February, 1969 □ 75 cents

A HOWARD W. SAMS PUBLICATION

Electronic Servicing

Formerly PF Reporter

1969 SOURCE GUIDE TO IMPORTS, page 20

Memory module color remote control, page 12

New Sylvania circuitry for '69, page 24

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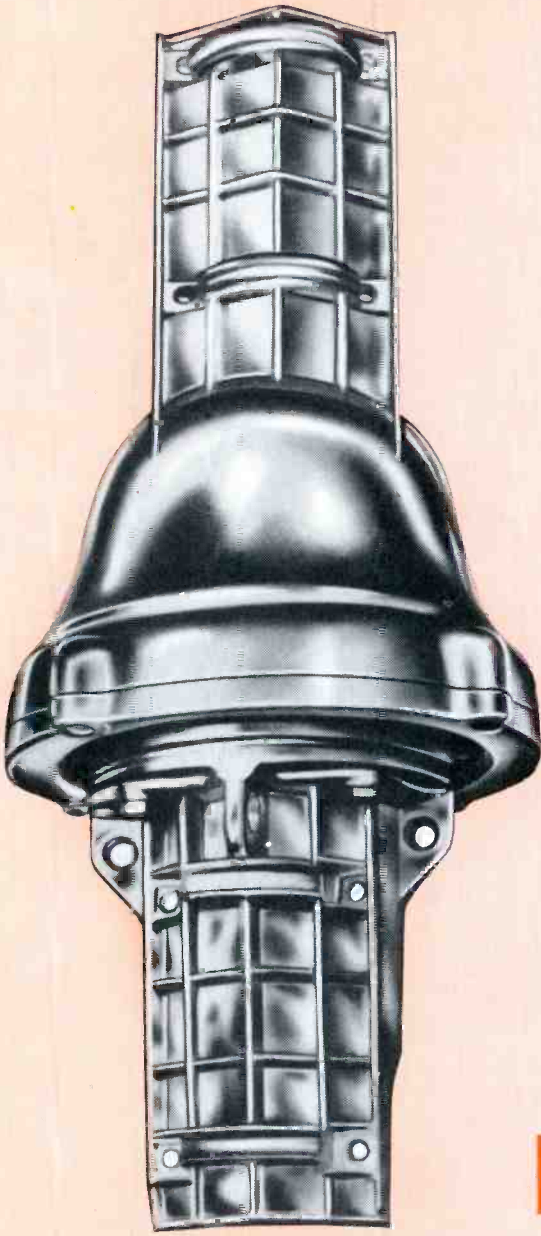
Never ask a lightweight rotor to do a heavyweight's job.



Selling your customer a lightweight rotor when he has a large antenna array just doesn't make sense. Especially since you can offer him an alternative: the heavy-duty "Bell Series" rotor, from CDE.

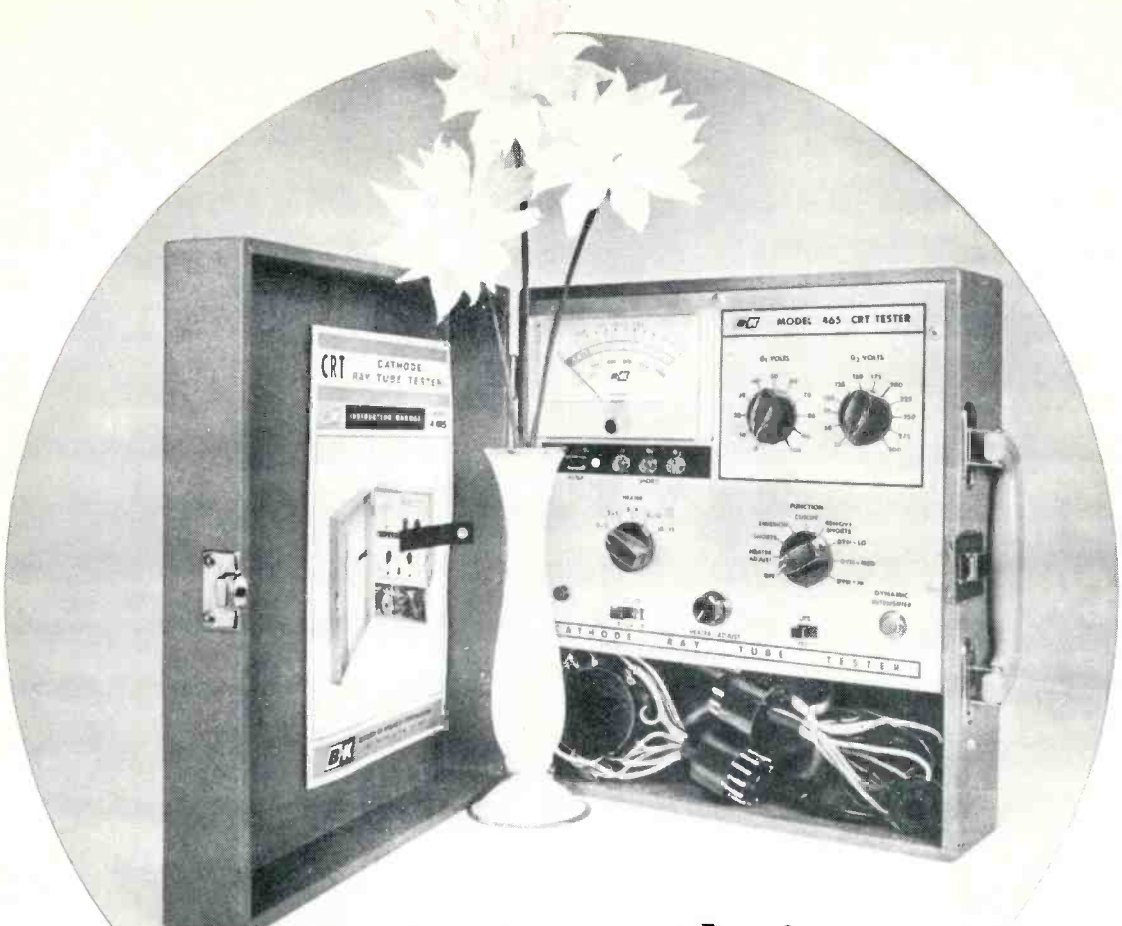
Available in both automatic and manual forms, this rotor is designed specifically for large, heavy antenna arrays...designed specifically for unmatched fringe-area reception...designed to give your customers the finest color TV reception possible. In fact, this is the *only* heavy-duty rotor available.

We call it the Bell Series because of its completely weatherproof, die-cast aluminum housing. You'll call it rugged because it has 4 to 5 times the stalling and braking torque of any other rotor! This means *any* antenna will turn, even under the most adverse weather conditions... and that your customers will get terrific color or black and white reception despite high winds or heavy icing. Great FM reception too!

The Bell Series rotor: one-of-a-kind built for one-of-a-kind performance!

CDE CORNELL-DUBILIER

Circle 1 on literature card

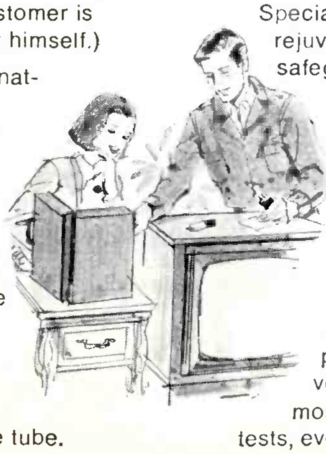


Customer Relations Specialist.

That's you. When you turn on your B & K tester / rejuvenator. A real customer pleaser (even the tough ones). At the same time, it ups your income and quickly pays for itself. This has been proved time and again:

First, by showing your customer, right in the home, the true condition of his picture tube. And how long it will last. (New picture tube sales are easier to justify when your customer is right there to see for himself.)

Second, by rejuvenating the picture tube, while your customer watches, relieved that he's been temporarily spared a major expense. You can do this as a part of your service or for an additional fee which you can offer to apply toward later purchase of a picture tube.



Third, by being able to test and repair all black & white and all color tubes, imports as well as American, in a few minutes. Without removing the picture tube from the TV set.

For shop use, of course, it's a must—for your customer's sake, or to validate your claim on an in-warranty picture tube.

Special B & K time-controlled rejuvenation-process safeguards the picture tube.

Adjustable heater voltage is metered and continuously variable from 0 to 13 volts. G-1 and G-2 voltages are completely and continuously variable.

All this enables you to pinpoint the desired voltage and make the most accurate possible tests, even on future CRT types.

Circle 2 on literature card

(How's that for non-obsolescence in an era of planned obsolescence?)

Color picture tubes are checked by testing each color gun separately just as the manufacturer would do it. (In fact, this CRT tester has become the commonly used diagnostic tool of the industry.)

The B & K 465 is the professional serviceman's tester.

If you would like to enlist the aid of this "customer relations specialist," see your B & K Distributor or drop us a note and ask for Catalog AP-24.

CRT Tester/Rejuvenator
Model 465 Net: $89.95

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Where electronic innovation is a way of life.

February, 1969 • Volume 19, No. 2

Electronic Servicing

Formerly PF Reporter

in this issue...

DEPARTMENTS

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Intertec Publishing Corp.
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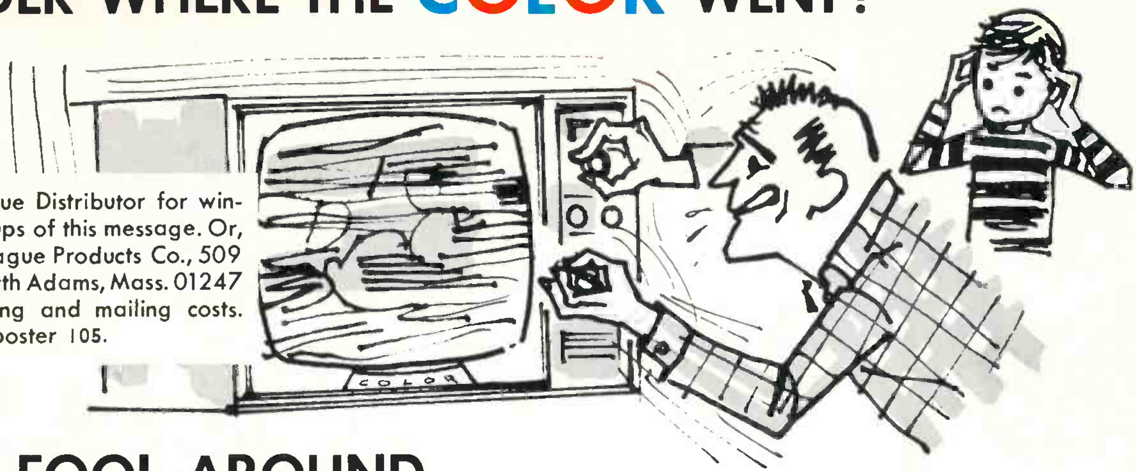
WONDER WHERE THE COLOR WENT?



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DON'T FOOL AROUND...
CALL YOUR NEIGHBORHOOD TV TECHNICIAN

HE'S THE ONE WHO CAN BRING IT BACK ALIVE!

There are many jobs around the house you can tackle yourself. If you're a bit handy, it's no trick to fix a leaky faucet or a broken window.

BUT a color TV set is something else again!

It's the most complicated piece of equipment you've ever owned—bar none. Yes, far more complicated than your old black and white set.

Trying to fix it yourself can be extremely dangerous.

Trying to fix it yourself can also be quite expensive.

So why try?

The independent radio-TV service dealer in your neighborhood can do the job right. As TV sets have grown more complex, he's kept abreast of the changes.

With the introduction of color TV, he's had to learn a lot of new things.

After all, he repairs all kinds of TV sets for a living and quite a few of them are color. In the last two years, almost as many color TV as black and white sets have been sold.

When your color TV starts acting up, you may think it has a new or unusual ailment. But your independent TV service technician won't consider the problem new . . . or unusual. Most likely, he'll know what to do within a few minutes.

Sure . . . he charges for his services. He's a professional.

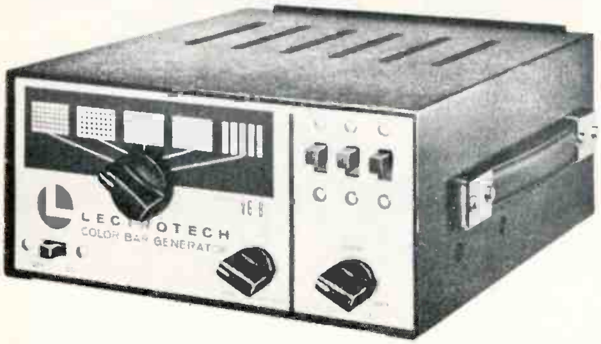
Because he is, you'll be pleased with the service.

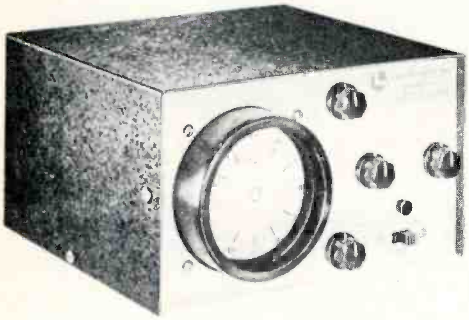
What he charges will be far less than you'd pay in the long run if you entrusted the job to an amateur or attempted to do some tinkering yourself.

THIS MESSAGE WAS PREPARED BY SPRAGUE PRODUCTS COMPANY,
DISTRIBUTORS' SUPPLY SUBSIDIARY OF SPRAGUE ELECTRIC COMPANY, NORTH ADAMS, MASSACHUSETTS FOR . . .
YOUR INDEPENDENT TV-RADIO SERVICE DEALER

DON'T FORGET TO ASK YOUR CUSTOMERS "WHAT ELSE NEEDS FIXING?"

Circle 3 on literature card





VISUAL DISPLAY

electronic scanner

news of the industry

3-D Color TV

The television electronics laboratory of the YMCA Institute of Technology is being made available for development of a new three-dimensional (3-D) color TV system.

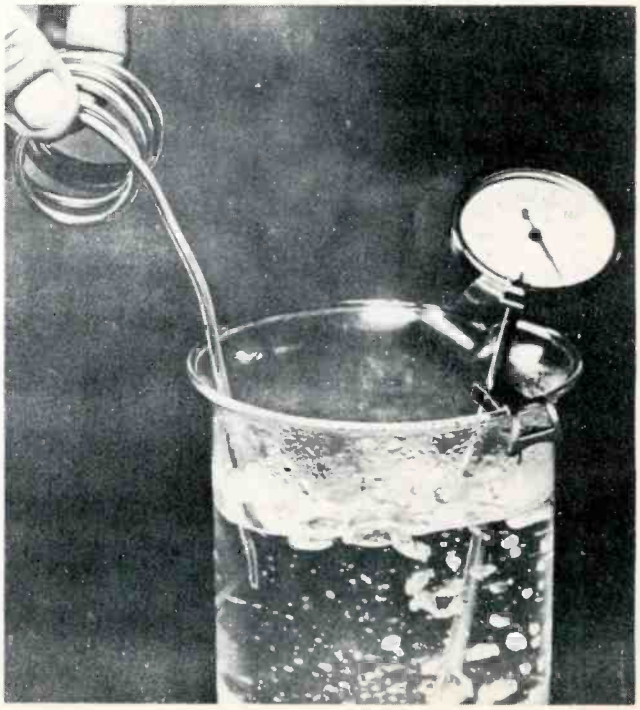
The originator of the system, electronics engineer Phillip Lee of Newark, New Jersey, has advanced the theory of development to a point requiring experimental proof.

Should laboratory experiments verify the theory of operation and practicality of development, Mr. Lee's system will make possible three-dimensional color TV with inexpensive, minor adaption to existing TV studio broadcast equipment and a simple addition to present receivers.

New Solder Melts at 212° F

A new ultra-low-melting point solder has been developed by the Alloy Department of Cerro Copper & Brass Company. Called "Cerrosolder," the bismuth-based alloy softens at 209° F and is fully liquid above 212° F.

The new solder was formulated to solve production problems where conventional soldering temperatures, or even special alloy solders, cause damage, such as in assembling integrated circuits where heat from a conventional soldering iron can cause damage to or even obliteration of some of the descreet components. Electrical conductivity is 2.9% of that of copper and resistivity is 349 circular mil ohms per foot.



Admiral Produces One Millionth Color Picture Tube

Vincent Barreca (left), president of Admiral Corporation, and Lothar Lewinson, general manager of the company's color picture tube division, display the one millionth tube produced since Admiral's picture tube plant started operations in 1965. They are holding the television industry's first 16-inch color tube, an exclusive development by Admiral.

Electronics, chemistry, geometry, metallurgy and optics are utilized in the production of color picture tubes, one of the most sophisticated and complex consumer products. Approximately 30 million gallons of water are needed monthly; over 1,000 tons of air conditioning are required—enough to air condition about 400 homes—and presently, Admiral's tube plant has 35 different conveyor systems totaling four miles.

FCC Authorizes Pay TV

A limited over-the-air subscription television (STV) system has been authorized by the Federal Communications Commission (FCC) as a supplemental broadcast service, effective June 12, 1969. The six month waiting period has been specified to provide time for congressional and court review. Before the end of this waiting period, the FCC will issue technical standards for STV systems. No applications for station authorizations will be accepted until the technical rules are adopted, and no grants will be made until the STV rules become effective.

The STV system will be permitted only on one station in each community, and only in communities that receive service from four commercial (free) TV stations. STV will be permitted to use both UHF and VHF stations.

It is expected that over-the-air STV will employ a system in which both the sound and picture signals will be transmitted in scrambled form by the TV station, and only those having unscrambling devices attached to their TV sets will be able to view the programs. The FCC already has stipulated that unscrambling, or decoding, devices on subscriber sets must be leased, not sold, to subscribers.

Experimental STV, using Zenith's Phonevision system, has been operating in Hartford, Connecticut since June 29, 1962.

Amphenol CB and Test Equipment to be Commander

The Amphenol lines of two-way Citizens Band radios and television test equipment have been sold to the Trippe Manufacturing Co., effective December 31, 1968.

A new company, Commander Corporation, has been established by Trippe to produce the radios and test equipment in facilities at 133 N. Jefferson St., Chicago. Terms of the sale permit Commander to sell the current inventory of these products under the Amphenol name. However, all units produced by Commander will carry the Commander name.

Initially the product line, pricing and general policies will be essentially the same. Commander will handle all warranty service.

According to Robert E. Svoboda, president of the Amphenol Distributor Division, the sale was prompted by the Amphenol Distributor Division's orientation towards the distribution of electronic components rather than the manufacture and sales of equipment.

Trippe currently produces inverters, burglar alarms and automotive lights.

Two New Sylvania Service Parts Centers

Sylvania Entertainment Products, an operating group of Sylvania Electric Products Inc., has announced two new service parts centers, bringing the total number to six across the country.

George Camp, Jr., National Parts Manager, said the new service parts centers located in Cleveland, Ohio, and Waltham, Mass., will provide greater home entertainment parts availability and quicker delivery service to franchised Sylvania distributors, dealers, and authorized service contractors.

The Cleveland center will serve the states of Ohio, North and South Carolina, and the eastern portions of Kentucky and Tennessee. The area previously was served by the Service Parts Center located at Melrose Park, Ill.

Waltham Service Parts Center will serve the six New England states with the exception of western Connecticut. The area formerly was served by the Service Parts Center at New Hyde Park, New York.

Other centers are located at Los Angeles, Calif., and New Orleans, La. ▲

letters to the editor

Direct Replacement?

Will you please explain why RCA claims that their 6LQ6/6JE6C tube is a direct substitute for a 6JE6? I have tried it and it doesn't work.

A 6LQ6/6JE6C type exhibits "runaway" characteristics when used in an RCA horizontal output circuit designed for a 6JE6. My solution to the problem is to replace a 6JE6 with a 6JE6. Can you explain why the 6LQ6/6JE6C will not replace a 6JE6?

Bernard H. Serota
Philadelphia, PA

After carefully studying the horizontal output circuit in question and the specifications for both the 6LQ6/6JE6C and 6JE6 listed in RCA's tube manual, we were unable to answer your question. So we posed the question to RCA. Their answer: It will work—Ed.

Best Method for Handling Color Chassis

I would like to see in ELECTRONIC SERVICING an illustrated article pointing out the best way to handle a color television during servicing. The article should explain what type(s) of service bench(es) is best, whether a mock-up is better than pulling the chassis, and what is the best method for supporting the chassis. Handling color chassis, especially combination models, has always been a problem to me. Such an article would be of great benefit to me and, I imagine, of real interest to other readers.

Warren Haferkamp
Hazelwood, MO

I am sure that many of the readers of ELECTRONIC SERVICING have devised effective methods for handling color chassis during servicing and will be willing to share their ideas with fellow servicemen. How about it readers?—Ed.

Jobless Training Costs Excessive

The article in the November PF REPORTER titled "Jobless to be Trained as TV Technicians" sounds pretty ridiculous to me.

According to the figure given it will cost about $8,000 to train each of these people. Any one of these people with the ability and guts to become a successful TV technician could be trained via the many correspondence courses, including RCA's, at about one-tenth this cost. In other words, about 4,000 men could be trained. Furthermore, anyone with the ambition and guts to stick to a home study program will more than likely turn out to be a success.

From what little I have seen and heard about these training programs the success percentage is around 10%. This makes the cost outrageous.

The remark that the program "will help alleviate one of the most acute problems" does not make much sense either. Even if the program is 100% successful it would only provide one for every 500 to 600 needed technicians and I doubt if this will make much of an impression.

Jack Watt
Ontonagon, MI

State of the Service Business

Mr. W. S. Harrison, president, Virginia Electronics Association has written a letter (December PF REPORTER) which, considering the subject matter, is a model of understatement and restraint. As a radio, and later TV, technician with almost 37 years full-time experience and a non-member of any service organization, I believe that I can speak impartially.

The service business is a sick business. A competent technician today is the intellectual equal of the average engineer of a generation ago. The majority of these men are a depression product; they went to work instead of to college. Their ranks are suffering from normal depletion, but replacements are not available on a man-for-man basis. Actually, our losses should be made up on a two-for-one ratio to allow for existing, critical shortages and to allow for the continuing proliferation of all kinds of electronic equipment on the consumer level.

What are the inducements offered these prospective replacements? Low pay, long hours, periodic and virulent abuse by magazine writers who need a non-retaliating target, wholesale-retail competition from their friendly neighborhood jobber (he's a jobber but there's a billboard in front of his store), meaningless franchises by big-name manufacturers and a few hundred equally exciting incentives. Any man who goes into that jungle with his eyes open doesn't have his share of brains.

Organizations are only partially effective because they lack enough money. You cannot hope to mold public opinion on a large scale without an expenditure of millions of dollars. The technicians don't have it. The manufacturers do—and it's tax-deductible as advertising.

In earlier days, there were fewer tubes, fewer set models and a higher concentration of sales on fewer and more profitable items. Shortcuts and improved techniques learned on certain sets could be profitably used because there would be many sets of the same model in town. Also, the work done and the equipment serviced did not spread over as wide a range either *technically or financially. Today's technician is not only supposed to work on all items from a $4.67 Japanese import to a $1200 home entertainment center, he's also supposed to ask humbly "What else needs fixing?" Does anyone honestly know any competent technician who hasn't more work than he can do and who isn't fed up with the business?*

Today's technician is a sucker. A sucker for doing John Public's work and taking his abuse. A sucker for working on equipment designed not to be repaired and giving many of our big-name manufacturers a good name by keeping their product out of the scrap pile. And a sucker for buying vast amounts of service data (of which he will not use over 5%) so that he can service equipment on which he derived no profit. And most of this junk is of a grade he would not have sold personally because he knows it for what it is—junk!

There is a strong trend toward utilizing the few men left by setting up repair depots to repair plug-in card assemblies and thus taking the service function out of the dealer's hands. This sounds attractive but calls for a high degree of standardization and tighter quality control. Both of those ideas are an anathema to today's manufacturer. Also, the costs may be higher than popularly supposed.

My own solution—and certainly not an ideal one—is to gradually phase out the general repair end of my business. This has been going on for some time and quite successfully. Eventually, I shall service only what I have sold—and I have always refused to sell substandard goods. The cure for the problems of the service business may be to let the public take their trouble where they took their money.

Francis C. Wolven
Saugerties, NY

Agrees with VEA Stand on Extended Warranties

Sometimes things get pretty disgusting for the electronic service technician. I have read the copy of Mr. W. S. Harrison's letter in the December issue of PF REPORTER, and I wholeheartily agree that the manufacturer should stop his so-called "extended warranties." And, if the manufacturer will not stop this monopolistic practice, there should be something done about it by the U.S. legislature.

I also agree with Mr. Harrison's statement that any warranty in excess of the proven ninety days is a sales gimmick that uses the consumer's own money to make him a captive customer.

We independent servicemen should oppose any stated or implied warranty in excess of ninety days which does not give the consumer the freedom to choose who will service the product he has purchased . . .

I think the manufacturer would be wise to forsake extended warranties and leave the routine maintenance of their products to qualified licensed technicians as was intended by the free enterprise system.

Porter H. Mam
South Bend, IN

Independent Service Is Here to Stay

I own an independent Radio and TV sales and service shop. My reason for writing you is that I am tired of experts telling me the small independent is on his way out.

I've been in business 20 years and have made a good dollar in my "going-out-of-business" business.

I'm certain I put a cramp in the style of larger shops. It is these bigger shops that had better watch out because we small independents are here to stay. We offer a lot more to our customers than the big shops, and because of this you can't convince me that we are on our way out.

So I'd like to offer a little advice to any TV technician who wants to open a small shop: Don't wait; do it now. There is a good buck in it and not much competition from the big guy. Just do a good job and you'll make money.

I do my own selling and servicing. If you can fix a radio or TV, you'll be able to sell them. Little guys, don't let those big guys scare you.

Here to stay,
Roger Monaco
Roger's Television and Radio
Belleville, NJ

▲

You're making money in electronics now.

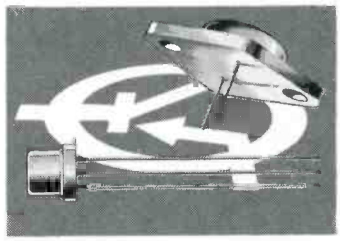
RCA offers 4 ways to make more.

Study at home... set your own pace. RCA Institutes has an easy approach to bring you bigger earnings.

COLOR TV During this course you'll perform over 50 experiments—*and receive all parts and instructions to build your own color TV.*

The cost of the Color TV Kit is included in the tuition—in both the beginner's program and the advanced course in color TV servicing.

Course is based on the latest receiver circuitry and equipment.



TRANSISTORS Transistor circuitry is what the TV repairman must cope with in most receivers today. This course gives you the necessary background.

You'll discover an easy way to an effective understanding of semiconductor technology, including characteristics of tunnel diodes, rectifiers and other solid state devices. Transistorized TV Receiver Kits also available.

FCC LICENSE TRAINING Get your license—or your money back! We're *that* sure you'll succeed with RCA Institutes Home Study Training. Course is all new—both in content and in the up-to-date method of study.

Choose the course for the FCC License you want: third, second or first phone. If you need basic training first, apply for the complete License Training Program.

CATV TRAINING Technicians are in short supply in CATV (Community Antenna Television Systems).

That's because CATV is expanding, as people seek better reception and more than local stations.

You'll receive two comprehensive lessons, covering the practical phases of CATV systems in either the Television Servicing or Communications courses.

WHEN YOU STUDY THROUGH RCA INSTITUTES HOME TRAINING, YOU CAN PAY FOR LESSONS AS YOU ORDER THEM, OR TAKE ADVANTAGE OF EASY MONTHLY PAYMENT PLAN. LICENSED BY NEW YORK STATE EDUCATION DEPARTMENT. APPROVED FOR VETERANS. ACCREDITED MEMBER NATIONAL HOME STUDY COUNCIL.

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Circle 11 on literature card

Motorola's Memory-Module Remote Control

A neon lamp, capacitor and MOSFET replace motor-driven potentiometers in this new remote control unit.

by Stan R. Prentiss

The motor-driven potentiometers that perform the on/off function and adjust the hue, color intensity and volume in conventional color TV remote systems have been replaced by three memory modules in Motorola's new remote control system. Channel switching is the only function performed by a motor in the new system.

Memory Module

The three memory modules are identical in both physical design and operation. The circuitry of the modules is shown in Fig. 1.

The primary function of each memory module is to provide a linear output voltage to increase or decrease the conduction of a two-stage transistor amplifier that, in turn, controls either the volume, hue or color intensity, depending upon the application of the module.

Each memory module employs a neon lamp, a 1.5-mfd capacitor, and an insulated-gate field-effect transistor, known to the trade as a MOSFET, or metal-oxide semiconductor field-effect transistor. As related to the ordinary junction FET, the depletion MOSFET is a "normally on" device that is induced into further conduction by a positive voltage on its gate if it is an N-channel MOSFET (as in this instance), and by a negative gate voltage if it is a P-channel type. During conduction, majority carriers pass from source to drain—there being no base region to transverse as in bipolar minority carrier transistors—and on into the reverse-biased load circuit. The gate can be compared to a capacitor with virtually no leakage and an input resistance that measures 10^{14} or 100 trillion ohms.

The NE-98 neon lamp fires, or ionizes, at approximately 80 volts, charging the memory capacitor to a certain voltage level which, with an almost infinite resistance as a load, the capacitor will maintain for as much as 1,000 hours unless disturbed. The NE-98 charges or discharges the capacitor linearly and, when inactive, presents an open circuit to the capacitor in any condition of charge or discharge. The voltage drop of the neon lamp is approximately 80 volts at full conduction. Any voltage in excess of this value will charge the capacitor and so bias the MOSFET whose gate insulation will tolerate a maximum of about 20 volts. Clamping diodes at the input to the module, biased at 100 and —80 volts, restrict any positive and/or negative excursions of voltage beyond these limits, thus setting up a —2- to 20-volt bias range that will bias the MOSFET fully on, partially on, or cut it off completely, depending upon the action desired.

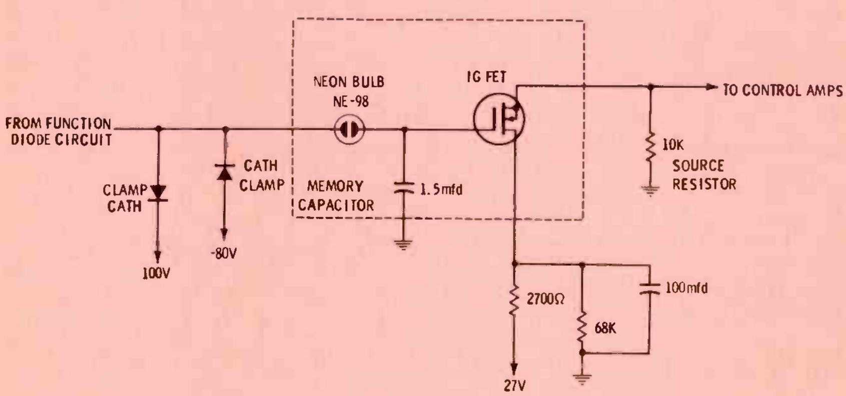
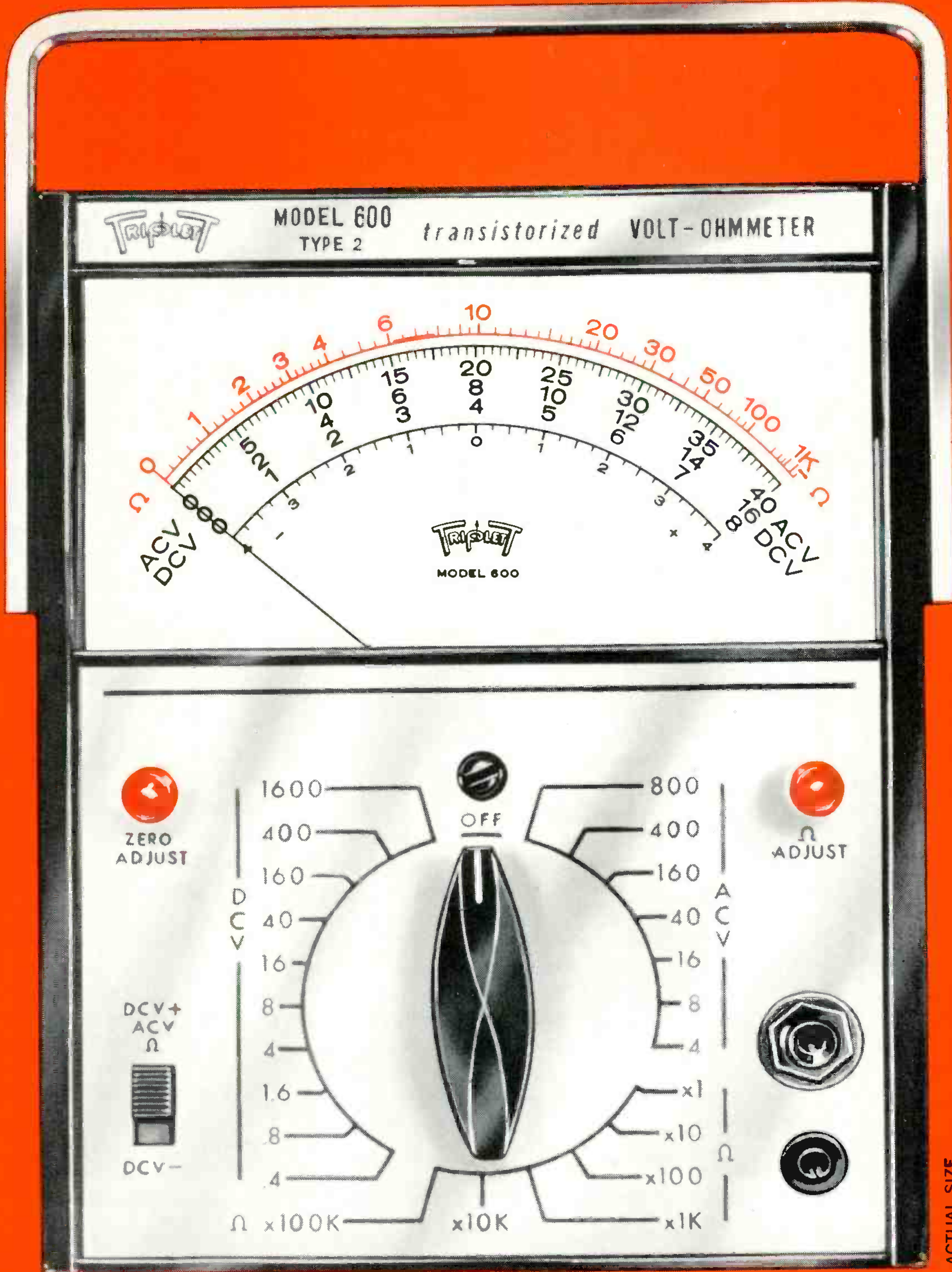


Fig. 1 Circuit diagram of memory modules employed in Motorola's new color remote control system.

The input to the memory module is either a positive or negative DC voltage, depending on the function selected by the operator of the remote transmitter, i.e., volume up or down, hue changed, or color intensity increased or decreased, etc. To explain the step-by-step operation of the memory module, assume that it is desired to increase the volume level of the receiver. Circuits in the transmitter and receiver (to be explained in detail later) function to produce a positive DC input to the neon lamp. When the input voltage reaches approximately 80 volts, the neon lamp fires and begins to charge the 1.5-mfd capacitor, which is in series with it. At this point there is an 8-volt drop across the neon lamp, its ionization potential. (If the input voltage to the memory module exceeds 100 volts, the clamp diode connected to the 100-volt DC source will conduct, lowering the input voltage.) As the capacitor charges, the voltage drop across the neon lamp decreases until it drops below the ionization potential of the lamp. At this point the lamp cuts off (deionizes), effectively isolating the capacitor from the input. The capacitor holds its charge because there is no path through which it can leak off.

The charge on the capacitor is applied to the gate of the MOSFET, which sets the operating point of the MOSFET. Current flows up from ground, through the source resistor and MOSFET to the 27-volt source. Current through the source resistor develops a positive voltage at the top of the resistor. This volt-



ACTUAL SIZE

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2. ONE SELECTOR SWITCH MINIMIZES CHANCE OF INCORRECT SETTINGS AND BURNOUTS. DC POLARITY REVERSING.
3. HUMAN ENGINEERED FOR EASE OF USE. CLEAN UNCLUTTERED SCALE, EXCELLENT RANGE OVERLAP, FOR MORE ACCURATE READINGS.

Model 600 on stand handle leather case $14.70

Model 600 TVO
(Transistorized Volt-Ohmmeter)

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BLUFFTON, OHIO

age, in turn, is used to increase the gain of the following audio function amplifiers. Thus the volume of the audio is increased.

The following paragraphs will provide a detailed description of each individual function performed by the remote control system.

Transmitter

The hand-held remote transmitter (Fig. 2) contains a conventional Hartley oscillator that is inductance- and capacitance-tuned for various frequencies ranging from 44.5 KHz to 35 KHz, depending on the signal selected by the seven function switches. It is powered by a 9-volt battery, draws 50 milliamperes of current during operation, and transmits some 40 to 50 feet. Its signal frequencies can be aligned with either an AC voltmeter or an oscilloscope by adjusting the appropriate transmitter trimmer for a maximum signal at the proper function diode (there are 6) on the remote control panel (Fig. 5). (The AC p-p amplitude will be more sensitive than simply the DC voltage on the output side of each diode.)

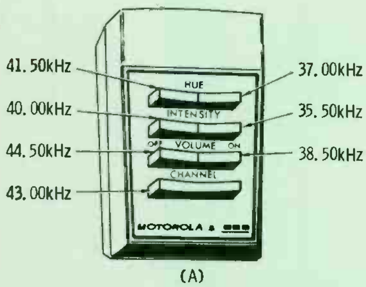


Fig. 2 Motorola remote transmitter provides seven signals in the frequency range between 35 KHz and 44.5 KHz. (A) Physical design with frequencies indicated for each function. (B) Circuit diagram.

Receiver Operation

The transducer in the receiver is located on the remote preamplifier panel (Fig. 3) and is a capacitor-type microphone that converts the signals from the remote transmitter into tiny electrical voltages. A polarizing voltage of 120 volts is applied to the microphone's center conductor. This voltage is applied at all times unless the set's on/off switch shuts off all power. When the remote transmitter or receiver on/off switch activates the receiver, 255 volts are fed into the microphone case to permit a polarity reversal between the center conductor and external case when the set is in operation. This prevents permanent polarization of the transducer. Needless to say, with these voltages delivered to the transducer, contact between it and common ground can produce a shock. Any attempt to unplug the transducer while the receiver is on could generate transients with sufficient amplitude to destroy not only Q1U* but also the IGFET's in the memory modules.

Signals out of the transducer are processed by three class A transistor preamplifiers. Q1U through Q3U are similar, except that Q3U has a 2K-ohm potentiometer, R15U, in its emitter circuit. This potentiometer adjusts the emitter current of Q3U so that nearby transmitters operating on the same frequency can be tuned out by lowering the stage gain and, therefore, the sensitivity of Q3U.

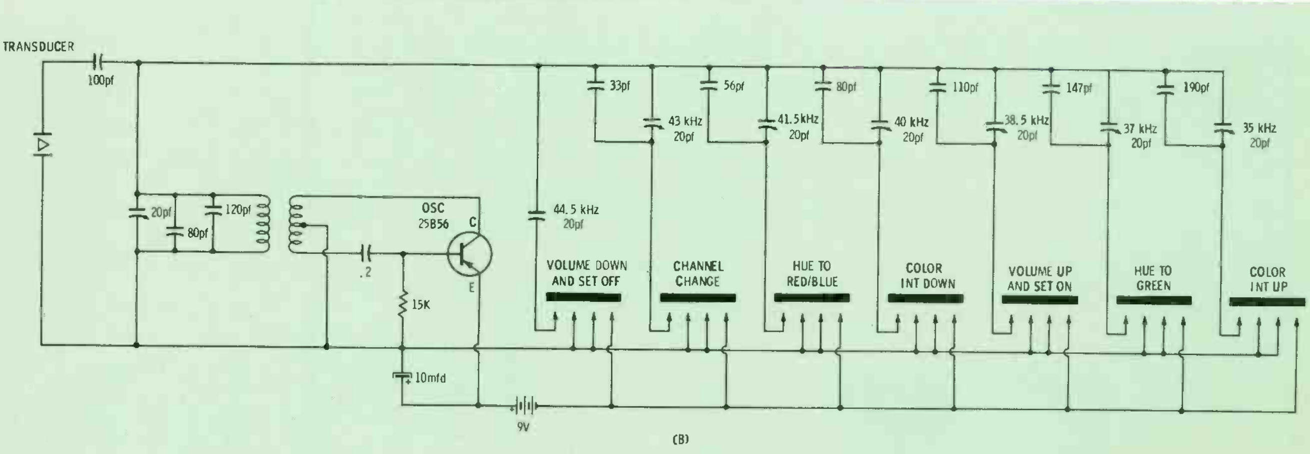
*Alphabetical suffixes to component designations in text indicate on which circuit panel the component is physically located.

Channel Change Function

Information from the three preamplifiers is AC coupled to Q1X, the all-function driver, on the remote power supply panel (Fig. 4). The output of Q1X feeds transformers T1X and T2X, which are frequency sensitive to specific signals emitted from the remote transmitter. T2X will pass only energy at 43 MHz, and, when it does, the channel change relay driver, Q2X, conducts and closes E1X relay contacts 1 and 3 that apply AC to the tuner motor. At the same time a hold switch in parallel with the relay contacts is also closed, keeping the motor operating when the function button is released. Further emissions from the remote transmitter activate the channel change relay and change channels.

On/Off Function

To turn the receiver on and off, the audio memory module supplies an output of 2 volts or more for the on signal and 1.5 volts or less for the off signal. This voltage is coupled to the base of on/off relay amplifier, Q3X, on the remote power supply panel. When NPN transistor Q3X is driven on, its collector goes low, removing the positive cutoff bias from the base of PNP transistor Q4X, turning this transistor on. Current through the collector of the relay driver operates on/off relay E2X, closing contacts 2 to 3 and 7 to 6, and sending cur-



rent to the CRT filament transformer instant-on switch and channel change relay E1X. These contacts are in series with the receiver on/off switch on the front panel.

Audio and Chroma Controls

Audio and chroma signals from the remote transmitter are passed through transformer T1X on the remote supply panel to the function output transistor, Q1Y, on the remote control panel (Fig. 5). Six discriminator coils, T1Y through T6Y, each frequency selective, are wired in series, with each output connected to an individual function diode (E1Y, E2Y, E5Y, E6Y, E9Y, E10Y). Q1Y effectively sees only one coil with a bandpass of approximately 700 Hz for each frequency and, therefore, has sufficient output to handle the load.

Audio

If a 38.5-KHz "volume on" signal is emitted from the remote transmitter, coil T2Y becomes frequency sensitive, offers resistance, and develops maximum positive DC voltage through rectifier diode E2Y. This voltage fires the E13Y glow lamp in the memory module and charges C7Y, the 1.5-mfd capacitor, which sets the conduction of the insulated gate field-effect transistor (IGFET). Since E14Y is connected in a source-follower circuit, this same voltage is developed across R9Y and acts as a positive DC gain-control voltage for the 1st and 2nd audio control amplifiers. If the volume-off control in the remote transmitter is pressed, T1Y will react, diode E1Y will pass a negative voltage to the neon glow lamp, reducing the charge on the C7Y capacitor (perhaps even turning it negative) so that the conduction of the IGFET is slowed or stopped, and the audio is either diminished or cut off completely.

Hue

To change the hue (phase), a 41.5-KHz signal from the remote transmitter resonates coil T3Y, causing maximum positive conduction through function diode E5Y, forward biasing IGFET E16Y, and increasing the DC bias on hue control amplifiers Q4Y and Q5Y. A positive voltage increases the amplitude of the 3.58-KHz reference signal fed to Q4Y, shifting the phase of the subcarrier oscillator from one end of the hue spectrum (green) to the other end (yellow-orange). A 37-KHz signal produces a negative output through T4Y and diode E6Y, discharging capacitor C20Y which, in turn, cuts off IFGET E16Y, decreasing the bias on the hue control amplifiers and the amplitude of the 3.58-MHz reference. This shifts the phase of the chroma reference signal from orange-red towards green.

Color Amplitude

The same process for the audio and hue remote controls is again repeated through T5Y and T6Y with 40- and 35.5-KHz signals, respectively. Reduction of the color intensity is produced by a negative signal fed through E9Y, and more saturated color is produced by a positive voltage through E10Y. The entire memory module and the succeeding amplifiers act much the same in each of the three circumstances, except that the audio control system has an additional on/off function.

Power Supplies

There are three half-wave power supplies on the remote power supply panel (Fig. 4). Each receives AC voltage from the remote power supply transformer. From these three power supplies are derived the 120- and the 100-volt buses, the —80-volt bus, and the 27- and 15-volt buses. The top end of the primary remote transformer is connected to the AC line, while the bottom half is in series with the front panel on/off switch, so that the transformer is active only when the main on/off and the —80-volt sources are partially regulated by series NE98 neon glow lamps that serve as both visual power-on indicating lamps and variable shunt resistances that hold the voltages relatively steady with increases or decreases in the current drawn from the base supply. The 27- and 15-volt sources, however, must be more closely regulated since they provide operational power for the memory modules, as well as various color amplifiers and audio amplifiers, and must furnish a fair amount of current with good voltage regulation and low AC ripple. A Pi-type filter comprised of C9X, R33X, and C16X removes ripple from the output of rectifier E4X. The output of the filter is then fed

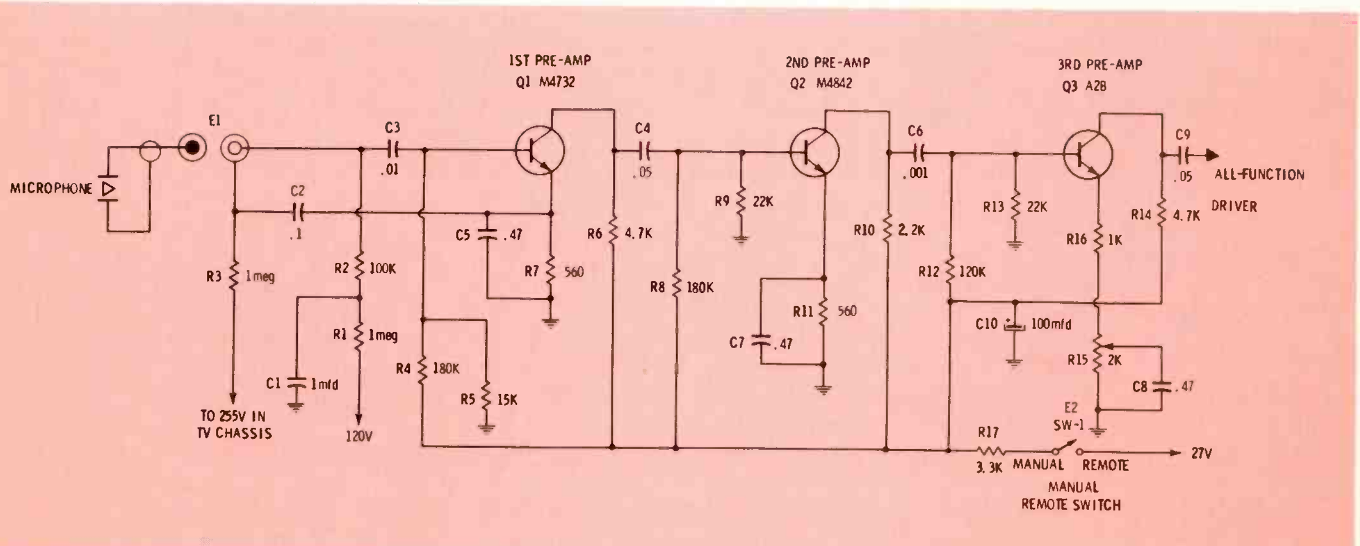


Fig. 3 Remote preamplifier panel (L) employs transducer and three class A amplifiers to boost signal from remote transmitter.

color

The RCA WT-509A Picture Tube Tester is a precision instrument in the famous RCA tradition. It tests both color and black and white picture tubes for emission quality, interelectrode leakage, and shorted elements. It's all solid-state AND IT'S ONLY $118.00.*

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*Optional Distributor resale price.

For a complete catalog of descriptions and specifications for all RCA test equipment see your RCA Test Equipment distributor or write RCA Electronic Components, Commercial Engineering, Department No. **B-33W** Harrison, N.J. 07029.

LOOK TO RCA FOR INSTRUMENTS TO TEST/MEASURE/VIEW/MONITOR/GENERATE

RCA

Circle 14 on literature card

through current limiting resistor R30X to the 27-volt Zener reference regulator, E7X. The base of regulator Q5X is consequently set at 27 volts. The collector and emitter of Q5X are connected through a 1K-ohm resistor. If the collector voltage rises, the emitter voltage rises, decreasing the forward bias of the base-emitter junction, thereby decreasing the current and the output voltage of the transistor. Should the collector voltage decrease, the junction will also increase, lowering the resistance of the regulator transistor and increasing the current through it, thus permitting extra output voltage. ▲

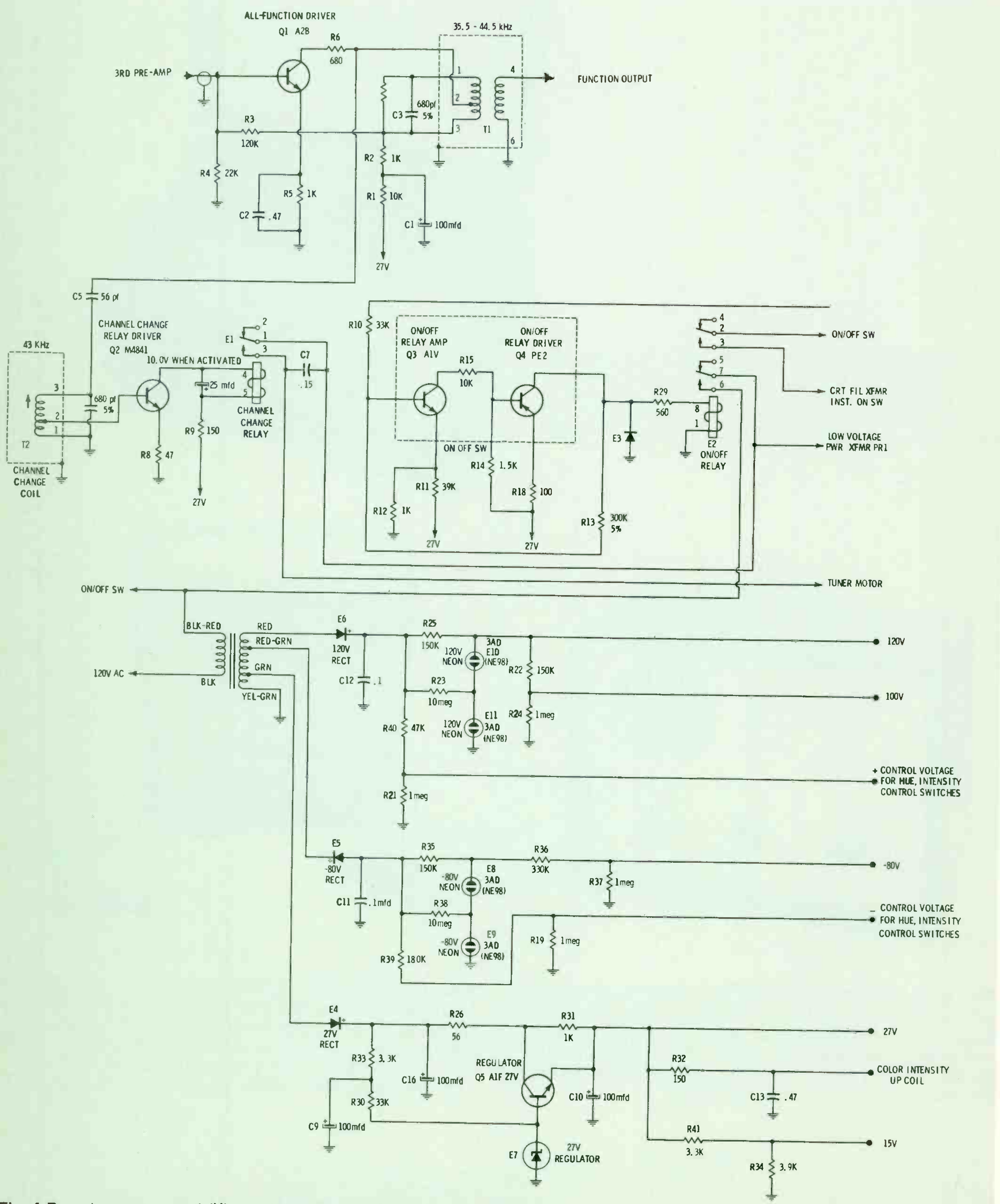

Fig. 4 Remote power panel (X) provides source voltages for all receiver circuits and contains circuitry for channel change and on/off functions.

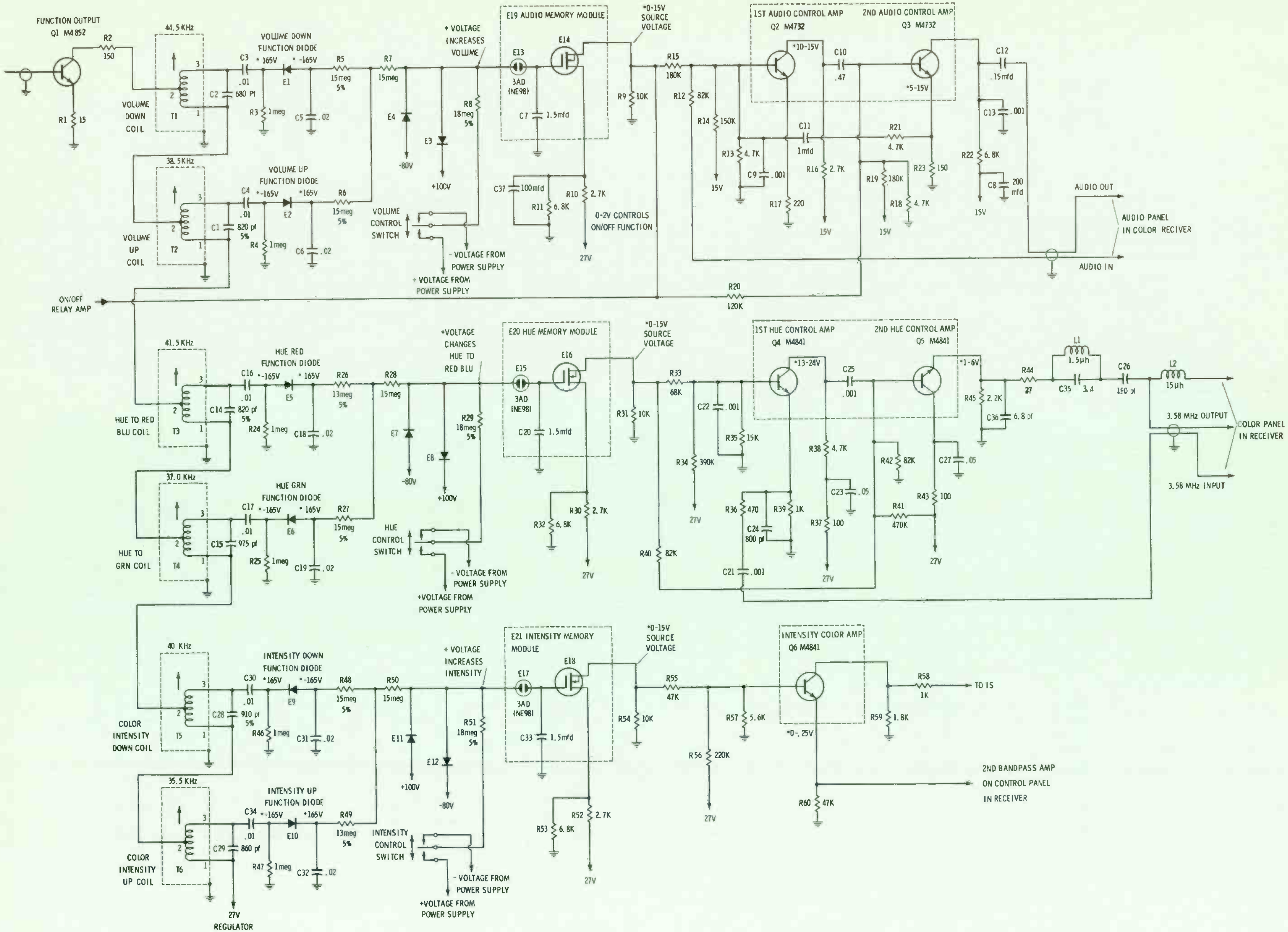

Fig. 5 Remote control panel (Y) employs three memory modules to control volume, hue and color intensity of color receiver.

1969 source guide to imported sets

This guide correlates the brand name of an imported product with the importer and/or distributor of that product and indicates whether or not that brand name is or has been covered in Howard W. Sams specialized series on transistor radios, auto radios and tape recorders (TSM, AR and TR series) or in *Photofact*.

The number following each brand name indicates the most likely source from which service information and/or parts may be obtained, or to which a set may be sent for repair service. Before shipping a set, it is best to write the company indicated to determine if repair service is available, and if it is, what the company rules are concerning shipment of the set.

We have attempted to list only those brand names that are still being marketed in this country. Other brand names and their importers and/or distributors can be found in the 1967 listing of imported sets, which appeared in the February issue of *PF Reporter.*

To provide continuous updating of this source guide, the editors of *Electronic Servicing* would appreciate receiving from readers other brand names that are being used but do not appear here. If the importer and/or distributor is known, please include it. If it is not known, we will attempt to trace it and publish the information in *Electronic Servicing.*

Complete Importer/Distributor list on page 22

Brand Name	Importer and/or Distributor	Sams Coverage
Adonis	1	no
Aimor	15	no
Aircastle	104	yes
Aiwa	98	yes
Alaron	14	yes
Ambassador	77	yes
AMC (Aimcee)	2	yes
AMC (York)	127	no
Amico	42	no
Annabel	14	no
Aristo	5	no
Aristocrat	11	yes
Aristo-Tone	5	no
Arrow	6	no
Aud-I-Tone	58	yes
Autovox	12	no
Belair (Hamway)	52	no
Belair (Mason)	73	no
Belaire	46	no
Belcorder	52	no
Blaupunkt	16	yes
Bradford	49	yes
Broadmoor	17	no
Browni	22	no
BSR	13	yes
Bulova	18	yes
Bush	121	no
Cameo	8	yes
Candle	20	yes
Capir	114	no
Clairtone	24	yes
Claricon	3	yes
Commodore	26	yes
Concertone	27	yes
Concertone (Monarch)	80	no
Concord	28	yes
Corvette	79	yes
Craig	30	yes
Crest	114	no
Crown	31	yes
Daltone	32	no
Decca	33	yes
Delmonico-Nivico	34	yes
Denon	100	no
Dia	84	no

Brand Name	Importer and/or Distributor	Sams Coverage
Domino	84	no
Doral	47	no
Dorset	113	no
Drexel	35	yes
Dyn	9	no
Dynasonic	9	no
Eldorado	23	no
Electra	36	no
Electro-Brand	37	yes
Electrohome	57	yes
Elgin	39	yes
Empire	119	no
Encore	19	no
Englishtown	104	yes
Essex	64, 64A	yes
Fabulloyds	64, 64A	no
Fannon	43	yes
Fen-Tone	44	no
Fidelity	94	no
Four-Star	45	no
Galaxy	9	no
Gaytone	52	no
Geloso	4	yes
Gema	9	no
Gotham	48	yes
Granada	46	no
Grand Prix	22	no
Grundig	50	yes
Halco	51	no
Heritage	53	no
Highwave	72	yes
Hit	53	no
Hitachi	54	yes
Hiwave	73	no
Imperial	55	yes
Imperial Deluxe	55	no
JJJ	58	no
JVC	34	no
Juliette	117	yes
Katone	59	no
Kensington	113	no
Koyo	62	yes
Lafayette	63	yes
Leak	41	yes
LIC	65	no

Brand Name	Importer and/or Distributor	Sams Coverage
Lloyds	64, 64A	yes
Luxtone	66	no
Mastercraft	74	yes
Masterwork (Columbia)	25	no
Masterwork	75	yes
Mayfair	7, 7A	yes
Megatone	1	no
Metex	84	no
Midland	79	yes
Monacor	80	yes
Monarch (B.S.R.)	13	no
Monarch	80	yes
Marvel	72	no
Morse	81	yes
NACO	86	no
Net	82	no
Nobility	83	no
Norelco	85	yes
Normende	107	no
NuVox	87	no
OKI	21	yes
Olson	88	yes
Orion	46	yes
Panasonic	76	yes
Peerless	89	yes
Penncrest	90	yes
Petite	107	yes
Phoenix	19	no
Plata	9	yes
Raleigh	61	yes
Realistic	91	yes
Realtone	92	yes
Rhapsody	14	yes
Roberts	93	yes
Robin	73	yes
Ross	94	yes
Ross Magnifique	94	no
Sansui	96	yes
Saxony	120	yes
Seavox	46	no
Seminole	95	no
Sharp	99	yes
Sheraton	100	yes
Shibaden	101	yes
Skymaster	83	no

Brand Name	Importer and/or Distributor	Sams Coverage
Singer	102	yes
Sony	103	yes
Soundesign	92	yes
Spica	108	yes
Stanbrooke	113	no
Standard	105, 105A	yes
Stanford	106	no
Starfire	70	no
Stellar	10	no
Stereo-Dyn	9	no
Stereomatic	1	no
Stewart	67	no
St. Moritz	69	no
Summit	108	no
Suora	35	no
Supre-Macy	68	yes
Symphonic	109	yes
Tact	52	no
Tandberg	110	yes
Telefunken	111	yes
Telmar (Martel)	71	no
Telmar	112	no
Ten	97	yes
Tonecrest	78	yes
Tonemaster (Broadmoor)	17	yes
Tonemaster (TAC)	121	yes
Tonex	19	no
Toshiba	118	yes
Townley	40	no
Tropicana	15	no
Truetone	125	yes
Tussah	122	no
Uher	71	yes
Valiant	123	yes
Vantage	60	yes
Vesper	115	yes
Vicount	29	no
Viscount	29	yes
Vista	30	yes
Vornado	124	yes
Waltham	57	no
Wilco	97	yes
Wilson	126	no
York	127	yes

more . . .

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Elizabeth, NJ 07201
4. American Geloso
Electronics, Inc.
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240 Fifth Ave.
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Chicago, IL 60607

7A. Bee Electronics
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Chicago, IL 60610

8. Arvin Industries, Inc.
Columbus, IN 47201
9. Associated Importers, Inc.
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Hialeah, Miami, FL 33010
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11. Automotive Associates
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New York, NY 10017
12. Autovox Corp. of America
250 West 57th St.
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Route 33
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15. Belletronics
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New York, NY 10009
16. Robert Bosch Corp.
40-25 Crescent St.
Long Island City, NY 11101
17. Broadmoor Industries
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Des Plaines, IL 60018
18. Bulova Watch Co.
630 Fifth Ave.
New York, NY 10020
19. Caltrade Mfg. & Trading Co.
360 9th St.
San Francisco, CA 94103
20. Candle America Corp.
1475 Venice Blvd.
Los Angeles, CA 90006
21. Chancellor Electronics Inc.
457 Chancellor Ave.
Newark, NJ 07112
22. Charles Brown & Co.
1170 Broadway
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23. A. Cohen & Sons, Inc.
27 West 23rd St.
New York, NY 10010
24. Clairtone Sound Corp. Ltd.
681 Fifth Ave.
New York, NY 10022
25. Columbia Records Corp.
51 W. 52nd St.
New York, NY 10019
26. Commodore Import Corp.
507 Flushing Ave.
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27. Concertone, Inc.
3962 Landmark St.
Culver City, CA 90230
28. Concord Electronics Corp.
1935 Armacost Ave.
Los Angeles, CA 90025
29. Consolidated Merchandise Corp.
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New York, NY 10001
30. Craig Panorama, Inc.
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34. Delmonico International
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38. Electrohome Limited
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61. Kaysons International, Ltd.
6500 Flotilla St.
Los Angeles, CA 90022
62. Koyo International
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New York, NY 10002
63. Lafayette Electronics
P. O. Box 13
Syossett, L. I., NY 11791
64. Lloyd Electronics Inc.
59 N. Fifth St.
Saddlebrook, NJ 07662

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of Calif., Inc.
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City of Commerce, CA 90022

65. Lucky International
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66. Luxor International
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New York, NY 10001
67. Lynn Stewart Co.
439 E. Illinois St.
Chicago, IL 60611
68. Macy Dept. Store
Herald Square
New York, NY 10001
69. Manhattan Novelty Co.
263 Canal St.
New York, NY 10013
70. Mar-Lin Radio Corp.
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88. Olson Electronics Inc.
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89. Peerless Telerad, Inc.
162 Fifth Ave.
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98. Selectron International
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100. Sheraton Electronics
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102. Singer Consumer Products
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103. Sony/Superscope
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104. Spiegel, Inc.
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105. Standard Radio Corp.
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Woodside, NY 11377

105A. Standard Radio Corp.
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106. Stanford International
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107. Sterling Hi-Fidelity, Inc.
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108. Summit International Corp.
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120. Trans-Aire Electronics Corp.
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121. Trans America
International Co., Inc.
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Chicago, IL 60631
122. Tussah Corp.
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123. Valiant Importers
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New York, NY 10010
124. Vornado, Inc.
174 Passaic St.
Garfield, NJ 07026
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Circle 15 on literature card

New From Sylvania for 69

by Ellsworth Ladyman

This manufacturer's new TV line features more solid-state circuitry, plug-in transistors and other design innovations that provide improved serviceability.

Sylvania has incorporated several circuit design innovations into their new line of color and black-and-white receivers. Transistorized stages now make up two-thirds of the total circuitry, resulting in lower requirements for power supply outputs and a reduction of total power consumption in color receivers to approximately 100 watts.

Plug-in transistors are employed in many color chassis. The success of this depends on the reliability of the transistor socket; however, Sylvania feels that they have a good, rugged socket that will greatly increase the serviceability of their equipment. Other Sylvania features that will please most service technicians include: removable bottom panels on most models of color receivers, which allow access to the circuitry without the chassis being removed; printed-circuit panels that are more translucent than previous designs, allowing better visibility when circuit tracing; components so positioned (grid layout) that servicing procedures are simpler to follow; and back cover removal in console models facilitated by the use of retaining clips that require only a greater turn for release. One model (a 19″ black-and-white) features a slide-out chassis that locks in place for servicing. This is a definite improvement over the "propping and leaning" procedure that is necessary in more conventional chassis.

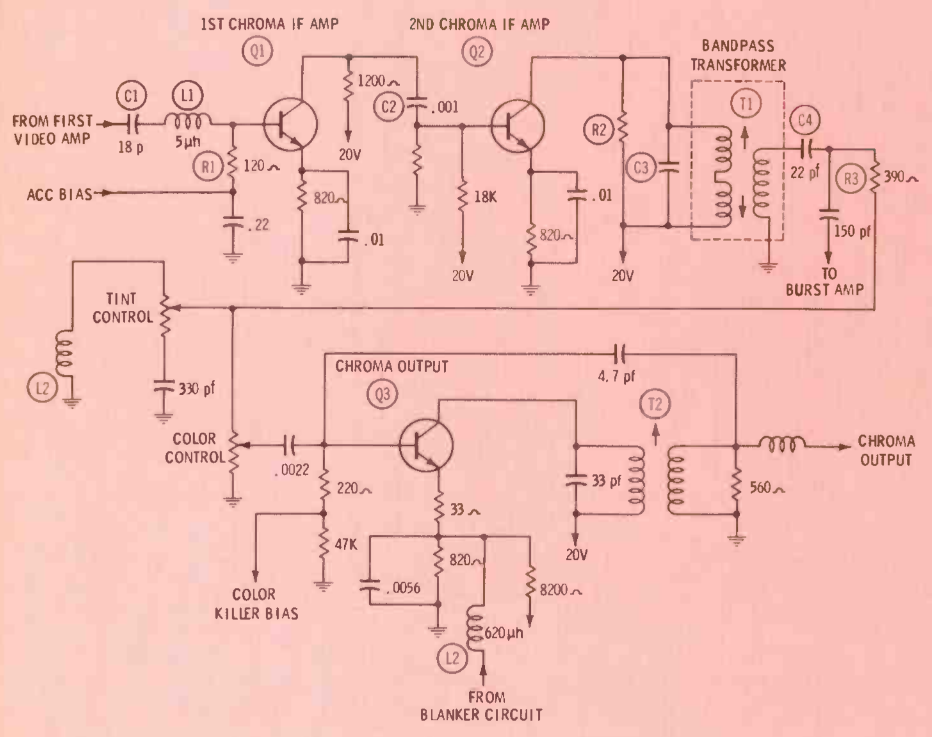

Fig. 1 Chroma IF amplifier and chroma output circuitry employed in Sylvania D12 and D13 chassis.

Chroma IF Amplifiers (Fig. 1)

The composite video signal from the first video amplifier emitter is coupled to the first chroma amplifier through a coupling network comprised of capacitor C1 and inductor L1. The values of these components are selected to provide attenuation of low-frequency video signals and to pass frequencies in the chroma IF band. The amount of amplification of these signals by the 1st chroma IF amplifier (Q1) is dependent on the amplitude of the ACC bias applied to the base of Q1 through resistor R1. The output of the first chroma IF amplifier is then coupled through C2 to the base of the second chroma IF amplifier, Q2.

The output of the second chroma IF is applied across a resonant circuit consisting of bandpass transformer T1 and capacitor C2. The resistor (R2) shunting the resonant circuit insures the proper bandpass for the circuit. The bandpass transformer has an upper and lower slug adjustment. The upper slug is adjusted for 3.1 MHz, the lower slug for 4.1 MHz. Proper adjustment of both slugs allows the bandpass

transformer to pass the full range of chroma IF frequencies.

The output of the resonant circuit is then fed to the tint and color controls through a coupling network consisting of capacitor C4 and resistor R3. The tint control functions to provide either capacitance or inductance loading of the bandpass transformer. This provides a phase shift of the entire chroma IF signal and results in full tint control. The color control functions to vary the amplitude of the color signals applied to the base of the chroma output stage, Q3.

The base of Q3 receives bias from the collector of the color killer transistor. A blanking pulse from the emitter of the blanker transistor is coupled through inductor L2 to the emitter of Q3. The blanking pulse effectively eliminates the 3.58-MHz burst signal from the chroma output collector signal, thus permitting only true color signals to be coupled through transformer T2 to the demodulator circuits, and providing suitable DC reference for the chroma signal.

Burst Amplifier (Fig. 2)

Chroma and burst signals are applied to the burst amplifier (Q1). This stage is normally biased off by the action of resistor R2, which maintains the base voltage at or near the emitter potential. When a pulse from the blanker emitter is applied to the base (during the burst interval) the burst amplifier is keyed on and passes only the burst signal. The burst signal is then applied across the primary windings of the burst transformer T1. The output of the burst amplifier, consisting only of amplified color sync bursts, is transformer-coupled to phase detector diodes X2 and X4 and killer detector diodes X1 and X3.

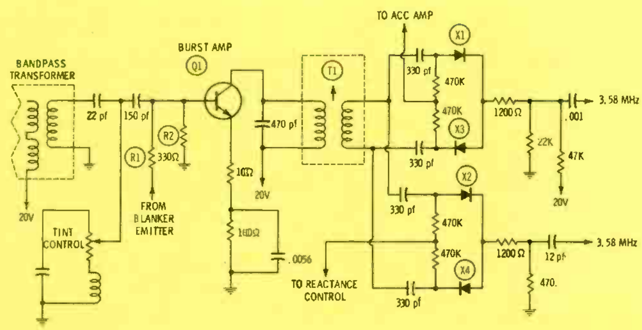

Fig. 2 Burst amplifier and phase detectors employed in Sylvania's new chassis.

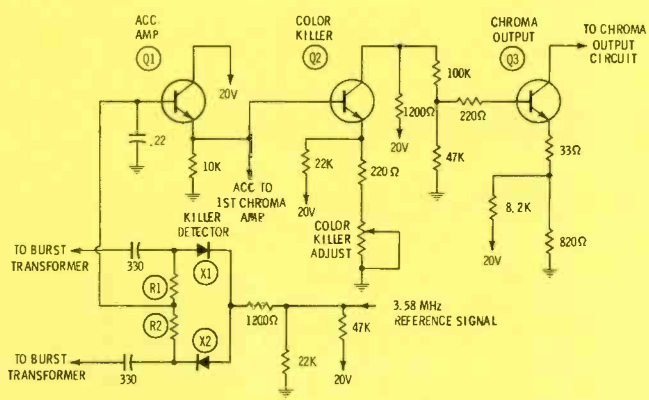

Fig. 3 Automatic chroma control and color killer circuits.

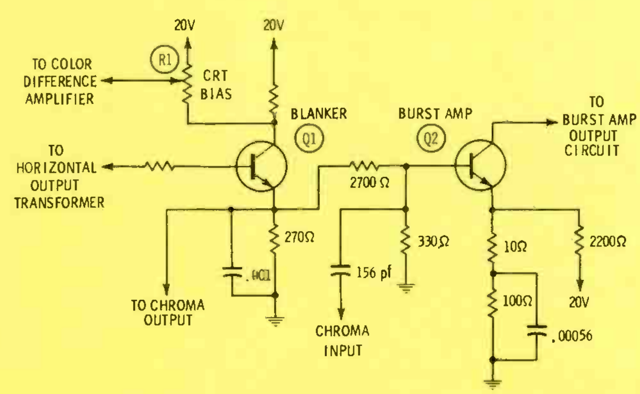

Fig. 4 Blanker circuitry cuts off CRT during horizontal retrace and establishes grid leak bias for color difference amplifiers.

ACC and Color Killer (Fig. 3)

When a color burst signal is received, it is gated by the action of the blanker stage and applied to the burst amplifier circuit. The output of the burst amplifier is transformer-coupled to the ACC and killer detector circuits. Opposite phases of the burst signal are applied to the cathode of X1 and anode of X2. Both signals are then compared in amplitude to a 3.58-MHz reference voltage, or signal. The reference signal is applied to the anode of X1 and cathode of X2.

During an interval of burst signal, one diode conducts more than the other and produces a less positive voltage at the junction of R1 and R2. This voltage is coupled to the base of the ACC amplifier, Q1, and biases it to cut-off, reducing the emitter bias voltage. The emitter voltage produced as a result of this circuit operation is used to supply ACC signals for the first chroma amplifier and as a "turn-off" pulse for the color killer stage. When the color burst signal is not being received, only the 3.58-MHz reference signal is applied to the ACC detector diodes; consequently, the voltage at the junction of R1 and R2 is more positive (approximately 4.0 to 6.0 volts). This positive voltage biases on the ACC and color killer transistors, and the emitter voltage of Q2, the color killer, drops to approximately 5.0 volts. This circuit action applies approximately 1.0 volt of signal to the base of Q3, the chroma amplifier stage, biasing it to cut-off and blocking any extraneous color signals.

Blanker Circuit (Fig. 4)

Positive pulses from the horizontal output transformer are coupled to the base of the blanker transistor, Q1. These pulses are inverted in the collector of Q1 to provide negative gating pulses for blanking of the CRT during horizontal retrace time and to establish grid-leak bias for the color difference amplifiers.

The CRT bias control, R1, is used to vary the amplitude of these pulses and, consequently, the amount of grid leak bias developed at the grids of the color difference amplifiers. The average CRT bias is therefore a product of the rate of conduction of the color difference amplifiers.

The blanker stage also functions as an emitter-follower circuit, supplying positive-going pulses to the base of the burst amplifier. These pulses bias on the burst amplifier during color sync burst intervals, so that it amplifies only color sync burst signals. The emitter of Q1 is also connected through a resistance-inductance network to the emitter of the chroma output stage to remove burst signals during retrace time.

X and Z Demodulators (Fig. 5)

To effectively demodulate the chroma sidebands, the X and Z demodulator circuits provide synchronous detection of these signals with a 3.58-MHz reference oscillator injection voltage. The amplitude of the reference signal is several times the magnitude of the chroma input signal voltage and supplies large amplitude 3.58-MHz pulses in the collector circuits of the demodulators. A phase shift network, comprised of inductor L1 and capacitor C1, shifts the phase of the 3.58-MHz signal applied to the Z demodulator approximately 90 degrees. This phase shift provides the most faithful color reproduction.

The phase and amplitude of the chroma signals applied to the bases of the demodulators affect the average amplitude of the pulses present in the collector circuit of each demodulator. These pulses will go somewhat less positive (to approximately one-half the B+ voltage). If the incoming chroma signal is in phase with the 3.58-MHz reference signal, the collector pulses will drop to less than one-half the B+ amplitude. If the incoming chroma signals are out of phase with the reference signal, the collector pulses will not drop to one-half the B+ value. If the incoming chroma signals are 90 degrees out of phase with the reference voltage, part of the collector pulse will fall below the nominal one-half B+ value, and part of the collector pulse will go above the one-half B+ level. This action produces an average of "zero change" in the collector pulses. A low-pass filter network, comprised of capacitor C2 and inductor L2 in the X demodulator and capacitor C3 and inductor L3 in the Z demodulator, functions to "average" the collector pulses. As a result of this filtering of the collector pulses, only color video information remains. This information is then capacitance-coupled to the color difference amplifier.

Protection for High-Voltage Circuits (Fig. 6)

A system of interconnected bias networks protects the high-voltage section. These interconnected bias networks perform the following functions:

1. Reduce the horizontal output drive signal.
2. Decrease the conduction rate of the CRT by negative biasing the final video amplifier stage.
3. Provide "over-voltage" protection for the horizontal output transformer, CRT and associated high-voltage components.

During normal circuit operation the shunt regulator, V2, conducts through diode X2, placing the anode of X2 at near B+ potential. This positive voltage is fed to the grid of the horizontal output tube through a divider network consisting of R1 and R2, driving this tube into hard conduction. If the high-voltage regulator stops conducting, its cathode will become more negative, reverse biasing diode X2. The positive voltage that was applied through divider network R1-R2 to the horizontal output grid will be removed and the grid will be more negative, and conduction will be decreased.

Feedback pulses from the horizontal output transformer are added to the grid-leak bias that the grid network develops. These pulses are rectified and filtered by diode X1 and resistor R2 to produce a more negative grid-bias potential. When the shunt regulator stops conducting, removing the positive potential from the grid, the negative potential increases accordingly, to decrease the output current of the horizontal output tube. This will tend to keep the high voltage within safe limits.

The horizontal output tube grid circuit voltage is also applied to the brightness control and the biasing circuit of the video output stage. If high-voltage regulation is lost (regulator ceases conduction) the increased negative voltage present at the horizontal output grid is also applied to the video output stage. The video output stage will decrease conduction in accordance with this biasing action. This will produce more positive voltage on the CRT cathodes, which, in turn, will decrease the CRT brightness.

Brightness Control and DC Restoration (Fig. 7)

The brightness control circuit provides a DC path for retaining the DC level of the video signal. One end of the control is connected to the horizontal output grid. This circuit makes available a large range of negative bias voltage for application to the grid of the video output tube. To decrease brightness, the control should be rotated in the direction of the horizontal output grid source, shown in Fig. 7. This will result in greater bias on the grid of the video output tube, increasing the plate voltage and placing a more positive voltage on the CRT cathodes.

DC coupling from the video detector to the cathodes of the CRT provides DC restoration. Part of this coupling path is through the brightness control. ▲

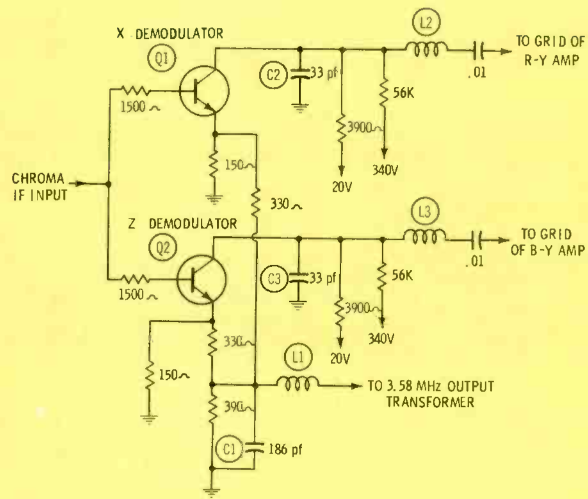

Fig. 5 Synchronous X and Z color demodulators are employed in new Sylvania chassis.

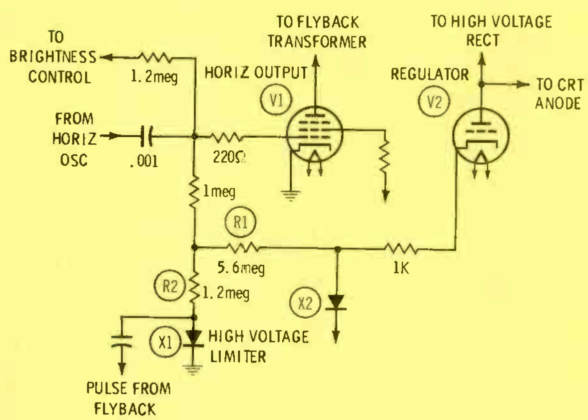

Fig. 6 Interconnected bias networks provide protection for horizontal output and high-voltage circuits.

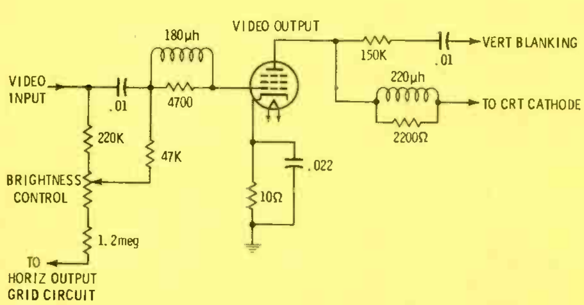

Fig. 7 Brightness control circuit is in grid circuit of video output tube in Sylvania's D12 and D13 chassis.

A look at RCA's solid-state color Part 3

Further analysis of RCA's CTC40, from the chroma takeoff to the CRT control grid clamp diodes.

by Ellsworth Ladyman

1st and 2nd Chroma Amplifiers (Fig. 1)

The chroma signal is applied to the base of the first chroma amplifier through a tuned circuit comprised of capacitors C1, C2 and inductor L1. This circuit is referred to as a "chroma take-off" or "chroma peaker" circuit. Resistors R1 and R2 broaden the bandpass to compensate for loss of chroma sidebands on the response curve of the peaker circuit. The ratio of values of resistors R1 and R2 also provide the proper input impedance for the first chroma amplifier.

Bias for the base of the first chroma amplifier stage is supplied and determined by the ACC amplifier. Output of the 1st chroma amplifier, Q1, is RC coupled to the base of the second chroma amplifier, Q2. The 2nd chroma amplifier stage is a straight-forward common-emitter circuit.

Bias for Q2 is obtained from a voltage divider network consisting of resistors R3 and R4. The output (collector) circuit consists of load inductor L2, capacitors C3 and C4, and the capacitance of the coupling cable. This combination of components forms a broadly tuned circuit with a response that falls within the limits of the desired chroma bandpass.

Phase Splitter (Fig. 2)

The phase splitter circuitry provides a means of varying the phase of the chroma signal, or, in effect, provides a method of varying the tint. Chroma signals are applied across the color control and capacitance-coupled to the base of the phase splitter. Output voltages are taken from both the collector and emitter and applied across a phase shifting network comprised of the tint control and capacitor C1.

The phase splitter and its associated circuitry are located on the customer controls bracket. The tint and color controls are consumer controls and extend through the front control panel.

Bandpass Amplifier (Fig. 3)

The output of the phase splitter is capacitance-coupled through C1 to the base of Q1, the bandpass amplifier. Q1 is connected as a common-emitter. Base bias for Q1 is obtained from the killer stage. The output load for Q1 is T1, the bandpass transformer.

A negative-going pulse is applied to the base of Q1 for burst blanking. This is done to prevent the color sync signal from being amplified by the bandpass amplifier.

A double-tuned bandpass transformer determines the exact range of chroma frequencies applied to the demodulators. The secondary winding of T1 is shunted and tuned by capacitor C2. Resistor R1 provides loading and aids in determining the "Q" of the circuit.

Burst Amplifier (Fig. 4)

A simplified version of the burst amplifier stage utilized in the

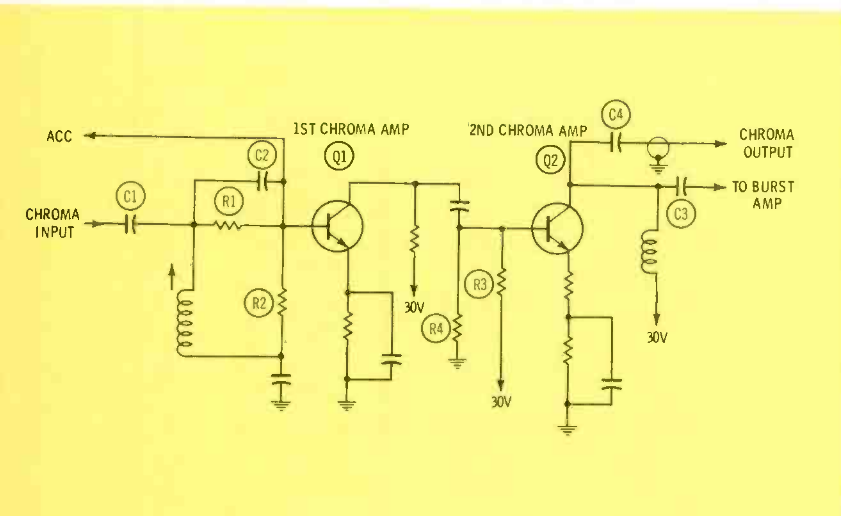

Fig. 1 First stage of two-stage chroma amplifier employed in CTC40 is ACC controlled.

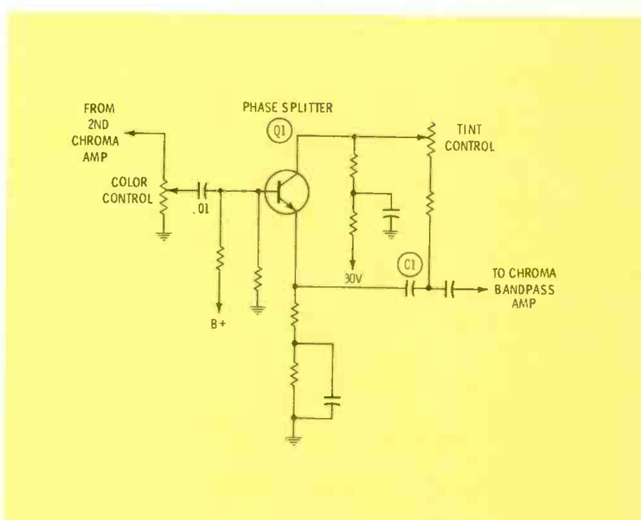

Fig. 2 Tint control in CTC40 is electrically located in collector circuit of phase splitter.

CTC40 chassis is illustrated in Fig. 4. The color sync signal from the collector of the second chroma amplifier is applied to the base of the burst amplifier transistor through capacitor C1. A positive-going keying pulse (15 volts p-p) from the horizontal output transformer is applied to the base across resistor R1. The integrating characteristics of capacitor C1 and resistor R1 provides the required time delay for the keying pulse.

The burst amplifier transistor is keyed into conduction by the pulses from the horizontal output transformer, which arrive at the base of the transistor at the same time as the bursts of color sync signals.

The burst signal is amplified by the burst amplifier and appears across the burst transformer, T1. Loading for the burst transformer is provided by resistor R2.

During conduction of the burst amplifier, resistor R4 establishes the proper emitter operating point. Capacitor C3 functions as an AC bypass capacitor. Resistor R3 provides the required amount of emitter degeneration for proper amplifier stability with maximum voltage gain. Capacitor C2 provides the amount of feedback voltage necessary to cancel the effects of the internal feedback capacitance of the transistor.

The burst amplifier base-emitter bias is maintained below cut-off during scan time, or between burst keying pulses. This assures that only color sync signals are supplied to the AFPC detector. The required "scan-time bias" is developed by the discharge of capacitor C3, the emitter bypass capacitor, through emitter resistor R4. Emitter current flow, resulting from the application of the burst keying pulse, places a positive bias on the emitter. This reverse biases the transistor during scan time. Diode X1 functions to prevent the bias voltage from exceeding the reverse emitter-base breakdown voltage rating.

Automatic Frequency and Phase Control (AFPC) Detector (Fig. 5)

The purpose of the AFPC detector circuit is to develop a DC voltage that is proportional to the frequency and phase difference that exists between the applied color sync signal (burst) and the reference signal supplied by the 3.58-MHz oscillator in the receiver. Rigid control over the operation of the 3.58-MHz oscillator is a prerequisite for proper color demodulation. This is because the output of the 3.58-MHz oscillator is the reference, or standard, on which chroma demodulation is based.

The AFPC detector circuit in the CTC40 chassis is, in effect, a phase-sensitive discriminator. The burst signal is fed at equal amplitude and opposite phases through capacitors C1 and C2 to diodes X1 and X2. A sample of the 3.58-MHz reference voltage is applied to the junction of the cathode of X1 and the anode of X2. When the reference voltage and the burst signal are in phase, the diodes will conduct in equal amounts but in opposite directions. The result is zero AFPC voltage.

If the reference voltage lags the incoming burst voltage, diode X2 conducts more than diode X1, causing an imbalance in current flow through resistors R1-R2, and a positive AFPC voltage will be developed. If the reference voltage leads the incoming burst signal, diode X1 conducts more than diode X2, again producing an imbalance in current flow through resistors R1-R2, but in this instance a negative AFPC voltage will be developed.

3.58-MHz Reference Oscillator (Fig. 6)

The chroma reference oscillator is a modified Clapp-type circuit. Feedback is accomplished by R7, C3, and C2, which couple an in-phase signal back to the base.

The operating frequency is determined by the 3.58-MHz crystal and the combined capacitance of capacitors C2, C3 and varactor X1. The varactor utilizes a specially

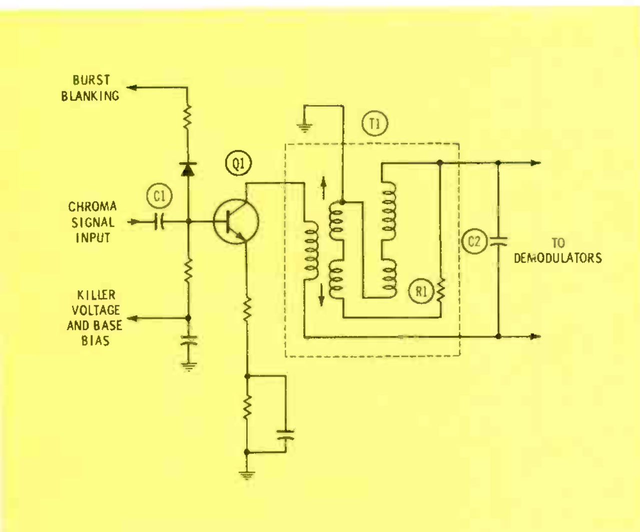

Fig. 3 Three signals or voltages are applied to base of bandpass amplifier: chroma input signal, bias from color killer and negative-going burst signal.

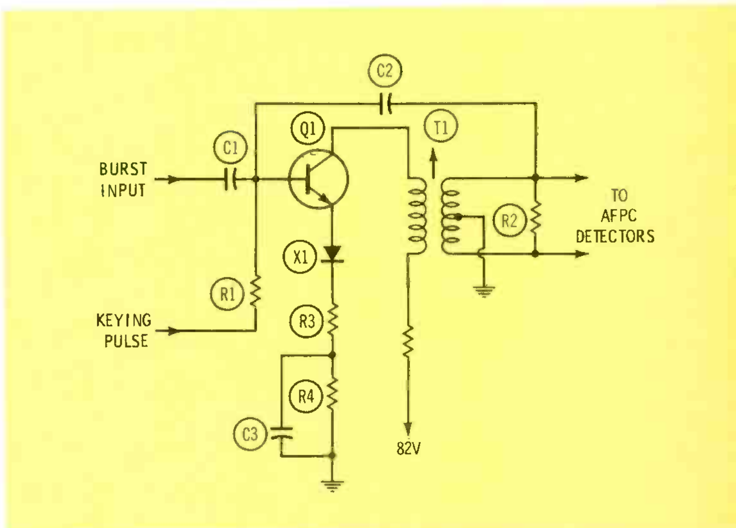

Fig. 4 Simplified schematic diagram of burst amplifier employed in CTC40.

constructed junction that enhances the normal voltage-dependent capacitance characteristics of a diode. The frequency of the oscillator can be varied over a very limited range by changing the voltage impressed across the varactor diode. Thus, the AFPC voltage, and the voltage determined by the divider network (AFPC adjust and R3), will vary the oscillator frequency a small amount. Capacitor C1 serves as a low-impedance ground return for the varactor and has no effect on the oscillator frequency.

The CW amplifier, Q2, operates into a high-Q, single-tuned transformer, T1, that develops a sine wave from the amplifier output current pulses. Capacitors C6 and C7 function as a capacitance voltage divider network that provides the 3.58-MHz reference level to the AFPC detector circuit. The transformer secondary couples the 3.58-MHz signal to the color demodulator stages.

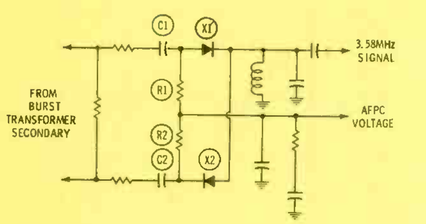

Fig. 5 Automatic frequency and phase control (AFPC) circuit develops DC voltage proportional to frequency and phase differences between color burst and 3.58-MHz reference signal.

Color-Killer Circuits (Fig. 7)

The primary purpose of the color killer system is to prevent spurious or extraneous color "noise" from being observed on the CRT during b-w reception. In the RCA CTC40 chassis this is accomplished by cutting off the bandpass amplifier stage.

Control voltage for the color killer is developed by the ACC detector circuitry and is applied to the killer amplifier. The killer amplifier controls the killer switch stage, which, in turn, switches the bandpass amplifier from a state of conduction to a state of non-conduction when a monochrome signal is received.

During periods of color transmissions, the killer switch stage is biased into saturation by the conduction of the killer amplifier. Saturation of the killer switch effectively clamps both its base and emitter elements to the potential of its collector. Since the killer switch is directly coupled to the base of the bandpass amplifier, its collector voltage (as determined by the divider network of R1-R2) determines the forward bias of the bandpass amplifier. This action controls the conduction of the bandpass amplifier which continues to conduct as long as there is a color signal being received.

During monochrome reception the absence of a color sync signal causes the ACC detector to develop a positive output voltage. This positive output signal biases off the killer amplifier and stops the forward biasing current to the killer switch. The killer switch is then cut-off, effectively "opening up" the bandpass amplifier forward bias circuit. With the bandpass amplifier "cut-off," no extraneous chroma information is fed to the color demodulators.

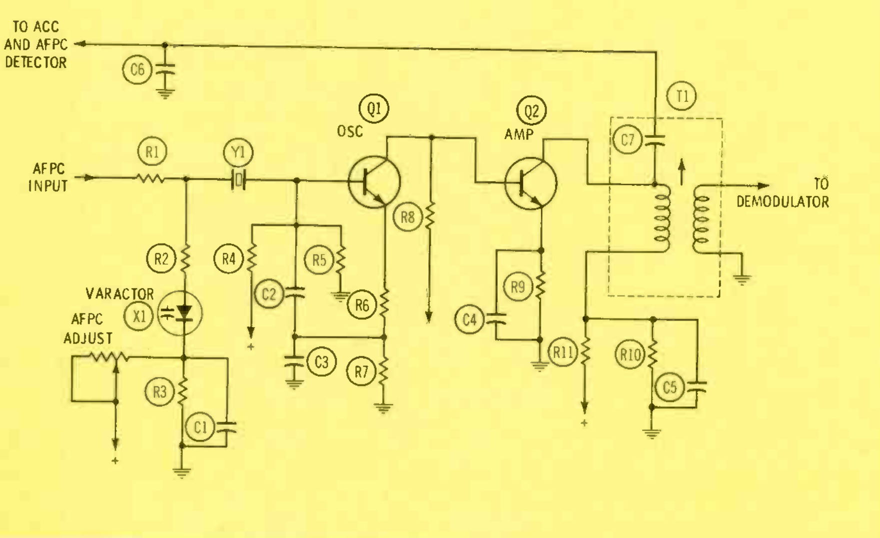

Fig. 6 Modified Clapp-type chroma reference oscillator utilizes regenerative feedback between emitter and base of Q1 via R7, C3 and C2.

Chroma Demodulators (Fig. 8)

Three color demodulator circuits are employed in the CTC40 chassis, one for each color-difference signal. The use of a separate G-Y demodulator increases the bandwidth of the signal.

The chroma demodulator circuits are balanced dual-diode detectors. The output of each dual-diode circuit is proportional to both the phase and amplitude of the applied signal.

Two signals are applied to each demodulator circuit: a composite color signal from the bandpass amplifier and the reference signal from the 3.58-MHz oscillator circuit. The phase of the reference signal is shifted a specific amount with respect to the burst signal for each demodulator, extracting the appropriate color-difference signal from the input chroma signal. Circuit action is as follows:

The phase of the 3.58-MHz reference signal applied to the R-Y demodulator is shifted by capacitor C1 and inductor L1. This phase shift permits the R-Y demodulator output to be proportional to the amplitude of the R-Y component of the chroma signal. Phase shifting for the B-Y signal is accomplished by capacitor C2 and inductor L2. The 3.58-MHz reference signal is applied directly to the G-Y component of the chroma signal. Proper loading of the 3.58-MHz CW amplifier is provided by resistors R3 and R4.

Color Driver and Output Circuitry (Fig. 9)

All three color driver and output circuits are identical with the exception of certain component values. For purposes of operational analysis only one circuit, the R-Y driver and output, will be discussed.

The actual theory and operation of the R-Y stage will be representative of all three circuits.

The driver circuit is connected as an emitter-follower to provide the proper impedance match between the comparatively high output impedance of the demodulator circuit and the relatively lower input impedance of the output stage. The 3.58-MHz ripple component is attenuated from the output of the demodulator circuit by a low-pass filter comprised of inductor L1 and the input impedance of the driver stage. Base bias for the driver stage is developed by the divider network comprised of resistors R1, R2 and R3. A better degree of stability is derived by connecting this network between the collector of the output stage and the base of the driver transistor. RF grounding is provided by capacitor C1, which reduces the effects of output-to-driver feedback capacitance. The gain of the output stage is a function of the emitter resistor R4 and the collector load resistance in the control grid circuitry of the CRT.

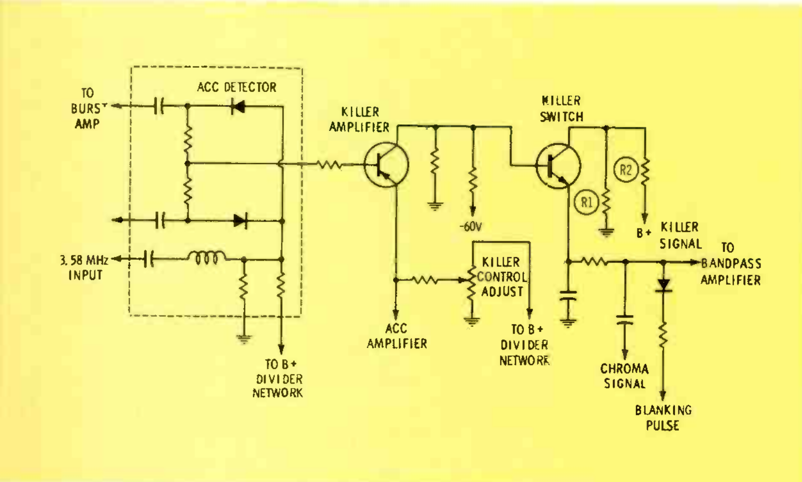

Fig. 7 CTC40 employs two-stage color killer section that controls conduction of the bandpass amplifier stage.

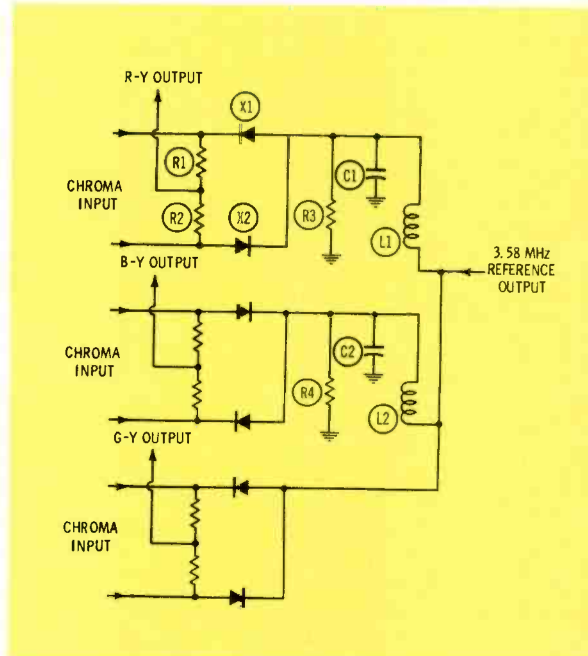

Fig. 8 Balanced dual-diode chroma demodulators produce outputs that are proportional to both the amplitude and phase of the applied chroma signal.

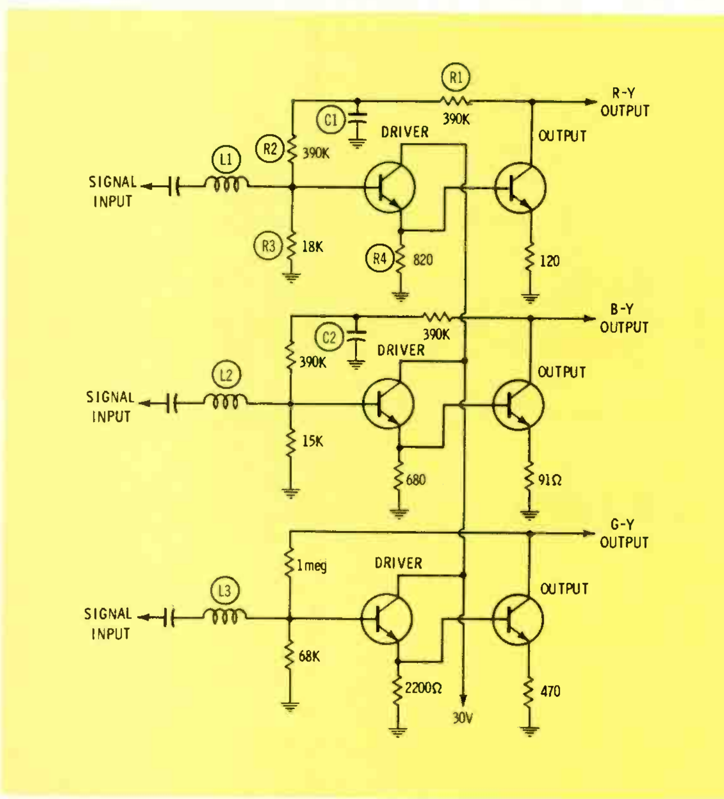

Fig. 9 Output of chroma demodulators is amplified by two-stage color difference amplifier. Driver stage is emitter follower for impedance matching between demodulators and output amplifiers.

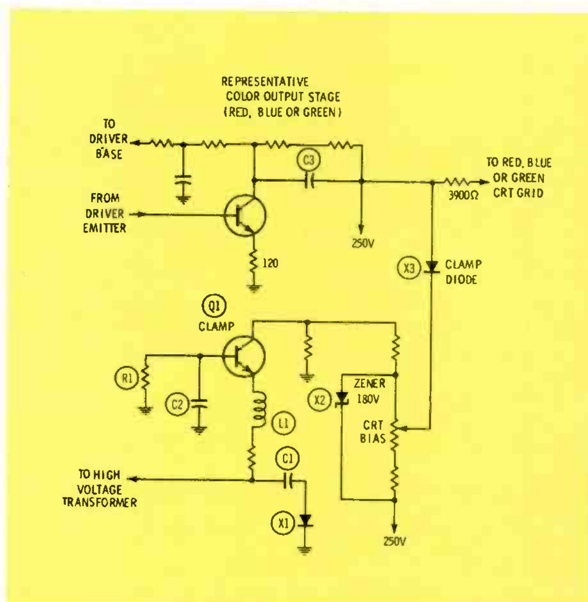

Fig. 10 Clamp diodes in grid circuits of CRT restores DC level of chroma signal lost in AC coupling between chroma demodulators, chroma amplifiers and CRT control grids.

Clamp Circuitry (Fig. 10)

A certain amount of the chroma DC level is lost because of the AC coupling between the chroma demodulators, chroma amplifiers and CRT control grids. It is the function of the clamp circuit to restore this DC level.

A negative-going 35-volt pulse is coupled from a tap on the horizontal output transformer to the emitter of the clamp transistor, Q1. Diode X1 removes positive ripple between pulses, and inductor L1 suppresses any radiation present in the clamp circuitry. Capacitor C1 is used to sharpen the timing of the horizontal pulses. These negative-going pulses drive the clamp transistor into saturation. The resulting current flow through the base-emitter junction to ground through resistor R1 develops a voltage across resistor R1, and a negative charge on capacitor C2. The charge on C2 allows very sharp turn-off of the clamp transistor at the end of each pulse.

The amplified pulse that appears across the CRT bias control is clamped by zener diode X2, at a level equal to 180 volts below the B+ voltage of 250 volts. A portion of the pulse voltage is fed to a clamp diode, X3, located in each of the three CRT control grid circuits, resulting in diode conduction, which effectively clamps the CRT control grids to the bias pulse voltage (80 volts). This voltage charges the coupling capacitor, C3, located in the color amplifier output stages. The DC level resulting from the average DC content of the chroma signal is added to this voltage. Thus, a CRT operating point representing the DC level of chroma information is established.

Tracking

Tracking could be termed as the ability of the CRT to maintain gray-scale throughout the entire brightness range. Proper tracking is accomplished by the development of proper bias levels on the CRT elements, screen grids, control grid, and cathode. The required adjustment procedures of the CTC40 chassis is similar to the procedures used previously in RCA chassis CTC28 and CTC30.

Some automatic correction of the potentials on the CRT elements is provided to offset any AC line-voltage fluctuations. Variable voltages for tracking adjustments are derived from the cathode drive controls, the CRT bias adjustment and the screen grid controls. Any fluctuations in AC line voltage is reflected in the B+ potential, and this, in turn, is reflected in the CRT bias and drive voltages. The action of the zener clamp diode, X2 in Fig. 10, causes the CRT bias voltage to vary directly with changes in B+ potentials. This diode action assures that the CRT grids follow the cathodes during changes in zener B+ and, therefore, assures a constant CRT bias with varying line voltages. The CRT screen voltages are obtained from a regulated source and do not vary under line-voltage fluctuations.

The final installment of this series covering RCA's CTC40 solid-state color chassis will analyze the horizontal AFC, oscillator and deflection circuitry. ▲

Practical stereo FM servicing Part 4

by Robert G. Middleton

Overall system evaluation using alignment procedures and harmonic-distortion and intermodulation tests.

Operational checks of an FM stereo-multiplex receiver system that doesn't sound right may provide clues that indicate a step-by-step system alignment is needed. A preliminary test comparing the sound reproduction of an FM stereo broadcast with that of a stereo record may indicate much better sound quality with the record. This symptom points to a malfunctioning of the FM tuner and/or multiplex section, and a step-by-step alignment job may be in order. More detailed data can be obtained by making system harmonic-distortion or system intermodulation-distortion measurements.

System Distortion Measurements

The test setup for making a system harmonic-distortion measurement is shown in Fig. 1. The receiver is driven by a modulated RF signal from an FM stereo multiplex generator. Suitable values of power resistors are connected across the audio-amplifier output terminals. A harmonic-distortion meter is connected across each of the load resistors. The FM tuner must be set precisely to the RF frequency of the generator (typically 100 MHz). Sufficient generator output is used to insure that the limiters in the receiver are saturated. When testing the output from the R-channel audio amplifier, the generator must be set to "R-channel output." When testing the output from the L-channel amplifier, the generator must be set to "L-channel output."

Most technicians are familiar with the operation of an FM stereo-multiplex generator. However, it seems that few technicians are familiar with the harmonic distortion meter. Therefore, let us spend a few minutes reviewing the operation of the instrument.

Fig. 2 shows a schematic diagram for a typical instrument. The meter indicates the "remains" of a signal under test as a percentage of the signal under test after the fundamental frequency is eliminated. The "indicated remains" include all

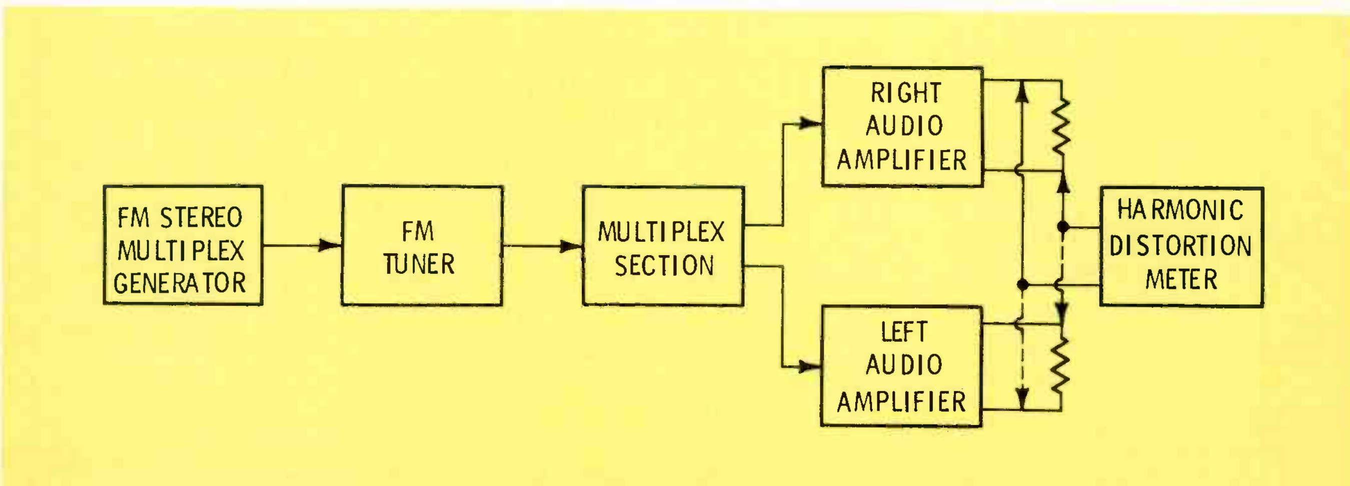

Fig. 1 Test setup for performing harmonic distortion measurement.

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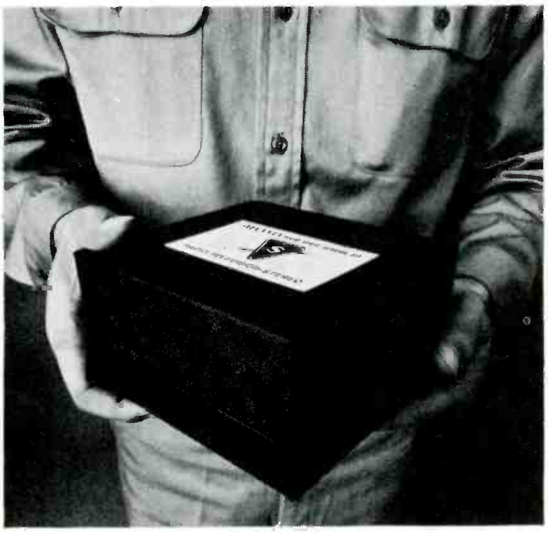

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frequencies in the audio range (hum, harmonics and noise). Normally the "remains" are predominantly the harmonics produced by the receiver system.

The circuit depicted in Fig. 2 may be considered to have three parts: (1) the fundamental suppression circuit; (2) the voltmeter circuit; and, (3) the power supply. Note that the fundamental suppression circuit consists of a triode voltage amplifier (one-half of a 12AX7) driving a phase splitter (12BY7). This phase splitter feeds a Wien-bridge null network that suppresses the fundamental test frequency. In turn, the signal "remains" are stepped up by a voltage amplifier (5879), which drives a cathode follower (one-half of a 12AX7).

It is important to note that the Wien bridge is tunable, and has a rejection characteristic as shown in Fig. 3. When the tuning control of the harmonic-distortion meter is rotated, the null point moves along the frequency axis in Fig. 3. It is also important to note that the Wien bridge can be switched in or out of the meter circuit. When the function switch of the instrument is turned to the "Set Level" position, the Wien bridge is out of the meter circuit. This setting permits us to adjust the receiver output for a reference value of full-scale indication on the meter.

After the full-scale reference level has been set, adjust the frequency switch on the harmonic-distortion meter to a suitable range and carefully adjust the tuning control for minimum indication on the meter. For example, suppose that the generator provides a 1-KHz audio signal. In such a case, set the frequency switch on the harmonic-distortion meter to the 200 to 2000-KHz range, and adjust the tuning control precisely to 1 KHz. At this point, the Wien bridge is tuned exactly to reject the 1-KHz fundamental, and the meter has a minimum reading.

As the minimum meter indication is approached, the pointer usually falls so near to zero that it is difficult to determine the exact minimum adjustment. This can be overcome by employing a higher indication sensitivity (see Fig. 4). If the setting of the sensitivity switch is dropped down from the original 100% setting to 10%, the meter deflection is increased 10 times. Or, if the sensitivity setting is dropped down from the original 100% setting to 1%, the meter deflection is increased 100 times. If a normally-operating hi-fi system is being tested, it is advisable to operate on the 1% setting to obtain ample pointer deflection on the meter.

After the minimum setting has been made, we are ready to read the percentage of harmonic distortion. This reading is made in much the same way as we read a VTVM scale. The only difference is that the meter scale is calibrated in percentage instead of volts. We note the setting of the sensitivity switch and the scale reading, and, in turn, we know the percentage of harmonic distortion. For example, suppose that the setting of the sensitivity switch is 1%. Then, the full-scale meter indication is 1%. If the reading happens to be at half of full-scale, the percentage of harmonic distortion is 0.5%.

Percentage of harmonic distortion is usually measured with full rated power output from the receiver. This is the most demanding test because harmonic distortion tends to de-

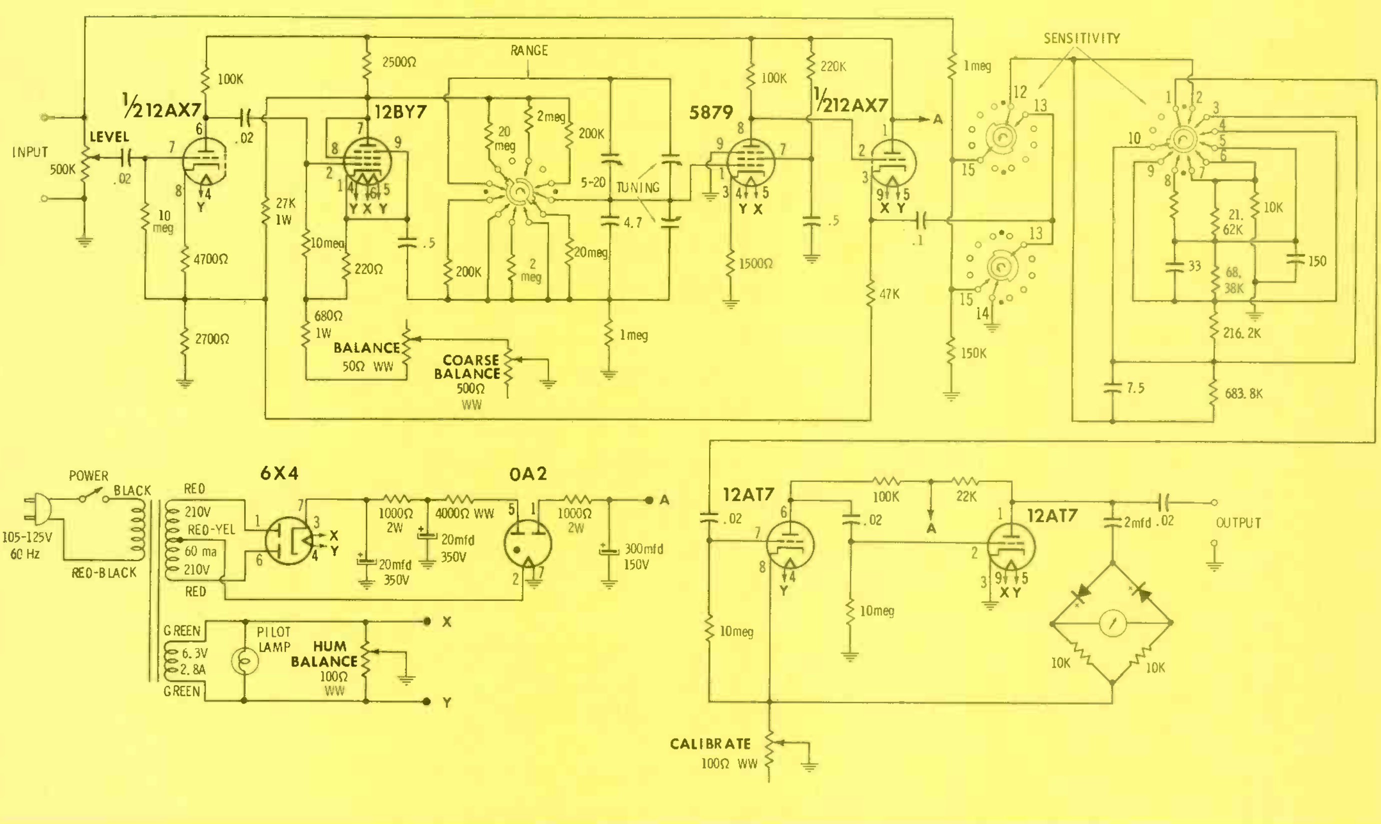

Fig. 2 Circuit diagram of a typical harmonic distortion analyzer.

crease at lower power levels. Let us observe typical test results for a good hi-fi system. Fig. 5 shows the results of a harmonic-distortion test at various audio frequencies for full rated power output, half-power output, and low-power output level. At full power output, the harmonic distortion is less than 0.1% at 400 Hz, and slightly greater than 0.1% at 1 KHz. At 10 KHz, the harmonic distortion is about 0.55%. At reduced power output the harmonic distortion is considerably less.

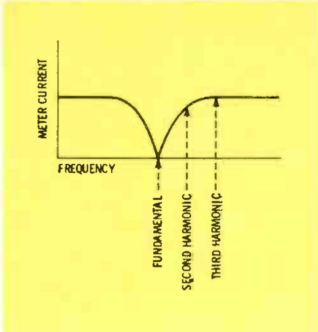

Fig. 3 Frequency-rejection curve for a typical harmonic distortion analyzer.

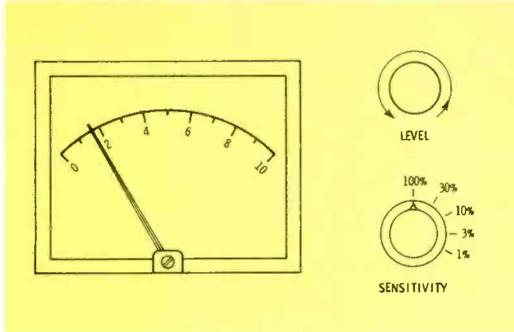

Fig. 4 Calibrated meter and sensitivity and level controls of a harmonic distortion analyzer.

Localization of Trouble

To localize the source of trouble, make a harmonic distortion test at the output of the R audio amplifier, and at the output of the L audio amplifier (Fig. 1). If the percentage of harmonic distortion is low in the R-amplifier test but is high in the L-amplifier test, the trouble will be found in the L amplifier. However, if the percentage of distortion is virtually the same at the output of each amplifier, the trouble is probably in the multiplex section or the tuner section. To definitely clear an audio amplifier from suspicion, make a distortion test of the amplifier by itself, as shown in Fig. 6. The AC VTVM is used to adjust the drive for rated maximum power output, and the harmonic-distortion meter is operated as explained previously.

If the audio amplifiers are not at fault, turn your attention to the multiplex section. Percentage of distortion is checked with the test setup shown in Fig. 7. Note that composite audio output from the generator (not modulated RF output) is used. The generator is set for R-channel output when the harmonic distortion meter is connected to the R output terminals of the adapter, and vice versa. Normally, an adapter has very low harmonic distortion. However, defective tubes or transistors with leaky capacitors that cause incorrect biasing of tubes or transistors can also be responsible.

Poor alignment of the multiplex section can also cause objectionable harmonic distortion, particularly when a synchronized subcarrier oscillator is marginally locked. Therefore, let us consider step-by-step alignment procedures.

In the first analysis, there are two basic types of multiplex configurations. These are called matrixing and time-division. Operation of the

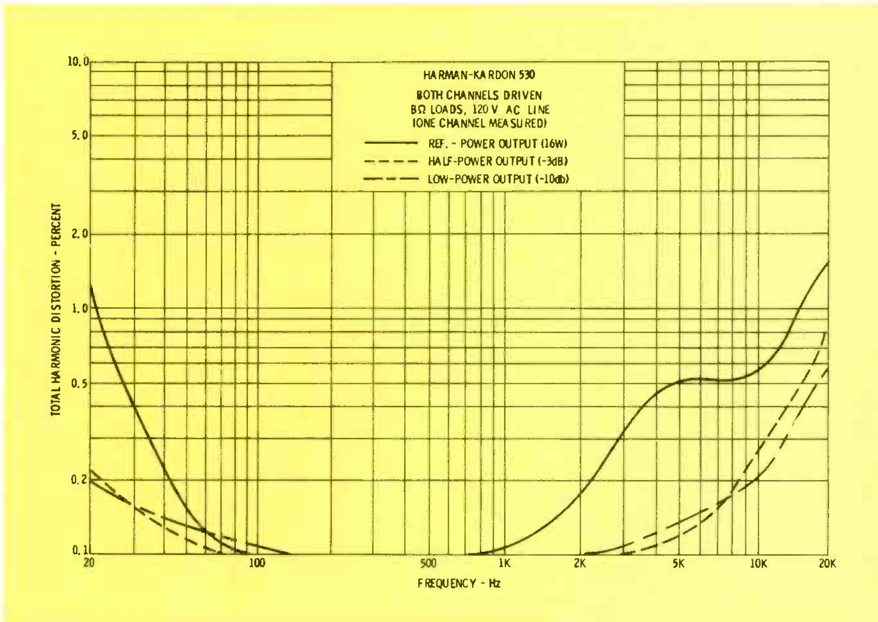

Fig. 5 Percentage of harmonic distortion at various audio frequencies in a good hi-fi system. Courtesy—Harman-Kardon.

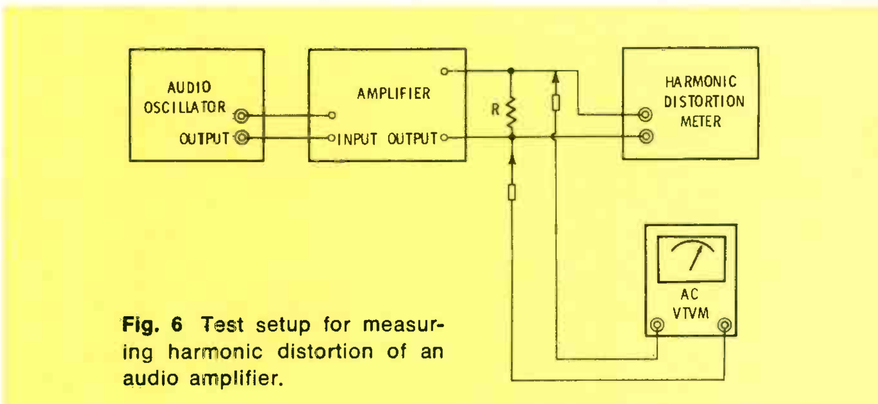

Fig. 6 Test setup for measuring harmonic distortion of an audio amplifier.

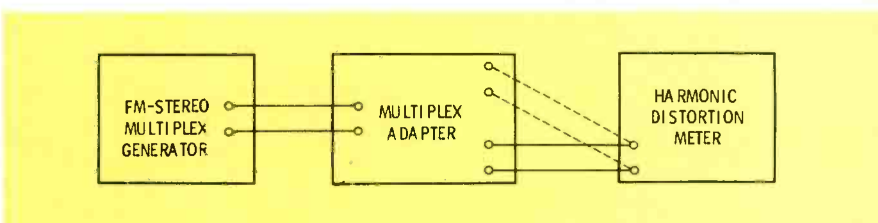

Fig. 7 Harmonic-distortion test setup for a multiplex adapter.

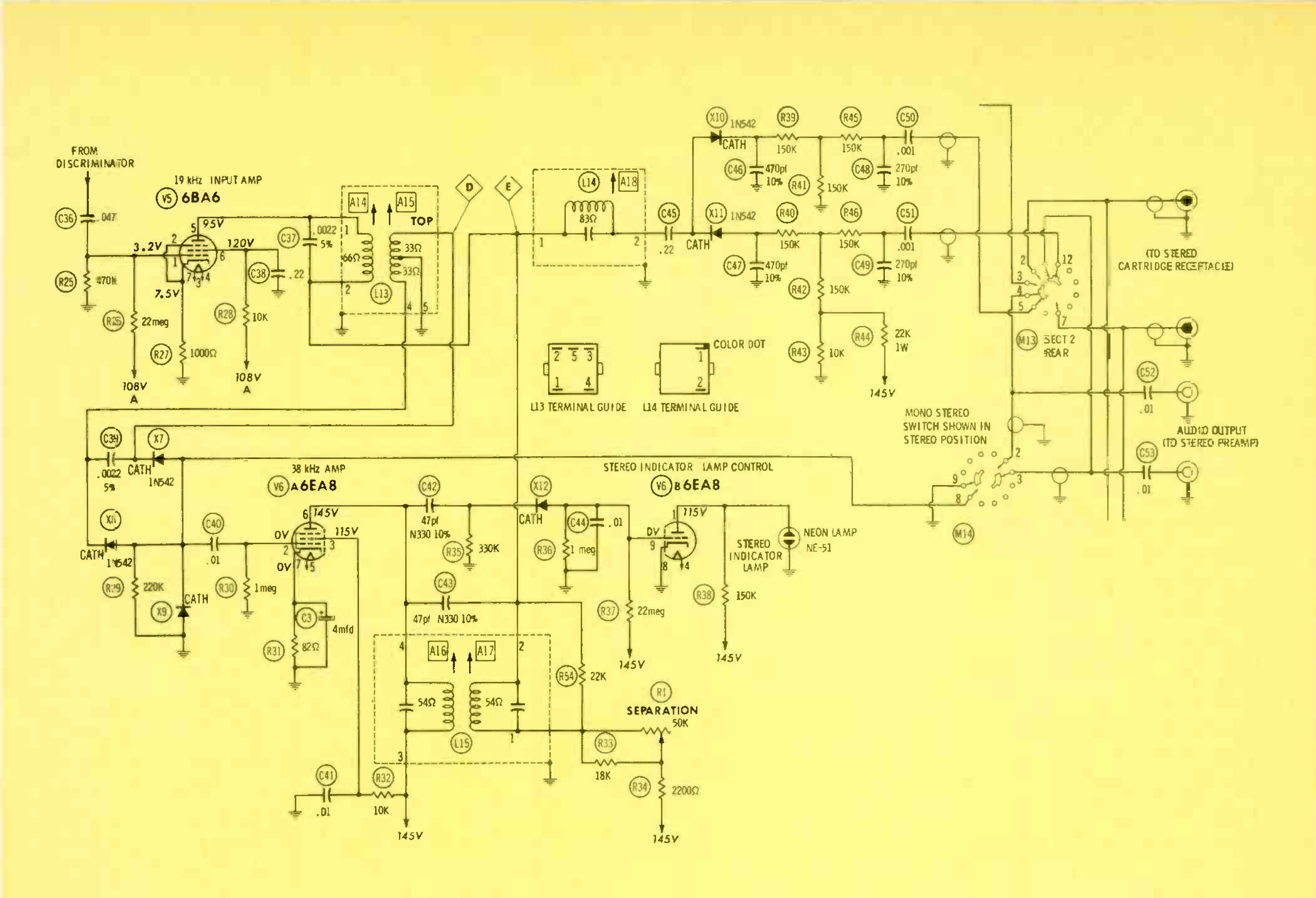

Fig. 8 Multiplex system using an envelope detector circuit.

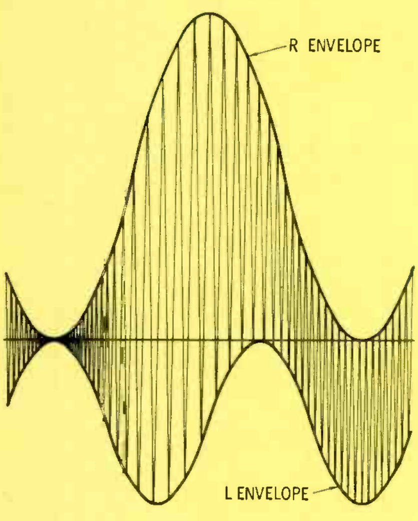

Fig. 9 Undemodulated multiplex waveform with L and R envelopes indicated.

Fig. 10 Test setup for measuring the harmonic distortion of an FM tuner.

TABLE 1

FM stereo multiplex alignment using FM stereo signal generator (±.0001% accuracy)

High side to point C, low side to ground.

	Generator Frequency	Indicator	Adjust	Remarks
1	19 KHz	Vert. Amp. of scope thru 47K to point D, low side to ground.	A14, A15	Adjust for maximum. Set scope to lock in 2 cycles of 19 KHz waveform.
2	19 KHz	Vert. Amp. thru 47K to point E. low side to ground.	A16, A17	Adjust for maximum 4-cycle waveform.
3	67 KHz	Vert. Amp. thru 47K to point E, low side to ground.	A18	Use Audio Oscillator if necessary. Adjust for MINIMUM

To align multiplex section using an air signal, first make sure FM section is properly aligned. Tune in a strong FM stereo signal. Follow steps 1 thru 3 above except in step 3 adjust to eliminate whistle or interference.

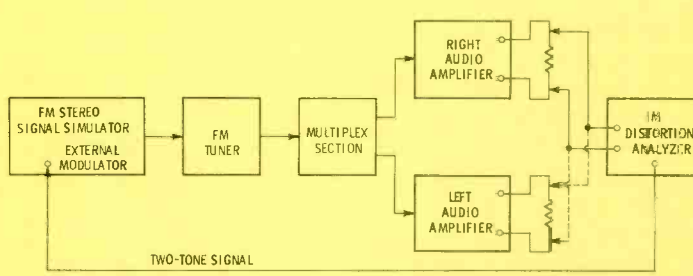

Fig. 11 Test setup for measuring the intermodulation distortion in an FM multiplex stereo system.

matrix type of decoder was explained previously. Therefore, let us consider the alignment procedure for the time-division type of decoder and, in particular, the envelope detection configuration. Fig. 8 depicts a typical envelope-detector circuit. A normal undetected (undemodulated or undecoded) waveform is shown in Fig. 9. Note that after the 38-KHz subcarrier is reinserted into the discriminator output signal, R-signal and L-signal envelopes become available.

With reference to Fig. 8, the output from V5 is fed to L13 and to L14. A 38-KHz subcarrier is fed from L15 into L14. Thus, the R and L envelope signals are fed to diodes X10 and X11. Note that X10 passes the positive envelope signal, and rejects the negative envelope signal. Conversely, X11 passes the negative envelope signal and rejects the positive envelope signal. It is evident that if misalignment causes the subcarrier to have an incorrect phase, both envelope signals will be distorted and the decoder will develop an objectionable amount of harmonic distortion.

If there is no component defect, and distortion is caused simply by misalignment, the procedure tabulated in Table 1 will restore the operation to normal. L13 is peaked to the pilot-subcarrier frequency, and L15 is peaked to the subcarrier frequency. L14 is a 67-KHz trap, and is aligned for minimum output. Thus, the step-by-step alignment procedure is comparatively simple. Next, if objectionable harmonic distortion persists, check for defective components as follows:

1. Test the tubes with a tube tester, or check by substitution.

2. Check capacitors for leakage. An open capacitor can also be the cause of distortion. For example, C45 (Fig. 8) might be leaky, or C38 might be open.

3. Next, we check diodes X17 through X11 for proper front-to-back ratio. Note that if X12 is defective, only the operation of the stereo indicator is affected.

4. Infrequent, though possible, causes of distortion include off-value resistors, noisy controls, and shorted turns in a coil or transformer.

Now, let us return to the troubleshooting procedures used to localize harmonic distortion to a particular receiver section. If the multiplex

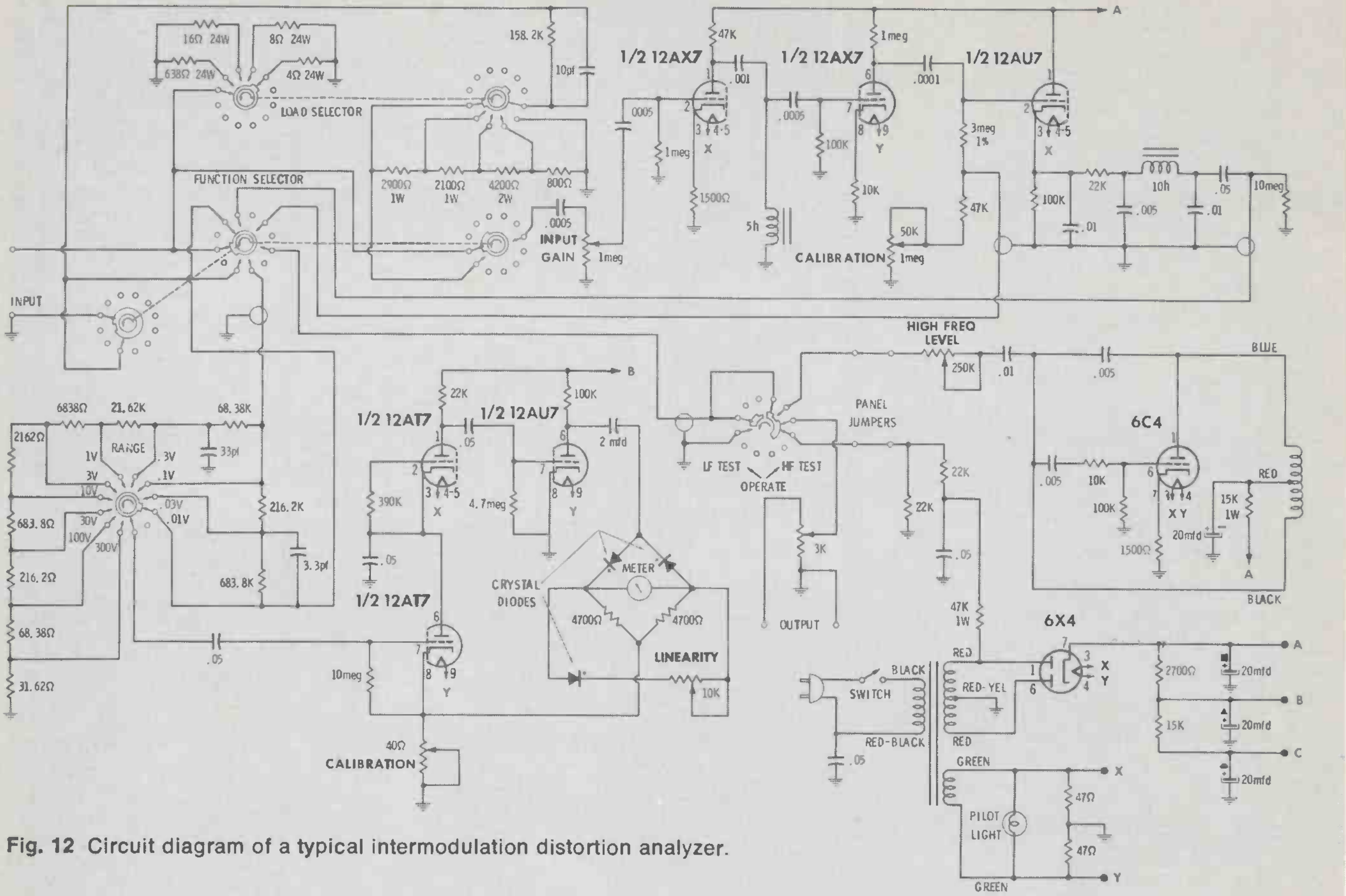

Fig. 12 Circuit diagram of a typical intermodulation distortion analyzer.

section checks normal, the trouble probably will be found in the tuner section. If this is the case, the test procedure shown in Fig. 10 will indicate an objectionable amount of harmonic distortion. Correct the trouble as explained in the first article; that is, make preliminary tube tests, and then follow a step-by-step alignment procedure, if necessary. If there are no component defects and the tuner is properly aligned, the test depicted in Fig. 10 will indicate a very low value of harmonic distortion.

After the cause of distortion has been localized and corrected, the final system check shown in Fig. 1 is repeated. Note that the total distortion of the overall system will always be greater than the distortion of any particular section because harmonic distortions in the various receiver sections add up (often in a somewhat unpredictable manner). In case the final system check does not indicate an acceptably low percentage of distortion, it is necessary to repeat the sectional tests. Also, make certain that each section is in optimum alignment.

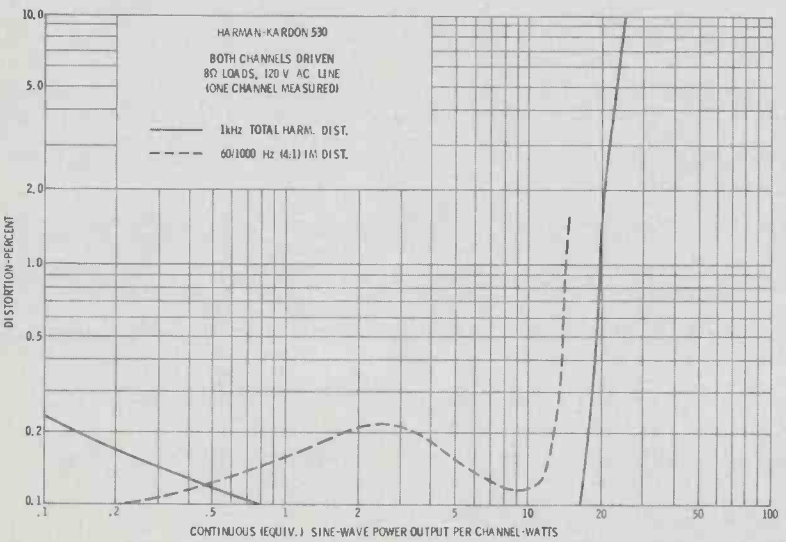

Fig. 13 Curve comparing intermodulation and harmonic distortion at various power levels. Courtesy—Harman-Kardon.

System Intermodulation Distortion

To make an intermodulation distortion (IM) test of the complete stereo system it is necessary to use an FM generator that can be externally modulated. That is, an IM distortion analyzer that supplies a pair of test signals (two-tone signal) that are used to modulate an FM RF carrier. The modulated RF signal is applied to the input terminals of the front end as depicted in Fig. 11. For example, an FM stereo signal simulator is one type of FM generator that provides an external-modulation terminal for hi-fi tests.

Intermodulation analyzers were briefly discussed in a previous article in this series. The circuit diagram for a typical instrument is shown in Fig. 12. Note that power resistors having values of 4, 8, 16 and 600 ohms are built into the analyzer. Therefore, it is seldom necessary to use the accessory load resistors depicted in Fig. 11. Merely switch the input selector of the instrument to a suitable load value.

The operating principle of an intermodulation analyzer can be compared with that of a broadcast radio receiver. The two-tone signal (a mixture of low- and high-frequency sine waves) is fed into the analyzer which amplifies the high frequencies but rejects all low frequencies except those actually modulating the higher frequency. Thus, only the high-frequency signal and its sideband are passed.

This modulated high-frequency signal is set to a predetermined level and is then demodulated. The remaining signal appears as a low-frequency component (envelope frequency) and is passed through a low-pass filter to remove any residual high frequencies. In turn, this remaining signal is fed to the meter, which is then calibrated in terms of percentage of intermodulation distortion.

A 12AX7 operates in the high-pass amplifier section. The high-frequency signal is amplified and fed through an LC high-pass filter to the grid of the second half of the 12AX7. After further amplification, the high-frequency signal is fed to the grid of the detector tube (one-half of a 12AU7). The reference level of the signal is set in the detector grid circuit.

The detector is an infinite-impedance (cathode-follower) type, and the output signal is taken from its cathode. The low-pass filter in the cathode circuit removes all demodulation products except the envelope

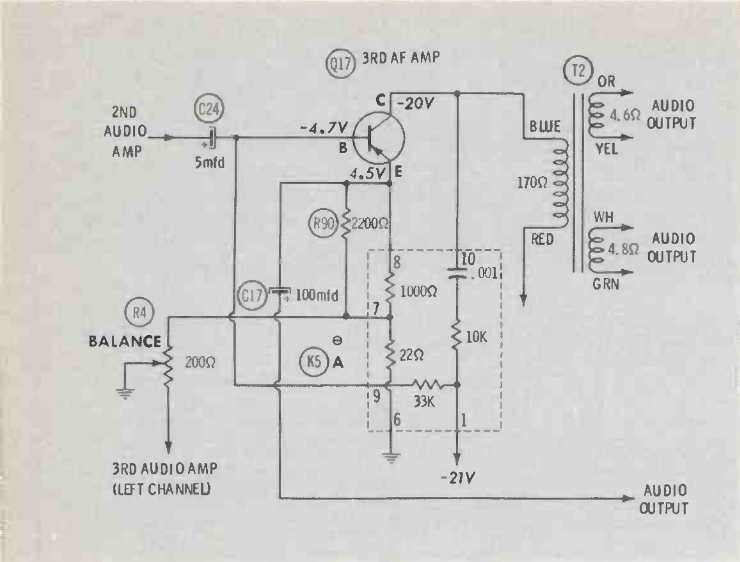

Fig. 14 Leaky coupling capacitor, C24, caused distortion in right channel.

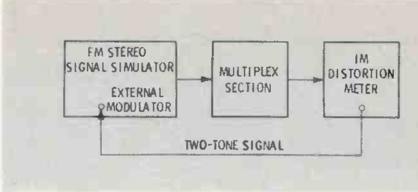

Fig. 15 Test setup for checking intermodulation distortion in a multiplex section.

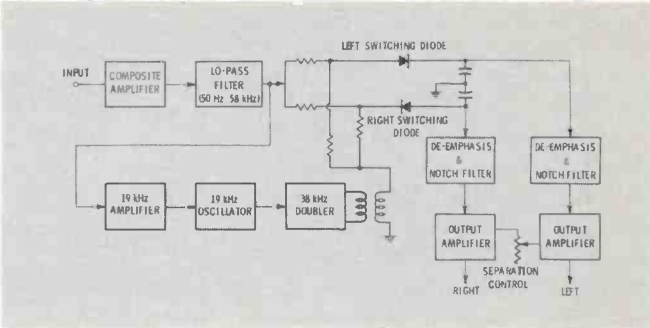

Fig. 16 Block diagram of a time-division demodulator employing a 19-KHz locked oscillator.

frequency. This envelope signal is then passed into the VTVM section for energizing the meter. Although the operation of an intermodulation analyzer is not as simple as that of a harmonic distortion meter, a little practice with the instrument is all that is needed. If the step-by-step instructions given in the instrument manual are observed, the operation is quite simple.

There is no simple relation between percentages of IM distortion and harmonics distortion. For example, Fig. 13 shows comparative test results for a good FM stereo-multiplex system. IM distortion was measured with a 60-Hz and 7-KHz two-tone signal, and harmonic distortion was measured with a 1-KHz signal. Observe, in this example, that IM distortion is less than the harmonic distortion at low power-output levels, but IM distortion is greater than harmonic distortion at medium power level. At a high power level, IM distortion increases faster than harmonic distortion.

Since an IM system test may show a widely different percentage of distortion compared with a harmonic-distortion test, it is good practice to make system measurements of both types of distortion. If you find that IM distortion is excessive, follow a step-by-step localization procedure similar to that employed for tracking down excessive harmonic distortion. That is, progressively eliminate the audio amplifiers, multiplex section and FM tuner from suspicion. After the trouble has been localized to a particular section, turn your attention to possible defects that can cause nonlinear operation. In general, the same component defects that cause harmonic distortion will also cause IM distortion.

Preliminary checks might show, for example, that IM distortion is satisfactory in L-channel operation, but objectionably high in R-channel operation. If this is the case, turn your attention at once to the right audio channel.

In a typical case history, C24 in Fig. 14 was leaky. This type of defect can be pinpointed either by DC voltage measurements at the associated transistor terminals, or by a careful waveform analysis at the base of the transistor. Defective audio-output transformers are less common, but this possibility should not be overlooked. If an output transistor is short-circuited, the associated resistors should be checked when the transistor is replaced.

Next, consider a situation in which the audio amplifiers check normal and attention logically is focused on the performance of the multiplex section. The IM test setup is shown in Fig. 15. If misalignment causes the subcarrier to be inserted with an incorrect phase, an objectionably high percentage of IM distortion will be indicated. This condition is aggravated when a synchronized 38-KHz oscillator "pulls." Similarly, a "pulling" 19-KHz oscillator also can cause objectionably high IM distortion. Fig. 16 shows a block diagram for a multiplex section with a 19-KHz locked oscillator. Tight locking requires precise alignment of the oscillator circuit and a normal signal-output level from the 19-KHz amplifier.

Alignment and Final System Tests

Fig. 17 shows a typical multiplex circuit with a 19-KHz pilot-subcarrier oscillator. To align the circuits, adjust L12 for minimum response at 67 KHz, L11 for minimum response at 71 KHz, and L13 for minimum response at 19 KHz. L14 and L15 are adjusted for maximum response at 19 KHz; L16 is adjusted for maximum response at 38 KHz. Finally, slight touch-up adjustments are made (if required) to obtain optimum separation of L and R signals. Note that L15 determines the free-running oscillator frequency. Tight locking depends upon precise adjustment of this frequency and injection of a normal 19-KHz signal level from L14.

After alignment and separation have been verified (or corrected), make another IM distortion measurement of the multiplex section. If there are no component defects, the percentage of distortion should be very low. However, if objectionable distortion is measured, look for component defects that can cause nonlinear operation. Assuming that the tubes and diodes have been

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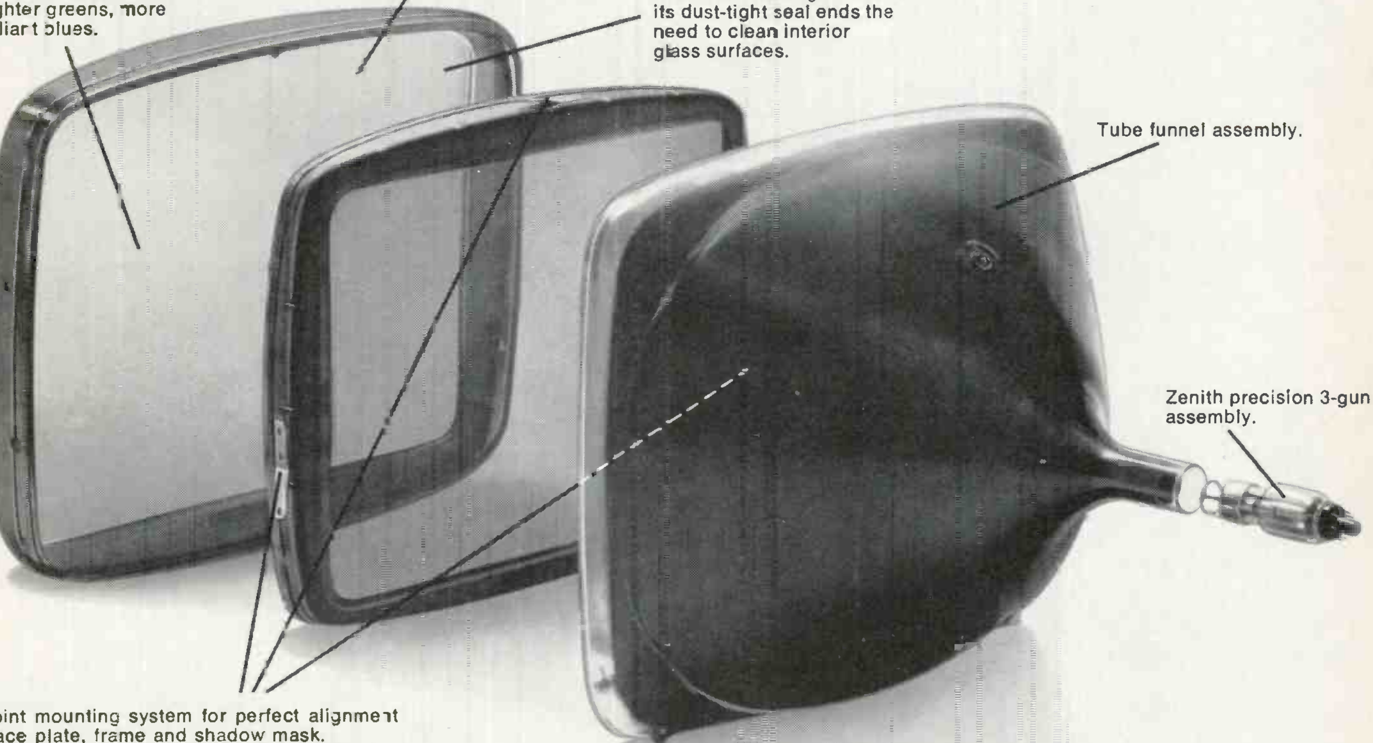

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checked, the most likely culprits are leaky capacitors which upset normal bias voltages. Off-value resistors are less-likely suspects, but the resistors should be checked if capacitors have been cleared.

Finally, let us consider the situation in which the multiplex section checks normal in the initial IM test. This leaves the FM tuner as the source of IM distortion. Tuner alignment procedures were explained previously. After the step-by-step system alignment has been completed, verify the end result by repeating the IM test depicted in Fig. 11. The percentage of IM distortion should be acceptable now, inasmuch as each section in the system has acceptable performance. However, in rare cases, the IM distortion might be a bit higher than anticipated. If such is the case, it is probably due to cumulative sectional distortions; consequently, individual sectional checks must be repeated.

It is advisable, at this point, to repeat a precaution mentioned earlier: Generators used in the foregoing step-by-step test procedures must have better characteristics than the receiver under test, otherwise, it is pointless to make distortion measurements of a hi-fi system. Even the best test equipment will occasionally require attention. It is good practice to feed the output from an audio oscillator directly into a harmonic-distortion meter to verify that the harmonic-distortion meter has acceptably low distortion. Crosschecks of all hi-fi test equipment should be made regularly for verification of performance.

The final installment of this series will discuss cartridge and turntable tests. ▲

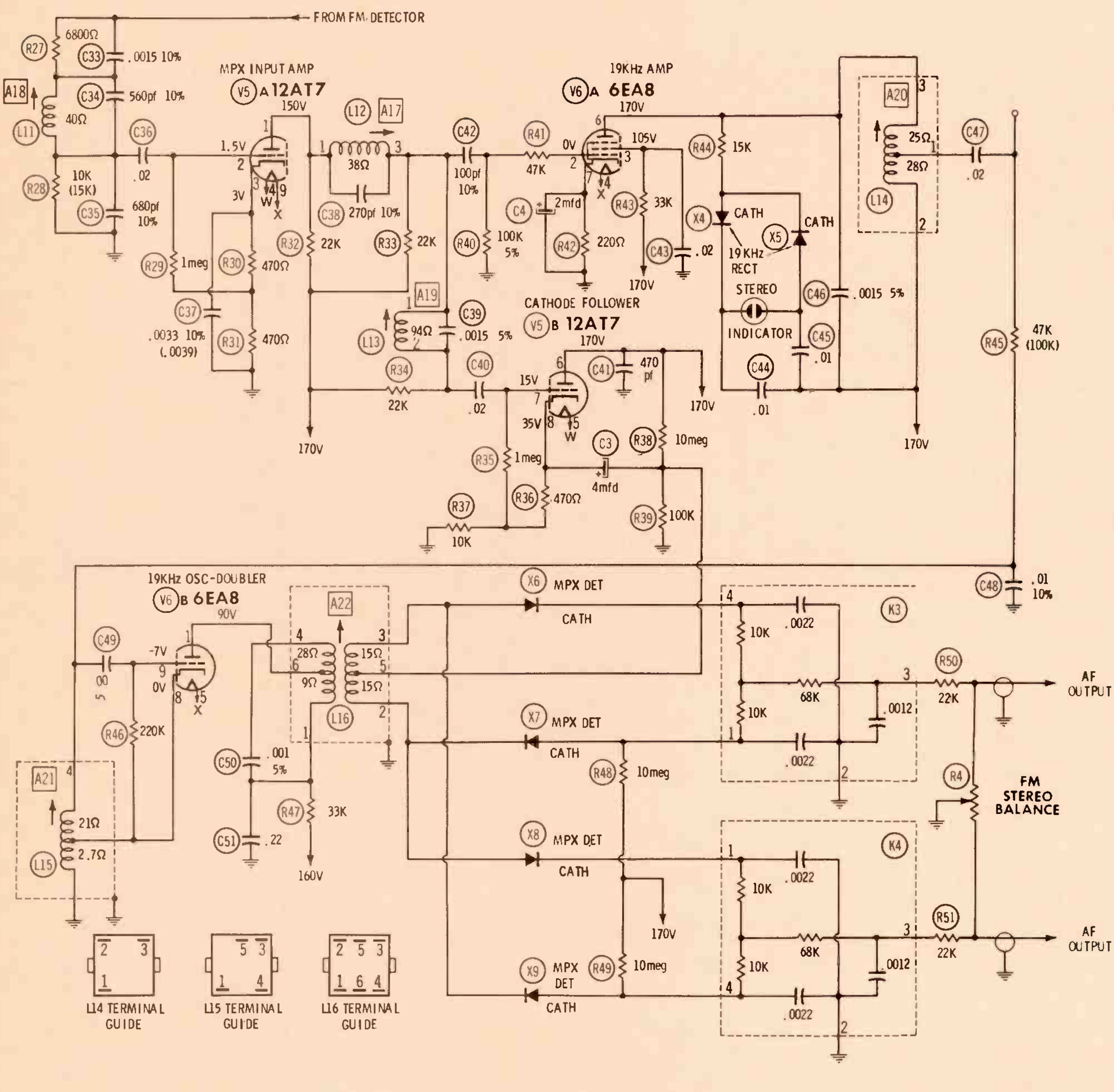


Fig. 17 Typical multiplex circuit employing a 19-KHz pilot-subcarrier oscillator.

testequipment

notes on analysis of test instruments, their operation and applications

B&K Diagnostic Oscilloscope Model 1450

The B&K Diagnostic Oscilloscope, Model 1450, was designed and engineered for shop troubleshooting procedures for the consumer electronics service industry. The instrument features all the usual oscilloscope functions plus such innovations as vectorpattern viewing and an intermittent analyzer circuit. A signal from the circuit under test can be monitored and when the signal voltage varies above or below a preset level, a lamp lights indicating a change in signal voltage, and, whether the change was an increase or decrease in input amplitude. An external accessory item, an intermittent monitor, can be connected to the Model 1450 to alert the service technician when an intermittent occurs. This is an exceptionally desirable feature, allowing a busy service technician to perform other duties instead of sitting and waiting for an intermittent to act up.

The vertical attenuator functions in conjunction with an illuminated graticule to allow the Model 1450 to be used in making peak-to-peak voltage measurements in a manner much like a VTVM. Two scales are engraved on the graticule: 0-2 and 0-6, representing vertical range switch positions 0.2, 0.6, 2, 6, 20, 60 and 200. These two scales, 0.6 on the left and 0.2 on the right, are visible only one at a time and correspond to a specific setting of the vertical range switch.

Power Supply

The power supply circuitry is comprised of the power transformer, a low-voltage rectifier, a high-voltage rectifier, and their associated components. The low-voltage rectifier stage provides operating voltages for the horizontal and vertical circuits. The high-voltage rectifier stage provides the high potentials

Model 1450 Specifications

VERTICAL AMPLIFIER

Sensitivity: 25 mv rms/inch (70 mv p-p/inch)
Undistorted Deflection: greater than 6 inches
Positioning: ± 2 inches minimum
Frequency Response: 5 Hz-4.5 MHz (± 1.0 dB), -3 dB @ 5.5 MHz
Rise Time: 120 nanoseconds maximum
Input Impedance: 3 megohms shunted by 47 pf
Vertical Attenuator: 7 step frequency compensated.

HORIZONTAL AMPLIFIER

Sensitivity: 0.5 volts rms/inch or better
Positioning: any portion of trace can be placed on viewing screen
Frequency Response: 2 Hz-750 KHz ±3 dB
Input Impedance: 5 megohms minimum shunted by 30 pf

SWEEP

Frequency Range: 5 Hz-500 KHz sawtooth
Special Sweeps: line (variable phase); TV-vertical and TV-horizontal
Synchronization: automatic; internal + and —; line and external

INTERMITTENT ANALYZER

Sensitivity: adjustable; triggers on ±10% to ±50% changes in input signal level
Output: 110V AC, 100 watt latched on after change occurs
Frequency Response: 20 Hz to greater than 5 MHz.

DIRECT AND LOW-CAPACITANCE PROBE

Attenuation: direct or 10 to 1
Maximum Voltage: 750 volts combined DC and p-p AC
Impedance Connected to Diagnostic Oscilloscope: direct, 1 megohm shunted by 150 pf; low capacitance, 10 megohm shunted by 15 pf

ACCESSORIES

Crystal Demodulator Probe
Remote Monitor Alarm for Intermittents

Fig. 1 Photo of B&K Diagnostic Oscilloscope, Model 1450, showing operating controls and input terminals.

required by the cathode ray tube.

An NE-2 neon lamp in the low-voltage circuits serves as a calibration voltage regulator to supply a semi-rectangular 60-Hz, 200 millivolt pulse calibration voltage. The 60-Hz voltage necessary for line sweep and sync functions is obtained from the power transformer filament winding. Utilization of a phase shift network permits variation in the phase of the voltage.

CRT Circuitry

The CRT circuit is made up of the CRT, focus control, intensity control, astigmatism control and their associated components. The intensity control provides a means of varying the grid-cathode voltage of the CRT which controls the electron beam and, therefore, the brightness of the trace on the CRT. The focus control is used to vary the amplitude of the CRT second anode voltage, which determines the size of the spot on the screen and thus the focusing. The astigmatism control varies the amplitude of the first anode voltage, which determines the shape of the spot. A certain amount of interaction between the focus and astigmatism controls can be expected.

Sync Amplifier

The sync amplifier and sweep generator stages are combined in one compactron tube. The A section is the sync amplifier which amplifies, shapes and limits the sync signal and couples it to the cathode of the sweep multivibrator. The limiting feature makes manual sync lock adjustments unnecessary and prevents waveform distortion that could be introduced by excessive sync amplitudes.

The positive and negative internal sync signals are derived from the plates of the push-pull vertical amplifier output stages. The line sync signal is taken from a filament winding on the power transformer. In the external sync mode of operation, an externally generated signal is applied to the sweep oscillator. The TV sync separator is comprised of a special waveshaping network that renders the amplifier insensitive to video signals.

Sweep Oscillator

The sweep oscillator is a cathode-coupled multivibrator utilizing the B and C sections of a compactron, the A section of which, as previously mentioned, is the sync amplifier. The sweep frequency switch selects the specific timing capacitor for the desired sweep range. The FINE SWEEP control is a potentiometer used to provide fine adjustment of the sweep frequency. Two capacitors (one a preset trimmer) are used to provide the TV-vertical and TV-horizontal sweep ranges. A retrace blanking pulse is taken from the plate of the C section of the sweep multivibrator and coupled to the CRT cathode.

Horizontal Amplifier

The horizontal amplifier also utilizes a compactron tube that performs the function of driver (A section) and push-pull output (B and C sections). A potentiometer, connected in the cathode of the driver stage, controls the horizontal deflection voltage and, therefore, provides horizontal gain, or control of the width, of the trace on the CRT. Input to the driver is from the sweep generator, the 60-Hz filament voltage or the horizontal input terminals, depending on the position of the sweep frequency switch. The plates of the push-pull output sections are direct-coupled to the horizontal deflection plates of the CRT. A potentiometer (HORIZONTAL POSITION) is used to control the balance of the output stage and, therefore, the position of the horizontal trace.

Vertical Amplifier

Signal voltages to be observed are applied to the four-stage wideband vertical amplifier section. The first stage utilizes a 6GH8A dual-section tube. Initial amplification of the input signal is provided by the A and B sections of the 6GH8. A preset potentiometer in the cathode circuit of the B section varies the effective gain of the B section and, therefore, effectively the overall gain of the entire vertical circuitry. This control may also be used for calibration to compensate for tube aging.

Two dual-section 6JV8 tubes comprise the balance of the vertical amplifier section. The A sections of the 6JV8's form a phase inverter stage for their respective B output sections. A potentiometer (VERTICAL POSITION) is used to vary the magnitude of the DC voltage potential on the vertical deflection plates of the CRT and, thus, the vertical position of the trace. Adjustment of the vertical calibration is provided by a potentiometer connected in the cathode circuits of the B sections of the 6JV8 output tubes. The CAL control is a front-panel adjustment.

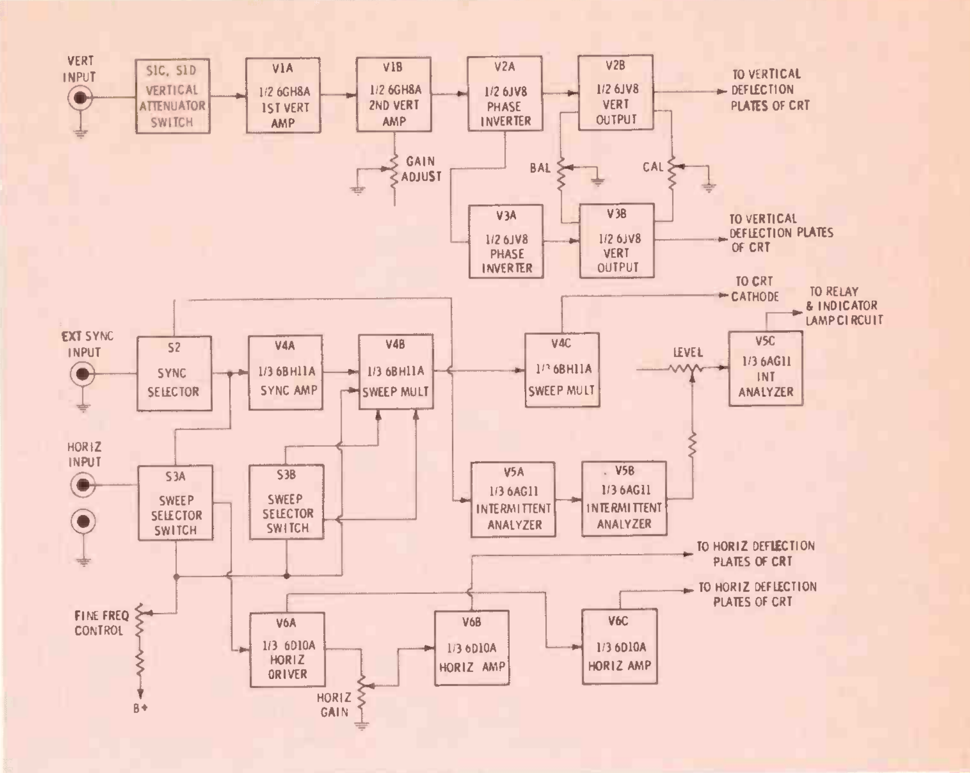


Fig. 2 Complete block diagram of B&K Model 1450 oscilloscope.

Intermittent Analyzer

The intermittent analyzer circuit consists of the A, B and C sections of a 6AG11 compactron and associated components. The A section functions as a voltage doubler, developing a DC voltage proportional to the peak-to-peak amplitude of the signal at the plate of the vertical amplifier output stage. The B section compares this proportional voltage to a DC voltage preset by the LEVEL control. When the signal under observation changes, the B section amplifies this change and applies the amplified output to the C section. The C section then conducts, energizing a relay and lighting a lamp to indicate that a change in the signal has occurred.

Maintenance and Service

An analysis of the operation of the Model 1450 Diagnostic Oscilloscope points up the fact that the design of the instrument permits rapid isolation of defects. All of the sweep stages are combined in one compactron (6H11A), the intermittent analyzer stages are all in one compactron (6AG11), the horizontal amplifier uses one compactron (6D10A), and the vertical circuit consists of a 6GH8A, and two 6JV8's. This tube complement, and the fact that each is related to only one circuit, makes troubleshooting the scope relatively simple.

Should either of the vertical output stages require replacement, it will be necessary to balance the plate voltage of both output tubes. This is done by connecting a VOM between the plates and adjusting the balance potentiometer (located in the cathode circuit) for a reading of zero volts on the VOM. Should any tube in the vertical circuit require replacement, it will be necessary to adjust or calibrate the gain. This is accomplished by setting the front-panel calibrate control to the center of its range, setting the vertical range switch to the vertical position and adjusting the GAIN ADJUST control in the cathode circuit of the B section of the first vertical amplifier. Adjust the GAIN ADJUST control as you would the front calibration control. ▲

symptoms and tips from actual shop experience

color countermeasures

Chassis: Admiral G11G1-3

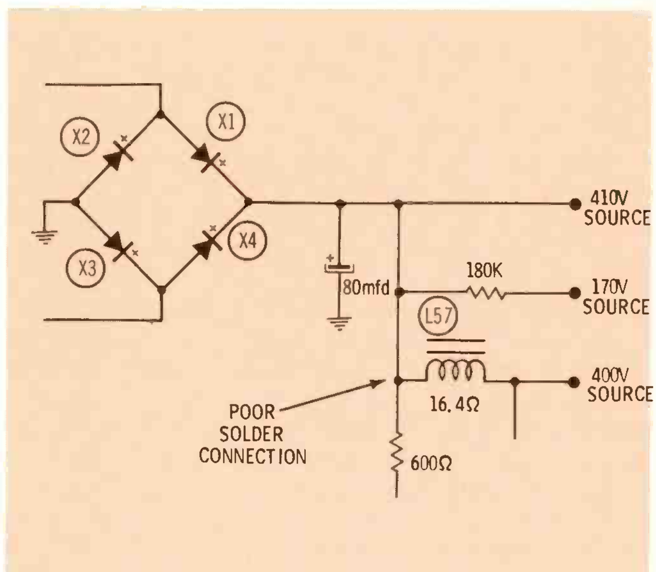
Symptoms: After the color receiver operated for one hour, the picture went out of focus as the screen darkened.

Tip: Suspect a poor focus control. Also check for correct high voltage on the CRT anode, and notice the decrease in voltage as brightness decreases. Check for high leakage between primary and secondary of the flyback transformer.

Chassis: CTC7A

Symptoms: Intermittent flashes in picture; also blurring.

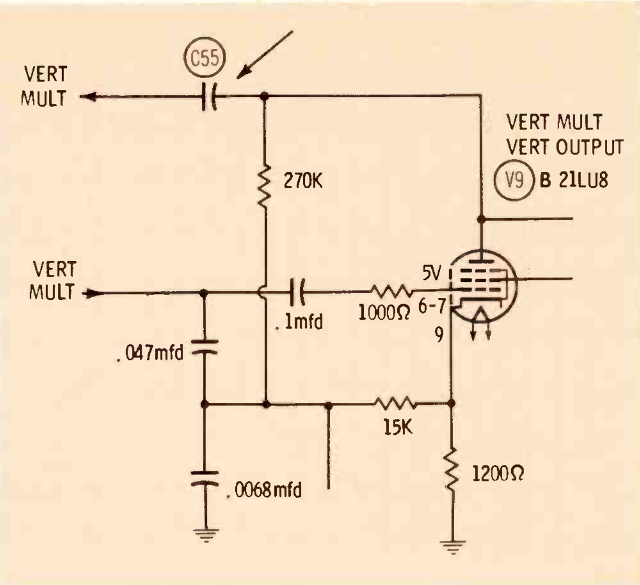
Tip: When the TV chassis was twisted or moved, the picture either would flash, go dark, or lose focus. Suspect poorly soldered connections where chassis points protrude through PC board. Solder all ground connections, especially those around the 2nd video output tube.



Chassis: RCA CTC35A

Symptoms: Picture and sound missing.

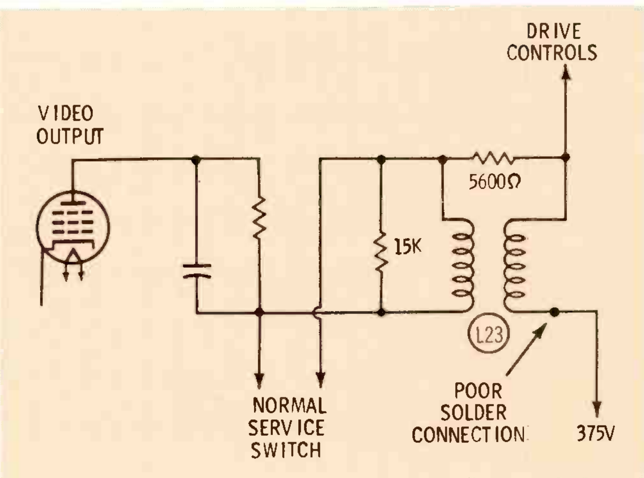
Tip: First, check voltages in the low-voltage power supply. Suspect an open L57 or poor solder connection on one lead of the choke. Also check for an open or shorted silicon diode.



Chassis: Sylvania DO3

Symptoms: Picture reduced to two-inch horizontal white line.

Tip: Shorted or leaky C55 in feedback circuit of vertical multiplier.



Chassis: RCA CTC30

Symptoms: Flickering picture.

Tip: Monitor waveforms at key points in chassis circuitry to localize cause of intermittent. Suspect a poorly soldered connection on L23.

Moving?

Send your new address to:

ELECTRONIC SERVICING, Circulation
1014 Wyandotte St.
Kansas City, Missouri 64105

photofact bulletin

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

GENERAL ELECTRIC

Chassis DE, D1 1009-1

HITACHI

TWA-63 1012-1

MUNTZ

Chassis AS-9015-4 1006-1
AM-FM Radio
Chassis AS-8104 .... 1006-1A
AM Radio
Chassis AS-8103 .... 1006-1B
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AM Chassis AS-8103 .... 1008-1B
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4866A-48, 4867A-46,
4868A-49 1010-2

RCA

Chassis CTC36E/H 1012-2

SEARS

Chassis 562.10430,
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5036 (Ch. 562.10470) 1008-3

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UT-Q3B 1011-1

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SYLVANIA

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Production Change Bulletin

AIRLINE

GHJ-17629A/649A/659A/
749A/759A/779A 1007-3

EMERSON

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858B 1007-3

MOTOROLA

XP300DH (Ch. D12TS-
458B-05 thru C-02) 1010-4

RCA

Chassis CTC31A/C,
CTC35C, KCS175B/C 1006-4

SEARS

Chassis 456/528/529.71000
thru 456/528/529.71015 1007-3
Chassis 456/528/529.70254/
255/257 thru 456/528/
529.70268 1010-4

TRUETONE

TAE4815A-86 (2DC4815) .. 1007-3

Got a Troubleshooting Tip?

If you've recently run across an unusual trouble symptom and have determined what caused it, why not pass the info on to the other readers of ELECTRONIC SERVICING. You'll not only be saving other service technicians valuable troubleshooting time, you'll also be making a little extra change for yourself. Send a thorough description of the trouble symptom and the solution along with a brief discussion of your troubleshooting technique to:

Troubleshooting Tip, ELECTRONIC SERVICING
1014 Wyandotte Street, Kansas City, Missouri 64105

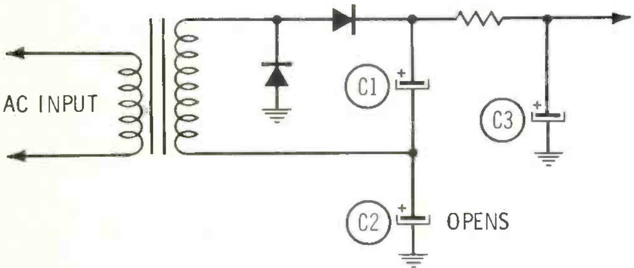
troubleshooter

Voltage Doubler

Another fellow and myself disagree on the operation of a few circuit designs and what happens in these circuits when a defect occurs. Our latest disagreement concerns a full-wave voltage doubler circuit. If the doubler capacitor should open in the power supply, I believe the output voltage will drop slightly because of reduced current of the supply. However, the circuit will continue to operate as a voltage doubler. My friend says the output voltage will drop to one-half because the circuit then will operate as a half-wave rectifier. Who is right, or are we both wrong?

Ed Tiesman

Fulton, IL



You are both slightly in error. Your friend is obviously thinking of a "short" rather than an "open," in which case the circuit would operate as a half-wave rectifier. Your assumption of reduced current was right, but the current flow would be almost negligible since the only return path provided would be through capacitor C3. The voltage output would be decreased more than one-half.

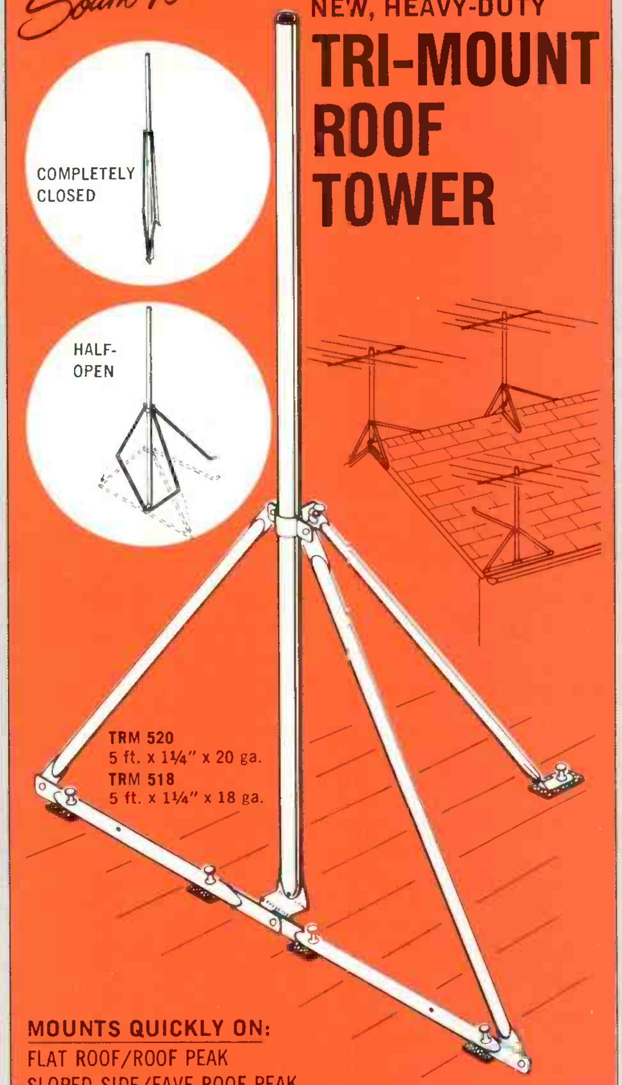
Corona!

Using Photofact *Folder 725-2 as a reference, I replaced a high-voltage transformer with the exact replacement that was listed. The original transformer had burned, ruining the insulated tube shield for the high-voltage rectifier. I replaced the shield with one from another chassis. The problem is a high-voltage discharge (arc) from the rear of the high-voltage rectifier. The replacement transformer runs cool; the picture is perfect; screen and grid voltages are correct on the horizontal output tube; and the bypass capacitor checks okay. I am a relative beginner in TV repair and would appreciate some help with this problem. I have used corona dope but from what I can ascertain locally, my problem is one of poor insulation of wires. Could it be in any of the tubes?*

John Green

Evanston, WY

Yes, it could be in the damper tube; however, it is very unlikely. I would suspect solder joints first. Be sure there are no sharp tips at the solder connections,



specifically at the filament connections of the high-voltage rectifier. All solder joints should present a round smooth surface. Check lead dress of all wires; dress them away from any metal shielding and away from each other. Be sure the CRT is properly grounded; remove any accumulation of dust around the ultor connection.

Tongue Testing Diodes?

The motor control transistor of a Phonotrix tape recorder is open, and I cannot find a replacement for it. The original number of this transistor is GFT 32; however, I cannot find any other information on this component.

Another matter concerns one of my students, and I thought it might be of interest to you. One day a few weeks ago we were discussing diode rectifiers and how to check them with an ohmmeter. One of my students said that he checked them with a 9-volt battery and his tongue. He went on to say that he could determine the method of connection in the same manner. I asked him to explain his theory behind this procedure. This was his reply:

Place one lead of a diode to the negative terminal of the battery, then touch the positive terminal of the battery with your finger. Place the other lead of the diode on your tongue. If you receive a shock, the diode is conducting. If you do not receive a shock, it is not conducting. Since current flows from positive to negative, the lead of the diode touching your tongue (when you receive a shock) would be the lead of the diode to be connected to the AC source.

I try to teach these boys principles to use to help them think on their feet. I think this is a good example of "thinking" to overcome a problem.

RALPH FORKE

Boystown, NB

There are several replacements that should work for the defective transistor in the Phonotrix tape recorder: Delco DS-26, IR TR-14, Motorola HEP254, Sylvania EC6-102, and General Electric GE-2.

As for "tongue testing" diodes, I do not doubt that the method described will work; however, I am a creature of habit, and I am in the habit of using a meter.

Low B+

I have an Admiral Model L71N52, chassis 25B6, in which the source voltages are all below the values indicated on the schematic. For instance, the 380-volt source measures 330 volts. I have substituted filter capacitors, changed the damper tube, etc. I have checked the audio circuit, boost circuit and all other loads. With this decrease in source voltage, the horizontal circuit has a tendency to become unstable and finally results in failure of the 6DQ5 horizontal output tube. I have previously experienced this same condition in both Philco and RCA chassis.

H. J. BISHOP

Bennington, VT

You have not supplied enough information for a definite answer; however, the fact that you are experiencing the same trouble symptom on different manufacturers' chassis would indicate that you have a line voltage problem. Assuming that the line voltage in your shop is up to standard it is a fairly simple procedure to isolate causes of decreases in source voltage:

1. Remove all loads from the power supply output terminals.
2. Check source voltages under "no load" conditions.
3. Reconnect the source lines one at a time, measuring voltage after each is reconnected.
4. When the source voltage decreases after a line has been reconnected, it is reasonable to assume that that line is the source of the trouble.

Horizontal Output Impedence Mismatch

We have a Zenith chassis 1Y21B55 in for repair. The trouble symptom is a narrow black vertical line, a little right of center. To the right of the line the raster is slightly shaded. The shading is more noticeable during a "no-signal" condition. The black line can be shifted by rapid rotation of the contrast control, but returns immediately to its former location. Adjustment of the horizontal hold control has no effect on the line.

B+ and boost voltages measure within tolerance. Signal voltages are normal in the video and vertical sections. The input signal to the sync separator is normal and most of the waveforms in the horizontal section are decreased in amplitude.

The schematic calls for 24 volts peak to peak at the center of the horizontal phase detector. Our reading is 6 volts peak to peak. At the junction of R114, R111, C104B and C106 the voltage reading is 6 volts peak to peak. At the collector of the horizontal AFC transistor the reading is 9 volts peak to peak. The voltage reading at the junction of capacitors C109 and C110 is 30 volts peak to peak. The voltage reading at the base of the horizontal oscillator is 12 volts peak to peak. The drive signal at the base of Q20, the horizontal driver, is 1.5 volts peak to peak; at the base of Q21, the horizontal output transistor, it is 4 volts peak to peak. These waveshapes are not distorted. The only waveform with any distortion is at the junction of resistors R111 and R114 where there appears to be a small amount of "hash" fringing on the waveshape. The sawtooth is of the correct width and shape, but approximately halfway up the slope the "hash" has a spurious dip.

Other waveform observations are: at terminal 6 of the flyback, 9 volts peak to peak undistorted; at the junction of the rectifier and resistor R129, 90 volts peak to peak; and at pin 3 of the CRT, 300 volts peak to peak. The waveform at pin 3 of the CRT is the same shape as the waveform at terminal 6 of the flyback. Pin 2 of the CRT measures 150 volts peak to peak undistorted, while pins 4 and 7 of the CRT measure normal.

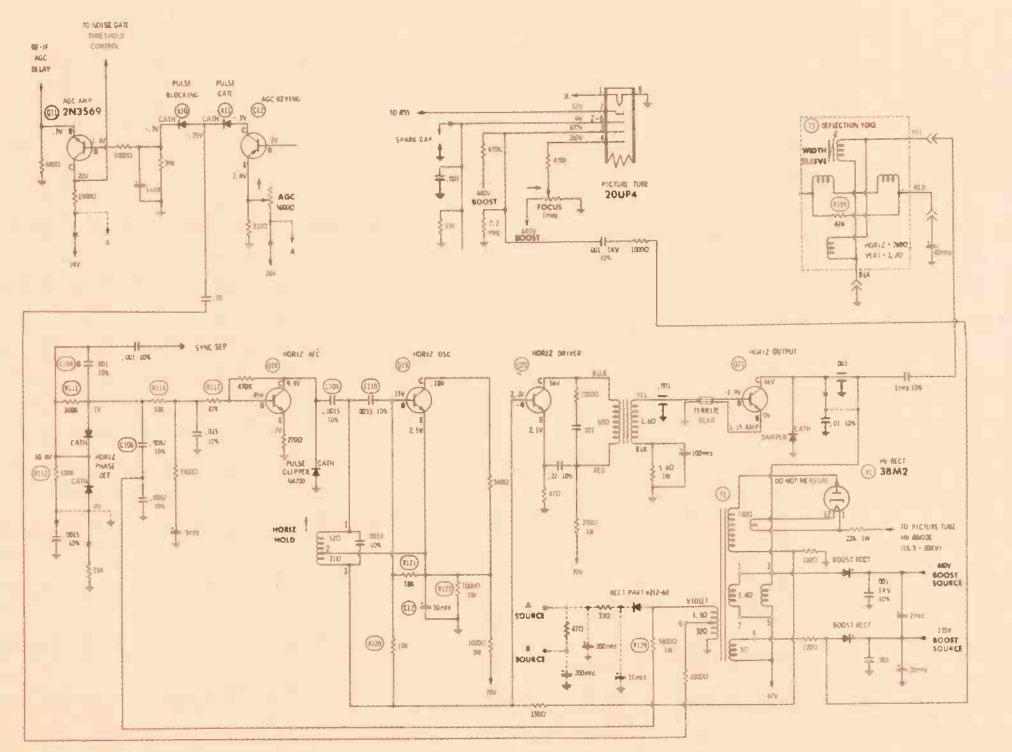
We have substituted the horizontal output transformer, the damper diode, capacitors C17 and C8, and resistors R120 and R121.

We have tried lead "dress." The yoke was checked and resistor R109 was replaced as it had decreased in value. The resistance of the yoke winding is correct. The 3BM2 was checked. High voltage measures only 15 kv. The waveshape at the junction of X10 and X11 is undistorted but measures only 9 volts peak to peak.

R. J. CLEVENGER

London, OH

It seems that the main problem is probably severe loading of the horizontal output circuit. I would try replacing the yoke even though the DC resistance reading is correct. DC readings of yoke windings can be deceiving. The entire horizontal output circuitry actually forms a resonant circuit. Any change in inductance, resistance, or capacitance can produce the symptoms you have described. ▲



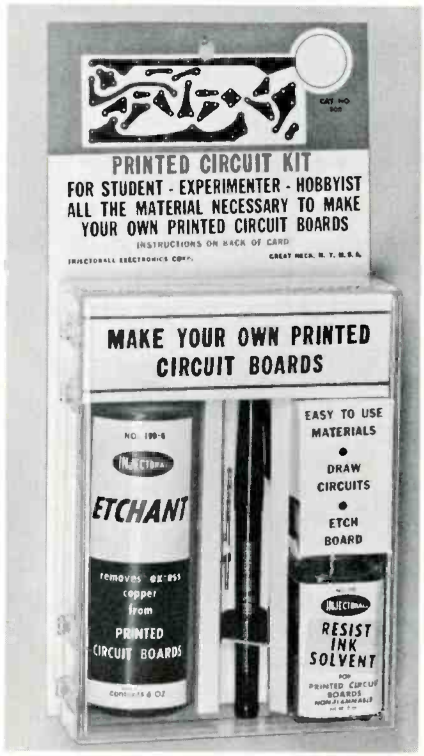
Circuits involved in discussion of possible causes of narrow vertical line displayed on screen of Zenith Chassis 1Y21B55.

product report

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

Printed Circuit Kit
(45)

Injectorall Electronics Corp. has developed the PC Kit No. 500, containing printed-circuit boards and all of the chemicals and supplies to make professional printed circuits easily.



Each kit contains two printed-circuit boards, 4¾" x 3¾", a resist ink pen, one 6-ounce bottle of resist ink solvent and one 1/16" drill bit. The kit is packed in a see-through acrylic box which serves as a developing tray. Complete step-by-step instructions are furnished with each kit. The kit is priced at $5.95.

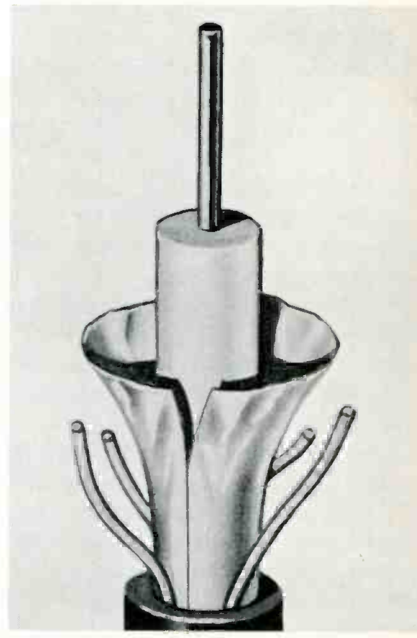
MATV 82-Channel Coaxial Cable
(46)

A low-loss, 100% shielded and sweep-tested 75-ohm coaxial cable suited for UHF MATV distribution systems now is available from **Belden Corp.** The cable is also applicable to VHF black-and-white or color TV systems.

Design of the 8228 Duofoil cable provides a small outer diameter (0.242 inch) and is terminated with standard F-type connectors.

Greater flex life for the 82-channel cable is achieved by spiral-wrapping the four drain wires for equal distribution of stress.

The shield is a polyester film with an aluminum laminant on both surfaces that minimizes signal radiation and protects the signal from degredation by auto ignition, electric motors, industrial machinery and other sources of electrical interference.



Further protection of the signal energy field is accomplished by a low-loss cellular polyethylene dielectric and a jacket of black all-weather polyvinyl chloride.

The cable is available in 100-, 500- and 1000-ft. spools and the price ranges from $6.50 to $41.40.

Power Supply Transformers
(47)

Eight new power transformers are now available from **Essex Controls Div.,** Stancor Products. These units are designed for solid-state power supply circuits and incorporate the most popular voltage and current ratings. Current capabilities listed for the high voltage winding are based on full wave center tap with capacitive input filtering. Units may be satisfactorily operated in full wave bridge configuration by allowing an approximate 65% decrease in rated current.

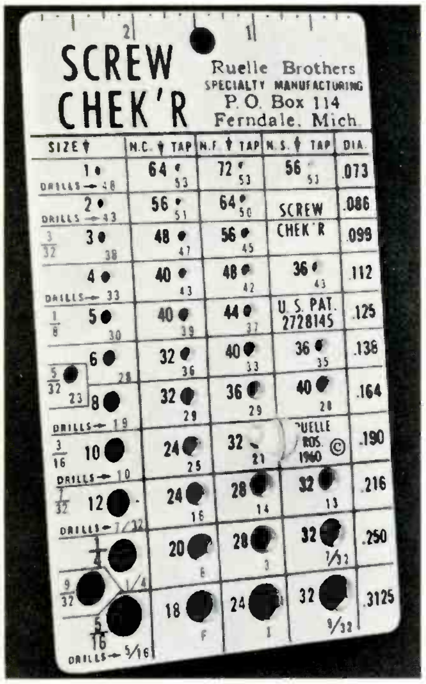
Each unit supplies a high-voltage B+ winding plus an additional 6.3-volt center tap filament winding.

Rated for voltages from 245 to 350 volts, these transformers range

in size from 2⅝" x 2 3/16" x 2 5/16" to 3⅛" x 2½" x 3⅛". The units feature wire lead terminations and are priced from $7.50 to $10.86.

Screw Checker
(48)

Introduced by **Ruelle Brothers,** this tool, called Screw Chek'r, is used to identify machine screws, wood screws, sheet metal screws, self-taping screws, drive screws, standard rivets and most cotter pins. It is used to measure screw size, threads per inch and proper drill size for tap hole. Screws can also be cut and straightened.



Two checkers are available: a satin-chrome plated steel model with screw shearing tool which sells for $3.98 and a Dupont "Delrin" plastic model available at $1.49.

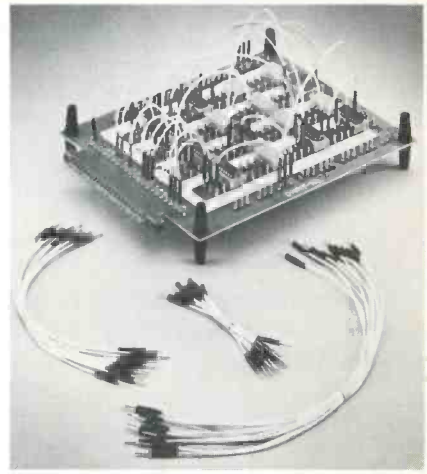
Patch Cords
(49)

Preassembled patch cords in four different lengths and colors compat-

Circle 32 on literature card

Circle 33 on literature card

ible with MBB-1000 and 2000 "Omny-Pac" circuit panels and other requirements for patch leads with .040″ pins are now available from **Methode Manufacturing Corp.**



The new patch cords have standard 0.040″ diameter, tin-plated, plugable pins. Cords are #22 AWG stranded conductors rated at 600 volts, 105°C and meet the requirements of Mil Spec 16878-D. They come in 4″, 8″, 12″ and 16″ lengths. Standard packages sold consist of ten patch cords having the same length and in one color. Four standard colors are available for the user to choose from: white, red, green and black.

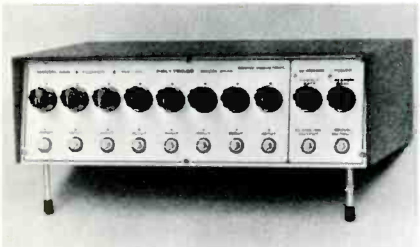
Price per package of ten patch cords in one length, one color is $3.25.

Indoor Antenna
(50)

Mercury Electronics Corporation is going into the indoor antenna business. Ten different models including standard rabbit-ear types in gold or brass, switch units, color UHF-VHF models and a UHF loop will be available. Suggested list prices are from $2.19 to $10.95.

Oscilloscope Converter
(51)

Grand Industries, Inc. announces a new electronic device: Poly-Trace. It accepts 2 to 8 signal inputs, each with gain control adjustable from 0 to 100% of input value and with individual pull-on switches so that all traces can be positioned on the screen for comparison, phase-checking, etc.



Features include input signals that range from —10V to 25V p-p into 10K-ohms input impedance. Frequency response is from DC to 1 MHz with 40 dB of crosstalk separation.

The case measures 4½" x 15" x 11¾". Warmup time is one minute through the use of integrated circuits. The price is under $500. ▲

advertisers' index

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catalogs literature

ANTENNAS

100 *Hy-Gain Electronics*—4-page brochure, Catalog "D", describes new line of Monitor antennas.

AUDIO

101 *Jensen*—Catalog 1090-C features custom installation and replacement applications for Concert and Viking series loudspeakers.

COMPONENTS

102 *Allied Electronics*—1969 Industrial Catalog Supplement No. 691 contains directory of semi-conductors and integrated circuits.

103 *Cornell-Dubilier*—68-page Electrolytic Replacement Guide serves as a cross-reference for locating electrolytics by catalog number, capacity and voltage.*

104 *Dialight*—Catalog L-209 provides complete data, drawings and ordering information for 513 series Momentary and Alternate Action Switches.

105 *Tedford Crystals Labs*—Bulletin lists low and high frequency quartz crystals ranging from 90 KHz to 210 MHz. Also included are complete specifications and dimensional data.

TECHNICAL PUBLICATIONS

106 *Howard W. Sams*—Literature describes popular and informative publications on radio and TV servicing, communication, audio, hi-fi and industrial electronics, including new 1968 catalog of technical books on every phase of electronics.*

TEST EQUIPMENT

107 *Beckman Instruments*—Electronic Instruments Div. has released a new 48-page directory of the division's products, services and 94 sales and service offices in U.S. and Canada.

*Check "Index to Advertisers" for additional information.

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