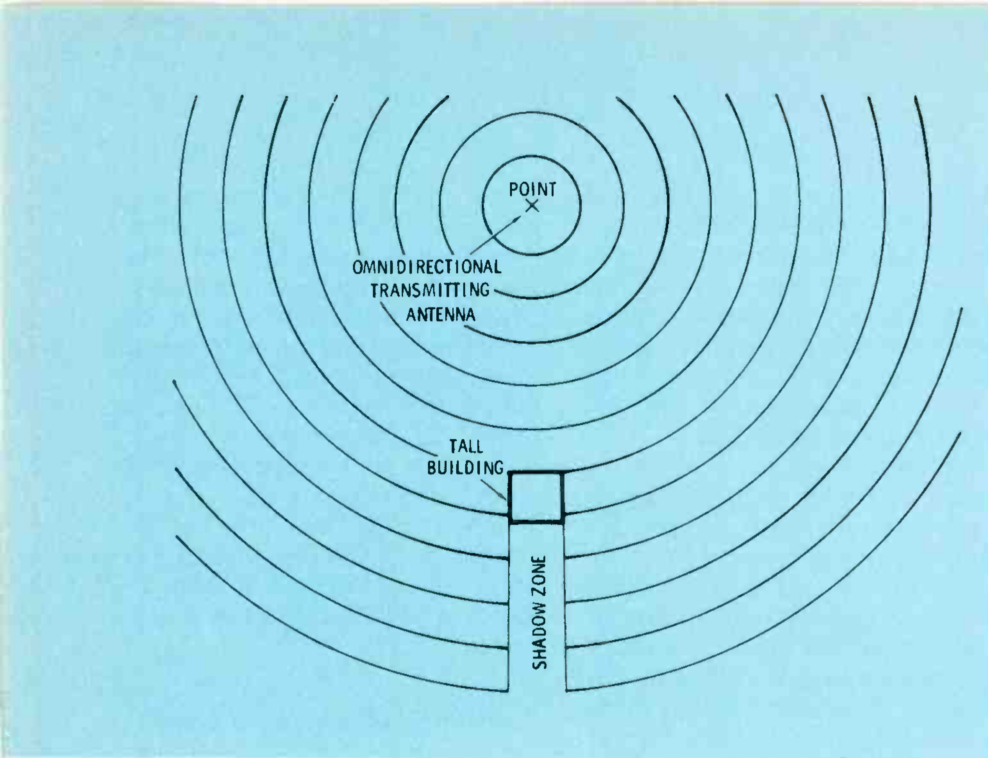


Fig. 7 The inability of the relatively short FM waves to bend around obstacles causes "shadow zones" in the propagation pattern of an FM transmitting antenna. Such zones of weak or missing signals are common in urban areas.

below the receiver's limit sensitivity, and noise bursts overpower the RF and IF amplifiers of the radio and get through to the detector. These noise bursts can unbalance the detector for a brief instant. Sometimes, however, the noise bursts last long enough to cause the AFC to lose its hold on the oscillator frequency. When the detector is once again in a balanced state, the AFC control voltage returns to zero and the capacitance of the varactor AFC diode returns to normal. When this chain of events occurs, the station will seem to drop out, then return with a popping sound as the AFC-local oscillator loop restabilizes.

One cure for this complaint is to instruct the user in the realities of FM reception. A technician of the author's acquaintance who lives in a fringe zone in which FM is almost unusable without massive outdoor antennas, sometimes increases the time constant of the AFC circuit in FM auto radios so that the station will not drop out on shorter noise bursts. This makes FM only a little more usable in that area. It also can cause the AFC circuit action to be too slow in strong-signal areas. For example, my favorite FM station is at 105.9 MHz and is located some thirty miles away. Unfortunately there is a 50,000-watt station less than a mile from me which transmits on 105.1 MHz. I find that frequent and critical retuning is the only way to keep my little underdash FM radio on station.

A situation like that just described can lead to the erroneous replacement of a receiver's AFC diode. When a customer complains that his receiver shifts station without even being touched, most technicians logically will conclude that the AFC diode is defective. Unless you are aware that the customer regularly attempts to listen to a distant station which is co-channel to a strong local one, you may inadvertently replace a good AFC diode when the real cause is weak-signal popping combined with a little co-channel capture effect.

There is, however, hope for improved reception of weak FM signals. That hope lies in the promise of great things from the Dolby noise-reduction system, which already is popular in some tape recording equipment. Experiments have been carried out using the Dolby type B system for FM broadcasts. Engineers have claimed as much as 10-dB reduction in noise levels. This should substantially increase the usable range of FM and stereo FM stations. One interesting claim by certain authorities is that the audio response curve of a "Dolbyized" FM transmitter is well within the limits established by the FCC and it is compatible with existing non-Dolbyized FM receivers. These are two requirements which the system will have to meet before the FCC gives its approval.

At present, however, weak signals can cause problems, particularly when a customer does not understand the limitations of FM and stereo FM. One common weak-signal complaint is "a flickering stereo-indicator lamp". If the signal strength of a distant station is rising and falling alternately above and below the stereo threshold level of a particular receiver, it will alternately turn on and turn off the stereo decoder section (along with the lamp). If you know the difference between what mono sounds like and what stereo should sound like, you can imagine just how weird it sounds when the radio shifts from mono to stereo every few seconds. The only effective cure for this "roller coaster" effect seems to be tuning in a more powerful station. If the set is equipped with a stereo-defeat or mono/stereo switch, it might be better to switch to mono reception. Quite often, a signal which is strong enough to produce acceptable mono will produce only "roller coaster" stereo.

The FM antenna also can cause flickering of the stereo-indicator lamp and alternate mono stereo reception. If the center conductor of the coaxial antenna feedline opens, AM reception will be lost completely. The small capacitance which exists between the two broken ends, however, is enough to pass some of the VHF FM energy on to the receiver. It generally will be weaker than a normal signal but it will be able to produce good monaural FM reception. If the connection is intermittent, the stereo lamp will flicker on and off as the connection makes and breaks.

Antenna Directivity

Antenna directivity is another little quirk which occasionally will pop up to harass the hard-working car radio technician. Although it is easy to see how windshield-type antennas can exhibit directional characteristics, it is not so easy to see how the standard whip can.

Vertical antennas work best with a good counterpoise ground, or groundplane. On a car, they tend to favor the direction of the greatest amount of car body; an antenna mounted on the right front fender will favor signals arriving from across the left rear fender. This major lobe is much more noticeable on FM because the antenna is close to being in resonance. On AM, the effect is reduced because the whip then becomes a compensation antenna considerably less than a quarter wavelength long. Unless you find a car with a two or three hundred foot whip on it, you will not have to worry about this occurring on AM.

Inattention to Operating Controls

A rather hilarious problem on some FM sets is a complaint of poor FM reception when it is due to a sensitivity switch being placed in the less sensitive position. Many of the Motorola produced sets (they called their sensitivity switch an "acoustinator" several years ago), many of the Beckers and Blaupunkts as well as numerous Japanese imports use such a switch. If the customer has not bothered to read his instruction manual or if a careless installer failed to leave it for him, he might not be aware of the switch's function, or, for that matter, its very existence. These switches usually insert either a resistor or small RF choke in series with the antenna lead when placed in the less sensitive, or "town", position. Some of them, however, approach the problem in a different manner. Those radios have a sensitivity switch in the RF AGC network. In any event, the sensitivity switch causes a lot of false troubles. ▲

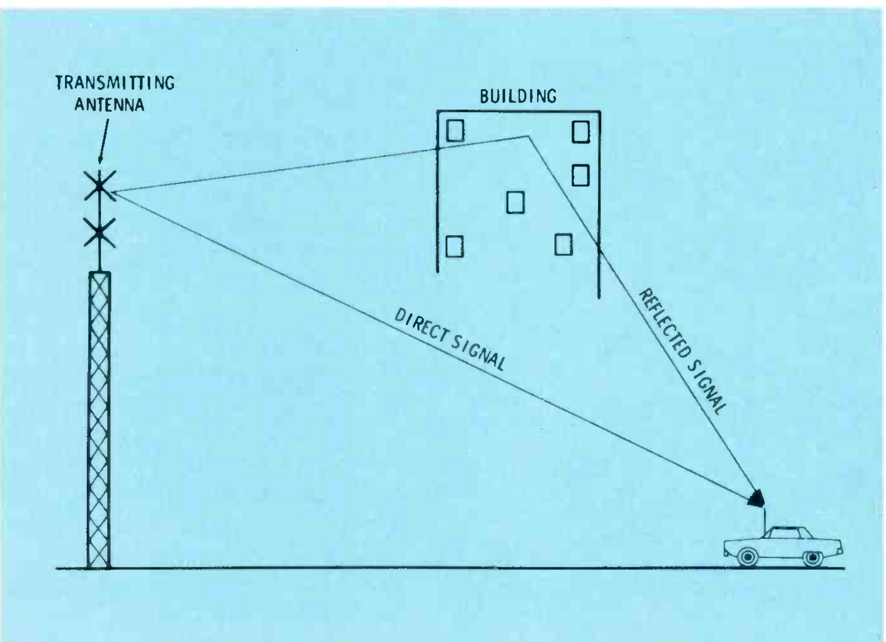


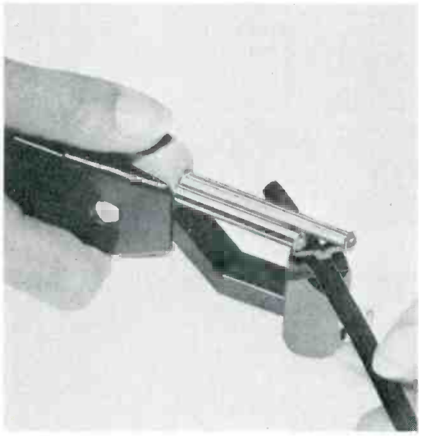
Fig. 8 Multipath reception occurs when an obstacle reflects a radio wave in the direction of a receiving antenna and, as a result, it arrives a few microseconds after the same signal which traveled over a direct and shorter route from the transmitting antenna to the receiving antenna. Because the two received signals will be out of phase, they will partially or completely cancel and, consequently, reception will be interrupted.

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

Coaxial-Cable Stripper

A thermal stripper for use on coaxial and other cables, and reportedly for use in slitting as well as circumference-cutting of all types of cables up to ⅝ inch diameter, has been announced by Jensen Tools and Alloys.

A special fixture at the end of the stripper has two slots into which the cable is positioned. One of these slots provides circumference cutting. The other reportedly provides slitting action.



Any type of cable insulation may be stripped, including **Teflon, KAPTON, KEL-F,** and a complete range of low-temperature cable coverings, according to the manufacturer.

Two models are offered. One, Model TW-6, has a reported fixed temperature of 1700-degrees F, for use on high-temperature insulations only. The other, Model TWC-6, reportedly features a solid-state temperature control adjustable from 100 degrees to 1700 degrees F.

The basic TW-6 is priced at $69.96. The TWC-6 model, with temperature control, is priced at $99.95.

Circle 70 on literature card

Color CRT Isolation/Booster

Perma-Power has made available two Color TV Tube Briteners which reportedly offer isolation to correct the effects of cathode/heater shorts and a slide switch to provide a higher heater voltage for boosting brightness.

Model C-503 reportedly is for the 70-degree round color picture tubes, and Model C-513 is for the 90-degree rectangular color tubes.

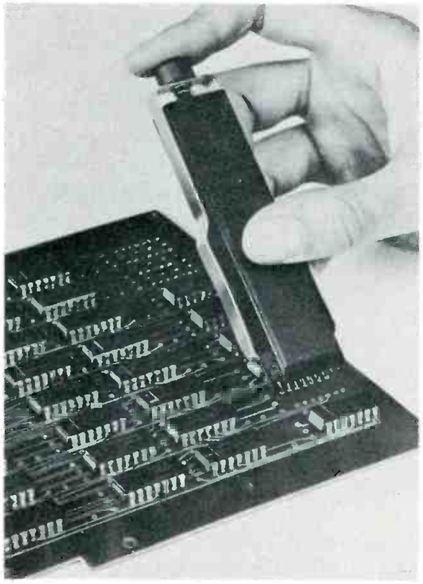
Price of either the Model C-503 or the Model C-513 is $7.75.

Circle 71 on literature card

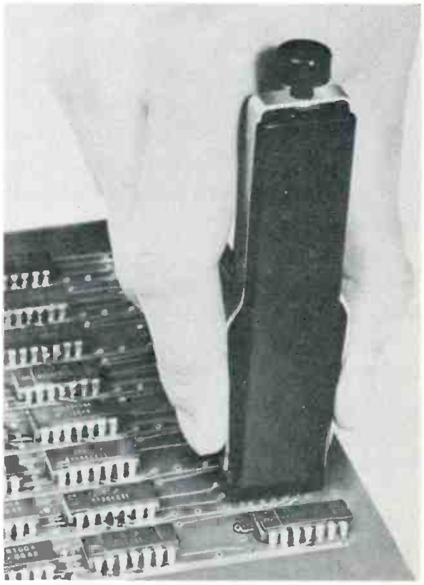
Slide-Grip Clip For IC Removal

A new slide-grip clip designed for inserting and extracting integrated circuits from printed-circuit boards has been introduced by the Solder Removal Co.

To insert an IC, the Pul-N-Sertic tool is loaded into the machined jaws of the tool, the lead pins on one side are lined up visually with circuit board holes and all pins are inserted simultaneously by rolling the tool. Pushing a button on top of the tool releases the component, according to the manufacturer.



To extract an IC, the tool reportedly is positioned over the component to be removed and the stainless steel spring removal clip is lowered until the clip jaws are under the IC base. Squeezing the clip securely grips the component. Lifting the tool pulls the IC free; pressing the top button ejects it from the tool.



The No. 885 Pul-N-Sertic sells for $15.95.

Circle 72 on literature card

Replacement Picture Tubes

The new HI-LITE color television picture tubes and two Silverama type black-and-white replacement picture tubes have been introduced by RCA Distributor Products.

The two color picture tube types are the H-19VBQP22 and H-20-VAHP22. Both types reportedly are 90-degree, RIM band, Einzel gun tubes. The H-19VBQP22 is a **MATRIX** tube while the H-20VAHP22 has a standard color screen, according to the manufacturer.

The two black-and-white television picture tubes are the 12-VAGP4 and the 23FNP4. The 12VAGP4 reportedly is a direct replacement for the 310FCB4. The 12VAGP4 features a T-band implosion protection system and has a high G2 and narrow neck design, reports the manufacturer.

H-19VBQP22 types sell for $178.00 each; H-20VAHP22 types sell for $190.00 each; 12VAGP4 types sell for $46.20 each; and 23FNP4 types sell for $63.75 each.

Circle 73 on literature card ▲

catalogs literature

ANTENNAS

100. *Vikoa, Inc.* — is making available a 64-page, illustrated catalog covering their line of wire and cables and IDS-MATV equipment. Hardware, accessories, connectors and fittings and an index also are included.

101. *Jerrold Electronics Corp.*— Catalog S, titled "Systems and Products for TV Distribution," lists specifications of this manufacturer's complete line of antenna distribution products, including antennas and accessories, head-end equipment, distribution equipment and components, and installation aids.*

COMPONENTS

102. *Precision Tuner Service*— announces a new tuner parts catalog, including a cross reference list of antenna coils and shafts for all makes of tuners.*

103. *Sylvania Electric Products, Inc.* — a 73-page guide which provides replacement considerations, specifications and drawings of Sylvania semiconductor devices plus a listing of over 35,000 JEDEC types and manufacturers' part numbers. Copies are $1.00.*

104. *Workman Electronic Products, Inc.*—has released a 32-page, pocket-size cross reference listing for color TV controls. 105 Workman part numbers are listed in numerical order with specifications and illustrations of the part.

105. *GTE Sylvania, Inc.* — has published an interchangeability guide listing 191 commonly used color TV picture tubes which can be replaced with 19 GTE Sylvania Color Bright 85® types.*

TV ACCESSORIES

106. *Telematic* — introduces a 14-page catalog featuring CRT brighteners and reference charts, a complete line of test jig accessories and a cross reference of color set manufacturers to Telematic Adapters and convergence loads.*

TECHNICAL PUBLICATIONS

107. *Howard W. Sams & Co., Inc.* — literature describes popular and informative publications on radio and television servicing, communications, audio, hi-fi industrial electronics, including their 1971 catalog of technical books about every phase of electronics.*

108. *Sylvania Electric Products, Inc., Sylvania Electronic Components Div.* — has published the 14th edition of their technical manual, which includes mechanical and electrical ratings for receiving tubes, television picture tubes and solid-state devices. Price of this manual is $1.90.*

109. *Tab Books* — has released their Spring, 1971 catalog describing over 170 current and forthcoming books. The 20-page catalog covers: schematic/servicing manuals, broadcasting; basic technology; CATV; electric motors; electronic engineering; computer technology; reference; television, radio and electronics servicing; audio and hi-fi stereo; hobby and experiment; amateur radio; test instruments; appliance repair, and transistor technology.

TEST EQUIPMENT

110. *Dynascan Corp.* — announces a new 24-page 2-color catalog of B&K Precision Test Equipment. A total of 21 instruments are reportedly presented; from a Mutual Conductance Tube Tester to a new DC to 10 MHz Triggered Sweep Oscilloscope. *

111. *Eico* — has released a 32-page, 1971 catalog which features 12 new products in their test equipment line, plus a 7-page listing of authorized Eico dealers.*

112. *Lectrotech, Inc.* — announces the 1972 catalog, "Precision Test Instruments for the Professional Technician". It contains specifications and prices on sweep marker generators, oscilloscopes, vectorscopes, color bar generators and other test equipment.*

113. *Mercury Electronics Corp.* —14-page catalog provides technical specifications and prices of this manufacturers' line of Mercury and Jackson test equipment, self-service tube testers, testers, test equipment kits and indoor TV antennas.

114. *Tektronix, Inc.* — has announced a 4-page brochure describing the 54 Series oscilloscope manufactured by Tektronix English subsidiary, Telequipment.

TOOLS

115. *Chapman Manufacturing Co.* — offers a pamphlet containing their line of tools and tool kits. Kit No. 6320, the Midget Ratchet is featured along with other available tool kits.

116. *Jensen Tools and Alloys*— has announced a new catalog No. 470, "Tools for Electronic Assembly and Precision Mechanics." The 72-page handbook-size catalog contains over 1,700 individually available items.

117. *Xcelite, Inc.* — Bulletin N770 describes this company's three new socket wrench and ratchet screwdriver sets.

*Check "Index to Advertisers" for additional information.

Index of 1971 content

The following code system is used to indicate department coverage of a subject: ASR, Antenna Systems Report; AUD, Audio Systems Report; CE, Carr Electronics; ES, Electronic Scanner; LE, Letters to the Editor; PR, Product Report; SB, Service Bulletin; ST, Shop Talk; SYM, Symcure; TER, Test Equipment Report; TS, Troubleshooter.

AUTO ELECTRONICS

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This classified section is available to electronic technicians and owners or managers of service shops who have for sale surplus supplies and equipment or who are seeking employment or recruiting employees.

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- "Blind" ads $2.00 additional
- All letters capitalized— 35 cents per word

Each ad insertion must be accompanied by a check for the full cost of the ad.

Deadline for acceptance is 30 days prior to the date of the issue in which the ad is to be published.

This classified section is not open to the regular paid product advertising of manufacturers.

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Need service manual, schematic for transistor camera-GBC "KOWA" Model AE-50. John Bylin, 3407 Jennings, Sioux City, Iowa 51104. 1-72-1t

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