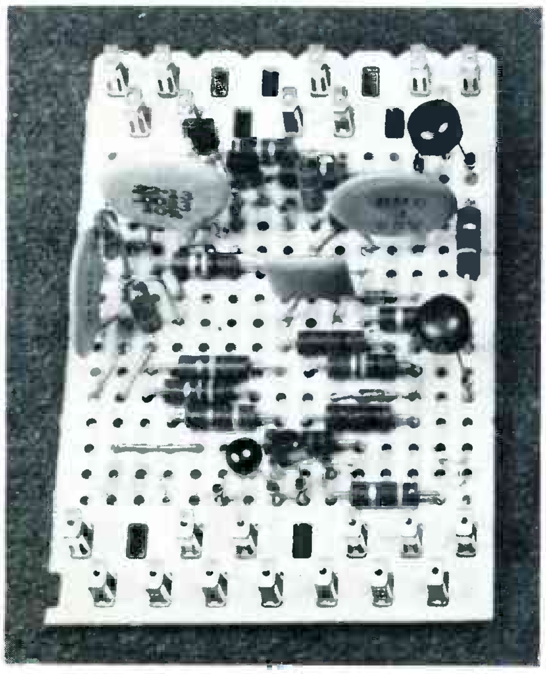
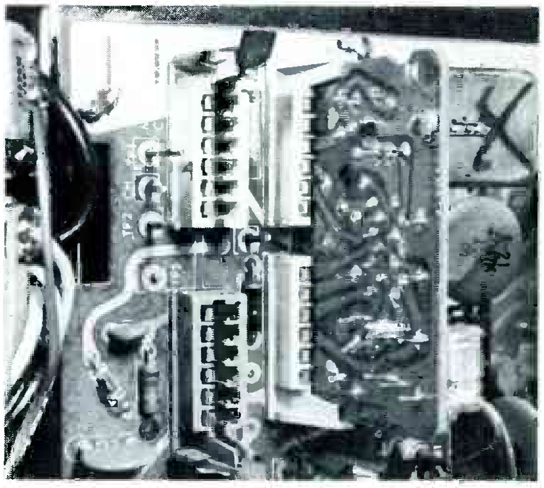
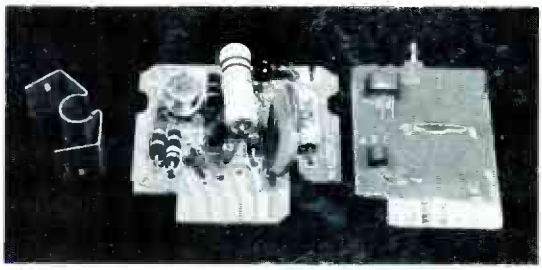
DECEMBER, 1970 □ 75 cents

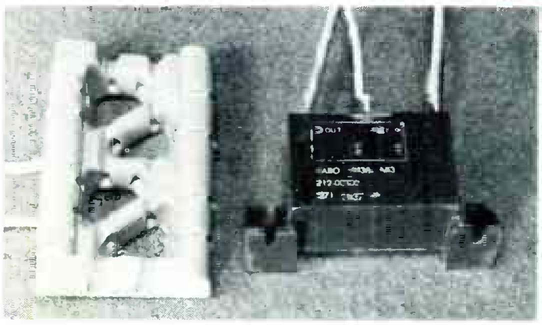
A HOWARD W. SAMS PUBLICATION

Electronic Servicing









NEW CIRCUITRY IN '71 COLOR TV

Articles beginning on pages 16 and 38

Updated and expanded Source Guide to Imports, page 50

Cut your time

With "QT." The Quick Turnover Parts Inventory System from RCA.

How much time do you spend in the shop searching for parts? And if you don't have them, how long does it take you to get them?

If you're doing more than your share of looking for parts or ordering them on the phone, you're wasting time.

Time that's cutting down your efficiency and preventing you from doing the really important things.

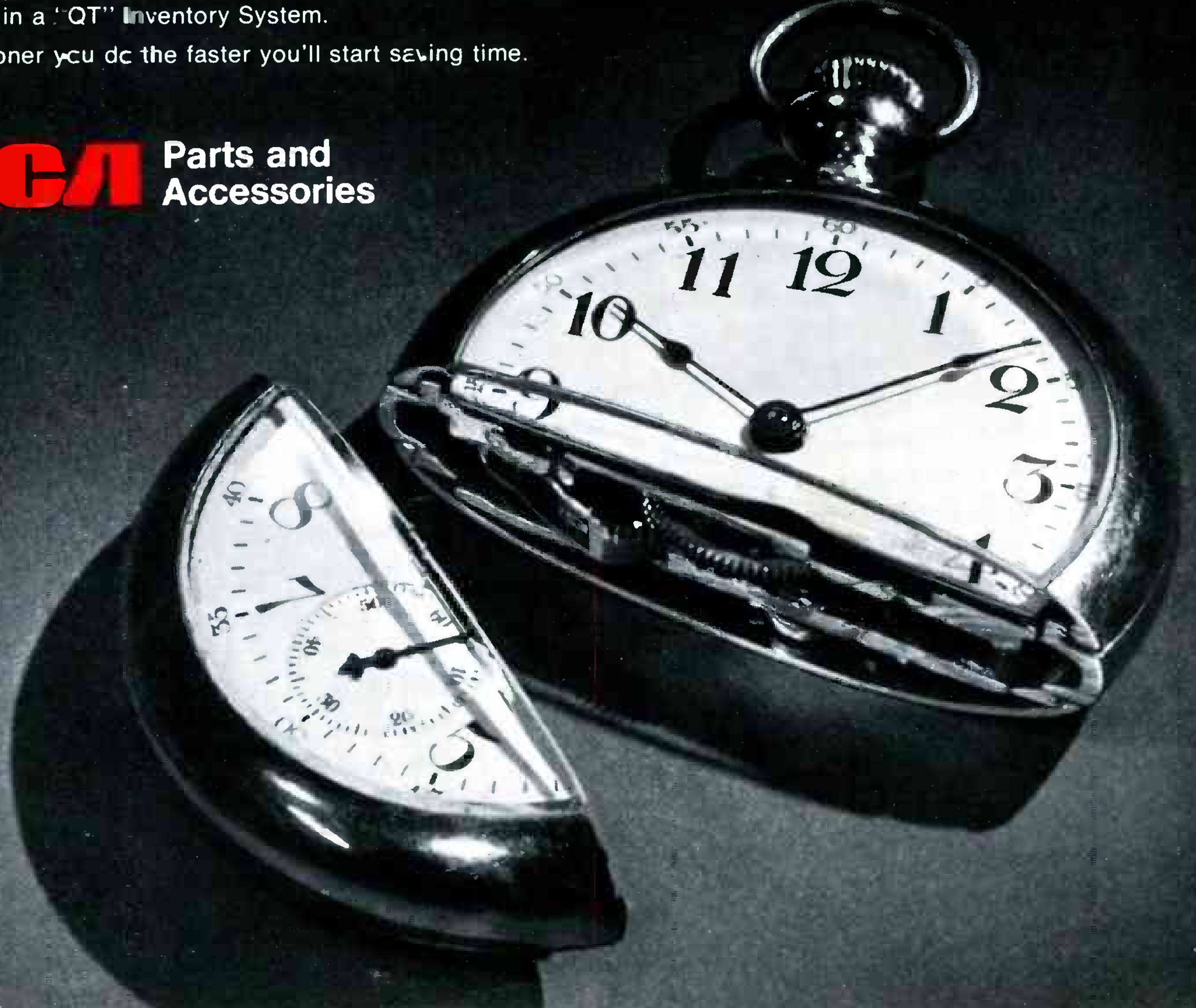
That's where our Quick Turnover Parts Inventory System ("QT" for short) can help.

It's a system that puts 250 of the fastest moving RCA parts for TV sets, radios and phonographs at your fingertips. Parts selected by RCA's computers.

You'll also know when the supply is running low. And should any of the parts be dropped from the "top-mover" list, simply return them through your "QT" distributor.
Talk to your RCA Parts & Accessories Distributor about putting in a "QT" Inventory System.

The sooner you do the faster you'll start saving time.

RCA Parts and Accessories



FREE! YOUR FIRST CAN OF TUN-O-BRITE IS ON US!

We say TUN-O-BRITE is head and shoulders above any other tuner spray you've ever tried. You say you've heard that song before.

It's time for us to put our money where our claims are. Tell you what we're gonna do. Buy a can of TUN-O-BRITE from your favorite distributor — at the regular price.

When you've used the TUN-O-BRITE up, send the empty can to us. We'll send you a new can *OF YOUR FAVORITE TUNER SPRAY FREE!*

There are no strings attached to this offer. If you ask for TUN-O-BRITE, we'll be delighted to send you another can absolutely free. If you ask for a competitive brand, we'll be disappointed, but we'll send it to you anyhow. Either way, you can't lose. You get to try TUN-O-BRITE at our expense because you can swap the empty can for a free can of your favorite tuner spray.

Of course, we're betting that once you try TUN-O-BRITE, you simply won't settle for any other product, no matter how cheap you can buy it. After all, you can tell a professional TV technician by the tools he uses.

ONLY ONE FREE CAN TO A TECHNICIAN.

This offer expires February 1, 1971

CHEMTRONICS Inc

CHEMTRONICS

1260 RALPH AVE.
BKLYN., N.Y. 11236

Circle 3 on literature card

← *Circle 1 on literature card*

December, 1970 • Volume 20, No. 12

Electronic Servicing

Formerly PF Reporter

in this issue...

DEPARTMENTS

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Robert E. Hertel, Publisher
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Do you want the same things Dick DeVroeg wants in capacitors?

Then you'll ask for Sprague Twist-Lok® Capacitors when you need twist-prong electrolytics.

As manager of S&R TV in Lake Forest, Illinois, Dick DeVroeg knows the importance of using quality components.
The 8-man S&R organization has built a name for itself in northern Chicago suburbs over the past 18 years.
"To maintain our reputation in servicing everything in electronics," Dick says, "we just can't compromise on dependability.
That's why we prefer Sprague Twist-Lok Capacitors."

Ask your Sprague distributor for a copy of Sprague's Electrolytic Capacitor Replacement Manual K-109 or write to:
Sprague Products Company, Marshall St., North Adams, Mass. 01247.

P.S. You can increase your business 7½% by participating in EIA's "What else needs fixing?" program. Ask your distributor or write to us for details.

Circle 4 on literature card

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THE MARK OF RELIABILITY

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electronic scanner

news of the industry

Business Consultation Offered By NATESA

A direct consultation service "on all phases of home electronic service business problems" is being offered members by the National Alliance of Television and Electronic Service Associations (NATESA).

There is no charge for the service except for those problems that require extensive and costly research. In such cases, the member will be advised of the cost before research of the problem begins.

Under this plan, the member is asked to submit his question in a typed, double-spaced letter, providing as many related details as possible. The member also must include his NATESA license number and a self-addressed, stamped #10 envelope.

Each question reportedly will be studied and, if necessary, researched and answered as soon as possible, depending on the complexity of the problem.

The service is not meant to replace members' own legal or accounting agencies, states Frank Moch, Executive Director of NATESA.

EIC Formed to Unite Electronics Industry and Solve Mutual and Related Problems

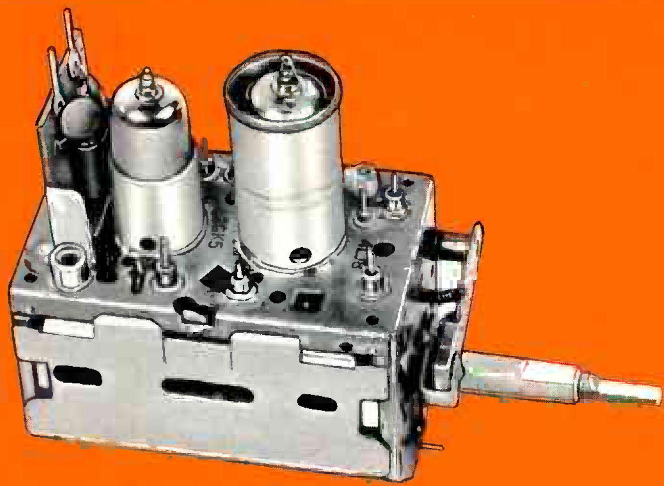
The Electronics Industries Council (EIC) was formed in Chicago on Sept. 29 to serve in a liaison capacity between all electronics trade associations. The group formulated plans for industry-wide cooperation encompassing all segments of production, service, merchandising, broadcasting, research and technical applications.

Associations represented at the first formal meeting of the council were: The Electronic Industries Association, Distributor Products division; National Electronic Associations; National Association of Broadcasters; National Alliance of Television and Electronic Service Associations; National Electronic Distributors Association; Electronic Representatives Association and the International Society of Certified Electronic Technicians.

Invitations to participate in the EIC are being extended to nine other trade groups: the National Appliance and Radio Dealers association; the Association of Electronic Manufacturers; the Western Electronic Manufacturers Association; the Society of Broadcast Engineers; the Institute of High Fidelity; the National Cable Television Association; the American Loudspeaker Manufacturers Association; and the National Association of Music Merchants. Other interested trade groups also are invited to send representatives to the Dallas meeting in February and to consider participating on a permanent basis.

The Chairmanship of the group will be rotated each succeeding session. Gene Hill, Kaiser Broadcasting Co.,

(Continued on page 6)



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TUNER SERVICE CORPORATION

PROVIDES YOU WITH A COMPLETE SERVICE FOR ALL YOUR TELEVISION TUNER REQUIREMENTS AT ONE PRICE.

TUNER REPAIR

VHF Or UHF Any Type $9.75.
UHF/VHF Combo $15.00.

In this price all parts are included. Tubes, transistors, diodes, and nuvistors are charged at cost.

Fast efficient service at our 4 conveniently located service centers.

1 year guarantee backed up by the largest tuner manufacturer in the U.S.—SARKES TARZIAN INC.

All tuners are cleaned inside and out, repaired, realigned and air tested.

TUNER REPLACEMENT

Replacement Tuner $9.75.

This price buys you a complete new tuner built specifically by SARKES TARZIAN INC. for this purpose.

The price is the same for *every* type of universal replacement tuner.

Specify heater type

Parallel 6.3V
Series 450 mA
Series 600 mA

All shafts have the same length of 12″.

Characteristics are:
Memory Fine Tuning
UHF Plug In
Universal Mounting
Hi-Gain Lo-Noise

If you prefer we'll customize this tuner for you. The price will be $18.25. Send in original tuner for comparison purposes to our office in INDIANAPOLIS, INDIANA.

TSC

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MIDWEST . . . . . 817 N. PENNSYLVANIA ST., Indianapolis, Indiana . . . . . TEL: 317-632-3493
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EAST . . . . 547-49 TONNELE AVE., Jersey City, New Jersey . . . . . TEL: 201-792-3730
SOUTH-EAST . . 938 GORDON ST., S. W., Atlanta, Georgia . . . . TEL: 404-758-2232
WEST . . . . SARKES TARZIAN, Inc. *TUNER SERVICE DIVISION*
10654 MAGNOLIA BLVD., North Hollywood, California . . . TEL: 213-769-2720

Circle 7 on literature card

who presided at the initial meeting, will continue as Chairman at the next session, to be held in Dallas, Texas, on February 10, 1971. The Chairmen for the following two sessions will be Frank J. Moch and M. L. Finneburgh, Sr., respectively.

Groundwork for activation of the Council was laid in St. Louis in July, and Hill, the acting Chairman, followed through by setting up the organizing session, held at suburban O'Hare Inn in an all-day meeting.

Among projects and actions recommended by the Council were: Exchange of statistical, research and survey data among the trade groups; a parts availability survey; a census of electronic service technicians to determine future needs and an analysis of the industries' manpower.

The group also voted to recommend to the trade associations a study of the present Electronic Hall of Fame with a view to its expansion as an all-industry honor.

A permanent administrative staff was named, to consist of Dick Glass (NEA), Secretary; Bob Flanders (NAB), Records Coordinator and S. I. Neiman (Electronics Information Bureaus), Information Coordinator. Bill Woodbury, Sprague Products Co., will coordinate the parts availability survey.

GE Introduces First Combo Horizontal Output/Damper Tube for Color TV

The Y-2014 Compactron tube—reportedly the first combination of horizontal output and damper tube functions in one envelope rated for color TV—has been announced by General Electric's Tube Department.

The new Compactron combines the conventional 6KD6 horizontal output tube (pentode) and the conventional 6CJ3 damper (diode) tube in one T-14 envelope, offering ratings compatible with requirements for horizontal service in 18-inch, 90-degree color chassis.

GE Halts B-W Picture Tube Production

General Electric has announced discontinuation of black-and-white TV picture tube production, according to a recent report in **Merchandising Week.**

The reason given for the halt of b-w CRT production is increased importation, which reportedly is expected to account eventually for as much as 50 percent of the domestic market.

NFIB Survey Reveals Trends of Interest Rates Paid by Small Independent Businesses

Whether or not the cut in the prime interest rate charged by banks will benefit smaller business firms remains to be seen.

Data from the September continuous field survey of the National Federation of Independent Business (NFIB) showed the average interest rate paid by small business on bank loans remained steady at 8.6 percent for the second consecutive month.

However, because the cut in the prime rate did not occur until late in September, any decline in the interest rate to the smaller borrowers would not be reflected in the September data.

But casting uncertainty over whether or not the drop in rate charged to blue chip borrowers will be passed along further down the line is the fact that the cut in the prime rate from 8½ to 8 percent earlier in the year failed to be reflected in subsequent Federation surveys.

There is evidence that cutting the prime rate has slowed down the rate of increase in interest rates to independent firms. The average interest rate being paid banks reported by independents at the first of the year was 8.4 percent. This jumped to 8.5 percent at the end of the second quarter of the year, and now stands as 8.6 percent. Last year the increase in the national bank interest rate to small business was at the rate of 1/10th of one percent per month.

While the highest small business rate remains in the Pacific Coast states, followed by the Mountain states, the increase so far this year in those areas has not been as high as in some other regions. In the Pacific states the current bank rate reported by smaller firms is 9.6 percent, up from 9.2 percent in January. In the Mountain states it is 8.9 percent, up from 8.8 percent the first of the year.

The movement upward in the average bank interest rate so far this year has been more pronounced along the Atlantic Seaboard, with the exception of New England. In the Mid-Atlantic states the reported average rate has gone from 7.9 percent in January to 8.4 percent in September, and in the South Atlantic also from 7.9 percent to 8.4 percent, or a full half percent. In New England the increase reported over this period was only from 8.7 percent to 8.9 percent.

Among independent businessmen borrowing from

(Continued on page 8)

finance companies, the average interest rate reported had remained fairly constant over the year so far. In January it was 12.4 percent, compared to 12.7 percent in September. The lowest rate from this source was the 10.3 percent reported in February and the highest 13.6 percent reported in July.

Sylvania To Phase Out Most of Semiconductor Production

Sylvania Electric Products, Inc. announced today it will phase out most of its semiconductor manufacturing operations over the next three months.

This action will have no effect on components for Sylvania Entertainment Products; the Semiconductor Division has directed its product lines almost totally to defense needs and the computer industry.

Garlan Morse, Sylvania President, said "the decision was made to terminate much of our semiconductor manufacturing because there is no indication that, within the foreseeable future, stability will supplant the disorderly conditions that have characterized this branch of the electronics industry for many years."

The semiconductor operations to be phased out represent slightly more than two per cent of Sylvania's total sales of a wide range of electronic and lighting products. The semiconductor products to be discontinued are integrated circuits, diodes, and rectifiers. Not included in the phasing out is the microwave diode department, which produces highly specialized semiconductor devices.

No other Sylvania operation will be affected by the semi-conductor phase out, and advanced semiconductor research will be continued at General Telephone & Electronic's Laboratories Incorporated, in Waltham, Mass.

Mr. Morse said the decline in defense spending and extreme price competition in sales to the computer industry have had a particularly severe impact on semiconductor profitability.

Merger to Create Giant CATV Setup Approved by FCC

The Federal Communications Commission (FCC) has put its stamp of approval on the creation of a cable antenna television (CATV) system having outlets in 28 states, according to a report in **Home Furnishings Daily.**

The merger of H & B American Corporation, formerly the nation's largest CATV company, and TelePrompter Corporation, the fourth largest, will establish the giant CATV system. The merged firms reportedly will operate under the TelePrompter name. (The largest stockholder in TelePrompter is Hughes Aircraft Corporation.)

TelePrompter reportedly told the Commission that the merger will enable it to originate high-quality programming. The FCC, earlier this year, ruled that CATV systems must originate programming, to keep their licenses.

North American Philips Offers Tape Recorder Servicing Seminars

A series of two-day seminars, conducted for its nationwide network of more than 300 authorized independent repair stations, has been inaugurated by the Home Entertainment Products Division of North American Philips Corporation.

The work-study classes—limited to 25 participants each—cover all aspects of service, repair and adjustment for the growing line of Norelco tape recorder products.

The first session was held the latter part of October at Norelco House, the firm's service facility in Skokie, Ill., according to Rudolph G. Kroupa, the division's general manager for service. It is being followed by seminars in factory service centers in New York, and Los Angeles, making a total of 18 meetings.

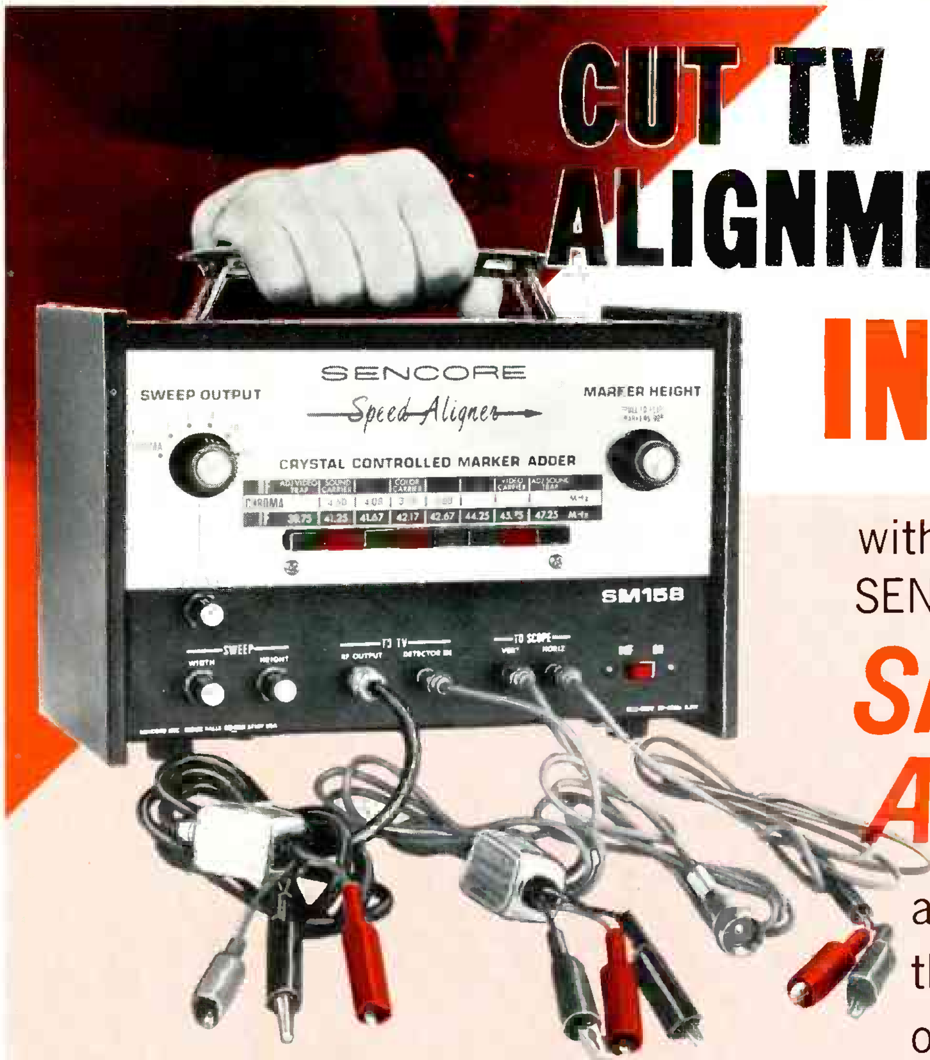
Audio Technician Seminars

Professional Audio Technician Seminars (PAT) are scheduled for successive sessions in all major cities of the U.S., according to Fisher Radio Corp., sponsors of the seminars.

All service technicians within each market area are invited to attend.

Details and specific dates and locations can be obtained by writing:

PAT Service Center
P. O. Box 1
Long Island City, N.Y. 11101 ▲



CUT TV ALIGNMENT TIME IN HALF!

with the all new SENCORE SM158

SPEED ALIGNER

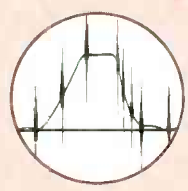
and at $120.00 less than competition!
only $275.00

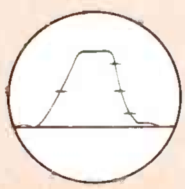
Here are 7 Reasons why we call the SM158 the Speed Aligner

AUTOMATIC ALL CRYSTAL CONTROLLED MARKERS: You will never spend any more time looking up marker frequencies or interpreting them when you own an SM158; they are automatic. For example, want the chroma carrier on any RF curve, IF curve, or chroma curve, simply push the chroma carrier marker button. Want the sound, video, adjacent carrier markers or any other marker on any curve, just push the button as directed on the panel. The SM158 is fast and saves you time . . . that's why we call it the speed aligner.

UNLIMITED MARKER AMPLITUDE: The marker height control is like a powerhouse; crank it up as far as you want, even to the point where the markers are larger than the scope screen, without upsetting the response curve. Each marker is crystal controlled on fundamental frequencies and post-injected so that you may place all markers on the curve at unbelievable heights without affecting the curve in the least. That's why we call the SM158 the speed aligner.

EASY TO CONNECT: Just four connecting cables clearly marked TO TV and TO SCOPE. It takes just seconds to connect . . . that's why we call the SM158 the speed aligner.





TWO EXTRA VHF CHANNELS: Competition has only two VHF channels; the SM158 has an extra high channel and an extra low frequency channel to prevent any co-channel interference. The SM158 is interference-free . . . that's why we call it the speed aligner.

PLENTY OF SWEEP WIDTH: A full 15 megahertz sweep signal, constant on all IF, chroma and RF curves, provides adequate sweep width to cover new solid state IF amplifiers. Competition covers only 12 megahertz. The SM158 gives you the full picture the first time . . . that's why we call it the speed aligner.

GENERATES A ZERO REFERENCE BASE LINE: You know where zero is with the SM158. All alignment instructions show a base line, yet some competitors do not generate a base line. You can follow TV manufacturers' instructions to the "T", easier and faster with the SM158 . . . that's why we call it the speed aligner.

SWITCHABLE HORIZONTAL OR VERTICAL MARKERS: want to tilt markers 90 degrees so you can view markers better in traps or for leveling? Merely pull the MARKER HEIGHT control out and markers appear horizontally — a real plus feature.

THE IDEA PEOPLE

SENCORE

3200 Sencore Drive
Sioux Falls, South Dakota 57107

Circle 11 on literature card

readersexchange

Electronic technicians and owners or managers of electronic service shops who need assistance obtaining a part, service literature or any other item related to the servicing of electronic equipment, or who have for sale such an item, are invited to use this column to inform other readers of their need or offer. Requests or offers submitted for publication in this column should be sent to: Readers' Exchange, ELECTRONIC SERVICING, 1014 Wyandotte St., Kansas City, Mo. 64105. Include a brief but complete description of the item(s) you need or are offering for sale, your complete mailing address and how much you are willing to pay or want for the item(s). Individuals responding to a request or sale offer in this column should write **direct** to the requestee or seller.

Test Equipment for Sale

I have a 5-inch, wide-band oscilloscope, Model 555, manufactured by General Electronic Equipment Co., Easton Pennsylvania. It is in good condition with operating instructions and schematics. I would like $50.00 for it.

James C. Williams
519 South 7th St.
Wilmington, N.C. 28401

I have the following test equipment for sale at a very reasonable price (one owner—all originally purchased brand-new by myself):

RCA Rider Chanalyst Model 162-C;
Hickok Dynamic Mutual Conductance Tube Tester combined with VOM, Model 534-A;
EICO grid dip meter, Model 710.

B. J. Brown
Box 548
Trion, Georgia 30753

I have the following TV test equipment for sale:

RCA Oscilloscope Type WO-91B;
Jackson-Sweep & Marker Generator Model TVG-2;
Sencore-DeLuxe Color-Bar Generator Model CG-141.

Low, bargain prices. All test leads, probes and instruction manuals are available. If anyone is interested, please write:

W. D. Shevtchuk
One Lois Avenue
Clifton, New Jersey 07014

I want to sell all of my test equipment, still in very fine condition, in one package for the best offer (express collect).

I have the following items:

1) *Heath Laboratory 5" Oscilloscope Model 10-12, plus two probes*
2) *Heath Vacuum Tube Voltmeter, Model 1M-11, plus two probes*
3) *Superior Genometer signal generator*
4) *Superior Cathode Ray Tube Tester and Rejuvenator*
5) *Superior Rapid Tube Tester*
6) *Radio Shack Tube Tester*
7) *One tube caddy complete with 218 Radio and TV tubes, all new.*

I also have for sale all issues of Electronic Technician/Dealer and Electronic Servicing/Formerly PF Reporter which date from 1961 to the present.

Charles C. Ramirez
306 West 15th St.
San Angelo, Texas

I have written many articles in different electronic magazines in the past years about test and hobby type equipment, and now I have a closet full of models, built especially for these articles all brand-new but bearing some signs of the extensive shipping. I would like to sell them for the price of the material. I will give the copy of the manuscript with each one, in case the article can not be located.

1) *"Triggered sweep for any scope" model and Heath 0-10 Scope*
2) *Transistor tester*
3) *Power supply, variable 0-50V*
4) *FET DC voltmeter*
5) *Studio microphone, Dynamic, Astatic 77-A*
6) *Horn and Hailer for Jeep/Boat 12 V, 5W*
7) *Professional Sun Gun with SCR dimmer, 1000W*
8) *Flashmeter*
9) *Stereo amplifier, solid state with preamp, 35W/ch.*

The manuscript contains all schematics so later repairs will not cause any problems.

Imre Gorgenyi
7807 E. Diamond St.
Scottsdale, Arizona 85257

Info About TV Technician Employment Opportunities Needed

I am training to be a TV technician and will complete my training in about one year. I would like any information that readers would care to give concerning which areas of the country opportunities for trained technicians are most lucrative.

Leonard P. Root, Jr.
15473 Patricia Dale Drive
Baton Rouge, Louisiana 70815

Help Needed

Can anyone help me obtain circuit information on a Superior Instrument Co. Genometer model TV50? The one I have is very weak.

L. H. Gray
212 Thoroughman
Ferguson, Missouri
63135

I need some help in finding some 12FR8 tubes, which seem to be out of production, with no sub-

(Continued on page 12)

stitute listed. If any of your readers can help me, I would like to know quantity and price.

John L. Wiersma
1819 Chamberlain SE
Grand Rapids, Michigan
49506

I need information on a Crosley regenerative receiver Model 5-50. It uses Armstrong patents dated October 6, 1914, and has five GW 201A tubes.

I also need an FM 1000 tube or a substitute tube or a solid-state device. It is a pentigrid type used as an FM detector in a Philco Model 48-482 (PHOTOFACT Folder 30-472-24).

Durward Dostie
54 Academy St.
Amsterdam, New York

I would like to obtain a schematic for a Lowery Organ Model .07, built in the 1930's by a Chicago manufacturer.

I would appreciate any help or assistance anyone could give me.

J. Corcoran
515 Skylark Dr.
Rockford, Illinois

I have been unable to locate a tube for a Philips TV set that was made in Canada. The tube is a 13CM5. I have tried all over the San Francisco and Oakland Bay area with no success. The tube is a Rogers brand, made in Canada.

Can someone please tell me where I can purchase this tube or where I might obtain the address of Rogers in Canada.

Monson TV
438 43rd St.
Richmond, California

Photofacts for Sale

I am working for a TV dealer now, and do not use my own Sams Photofacts.

I have folders No. 158 to No. 1037 inclusive with file cabinets.

I would like to sell them.

Tony Braidic
5831 Marra Drive
Bedford Heights, Ohio 44146

Radios for Sale

I have for sale two Majestic console radios, Model 70, manufactured by Grigsby-Grunow of Chicago.

Robert S. Rash
Custom TV
2962 Brockton Ave.
Riverside, California

▲

troubleshooter

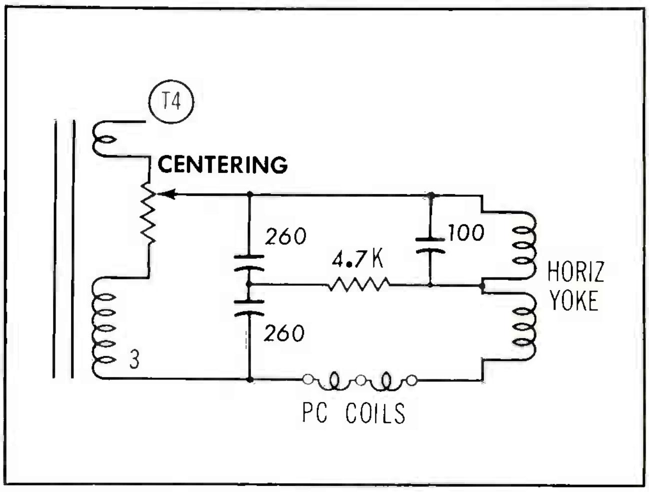
Yoke Resistor Smokes; High Voltage Will Not Vary

The 4.7K-ohm resistor inside the yoke of a GE Model M907 color TV runs so hot it smokes. R10, the pincushion control, also overheats. In addition, the high voltage doesn't change when the high-voltage control is adjusted; it remains at 26KV.

I have replaced all the horizontal tubes, checked all capacitors, and replaced the boost and focus rectifiers. The pincushion transformer tests normal on an ohmmeter.

My guess is that the flyback is bad. I hope you can prove me wrong.

Willie Buendia
Planada, California



During normal operation, the two 260-pf capacitors (see diagram) and the two horizontal yoke windings form a balanced bridge. No voltage appears across the 4.7K-ohm resistor, except for a slight unbalance, and the resistor operates with very little heat.

Any unbalance of the 260-pf capacitors or the yoke windings will cause the resistor to overheat and burn up. Excessive leakage in the 100-pf, anti-ringing capacitor also will cause the resistor to burn.

An open in one of the yoke windings, shorted turns in one of the yoke windings or leakage in the 100-pf capacitor will cause a trapezoidal picture.

An open in either one of the 260-pf capacitors will cause the 4.7K-ohm resistor to burn up and the yoke current to increase.

Check for the remote possibility of a defect in the pincushion circuit by simply shorting across the PC transformer winding that is in series with the cold end of the yoke. If there are no defects in it, nothing should change except the pincushion correction. If the overheating of the 4.7K-ohm resistor ceases, a defect in the pincushion circuit should be suspected. After the defective part is located and replaced, the high voltage should be readjusted. ▲

letters to the editor

Changes Stand on Technician Licensing

I wrote a letter to ELECTRONIC SERVICING some time ago favoring the licensing of television technicians. Now, I believe licensing is a mistake.

I have looked around quite a bit and found that those who have a license actually are more free to cheat the public than unlicensed technicians because most customers are naive enough to believe that a license makes him the most honest man around. Certainly licensing should encourage a technician to be honest, but there are few individuals who will not try to get a fast buck if they can. With a license the technician is free to get it. The license does not make the best man, either; it only indicates that he should be the best man.

Licensing to some extent does restrict free enterprise—the freedom of servicers to deal with each other on a competitive basis to keep prices within reach of all consumers. The licensed man usually is the highest-priced man around, and no one can force his prices down.

My business gets so slow in the summer that I have to close up my shop and seek other sources of income. Everyone is either on vacation, working in the field or lounging around lakes. Consequently, I am a part-timer. But don't knock it. A part-timer is not necessarily a "sorry" technician . . .

I am considering shutting down altogether, except in my spare time, and taking a supervisory position with a company.

Billie W. Fowler
Memphis, Texas

Views on RCA's "Service America"

In reviewing the recent article on RCA's entrance into the all-brand servicing with "Service America" I have suddenly realized that the "Independents" may not be long for this world.

Qualified technicians are few in quantity and quality and greater effort should be put forward to recruit and train new technicians for the ever increasing service market. Is "Service America" truly the answer to the "Independents" quest for relief? What would happen if other large companies such as Zenith, Magnavox, Sylvania, Motorola, Westinghouse, etc. were to jump on the bandwagon with similar service centers?

Robert L. Crutchfield
Torrance, California

I was much amazed and amused by the "All-brand Servicing" article in your September issue.

Why RCA feels obligated to apologize for or relinquish cost saving advantages in providing repair service amazes me.

The main reason for entering the "all-brands" servicing field should be to make a profit. This can only be accomplished by superior management minimizing operating expenses, while maximizing servicing skills and customer awareness. If deemed necessary by RCA, this should include recommending RCA products, without apology, and use of RCA facilities, whenever cost advantages may be realized.

It is amusing, though unfortunate, that certain entities, apparently prodded by an appeal to weakness, feel compelled to band together and exert pressure to reduce the capabilities of others to a common level. How much more worth-while if this vast energy were directed inward toward self-improvement and proficiency!

I am a one-man operation because I want to be, but I can effectively compete in many ways through my own efforts.

May I never cultivate a desire to mind the other fellow's business, large or small, or expect to succeed in business without really trying.

Here's hoping RCA Service America and all electronic servicing entities, including my own, always receive exactly what they earn.

Robert N. Woodcock
Manhattan Beach, Calif.

Parts Availability

In answer to George Savage of Grand Island, Nebraska: Not all companies delay sending parts.

In August of 1970, I needed a transistor for a Magnavox TV. I ordered the part from the company in Skokie, Illinois, after finding that it could not be purchased locally. I figured what I thought to be a reasonable amount for the part, and added for postage and handling. I then sent a signed blank check good for no more than a specified amount. Five days later, I had the part—and a satisfied customer.

It seems that if one is willing to trust a manufacturer, one gains by it.

L. J. Pederson
Kansas City, Missouri ▲

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New Service Literature

TV TECH AID, Edward G. Gorman, Kings Park, L.I., New York 11754; printed monthly; yearly subscription $7.95.

A monthly summary of actual color and b-w TV trouble symptoms, their possible causes and the cure for each. Where needed, a schematic of the circuitry involved is included.

The troubles and cures are grouped according to manufacturers, which, in turn, are listed alphabetically. The format of the publication is designed to facilitate filing the troubles and cures according to manufacturer and chassis number—**a definite aid to quicker servicing.**

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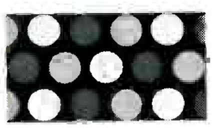

Zenith Chromacolor picture tube pinpoints the color dots on a jet black background and for the first time fully illuminates every dot.

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shoptalk

With Carl Babcoke
ES Technical Editor

New and Changed Circuitry In '71 Color TV

General trends in the designs of new color TV circuits for 1971 are almost identical with those reported in the December '69 issue of ELECTRONIC SERVICING. These major trends are:

- Increased use of solid-state components in both hybrid and all-solid-state designs. Integrated circuits show a small increase in usage, but the increase is less than had been predicted by some sources.
- Solid-state high-voltage tripler and quadrupler rectifier assemblies, which include both the diodes and capacitors, are found in nearly half of the new chassis. Two such assemblies, employed in Zenith chassis, are shown in Fig. 1. High-voltage regulators of the 6BK4 type are used only in about 15 percent of the new chassis designs.
- Automatic tint control (ATC) circuits are in fashion now; most of the major manufacturers offer at least a few models equipped with one of the two basic types of ATC.
- Varicap- or varactor-tuned circuits in both VHF and UHF tuners have received much publicity, but, as yet, few new color receivers have this feature.
- The use of plug-in modules is increasing slowly, but the trend is well established and probably will eventually be adopted by most major manufacturers.

Despite the undeniable fact that the major trends differ only in degree from those of last year, a varied assortment of completely new and modified versions of previously existing circuits are incorporated in the new color receivers. The new and most-changed circuits are analyzed for you in the following paragraphs.

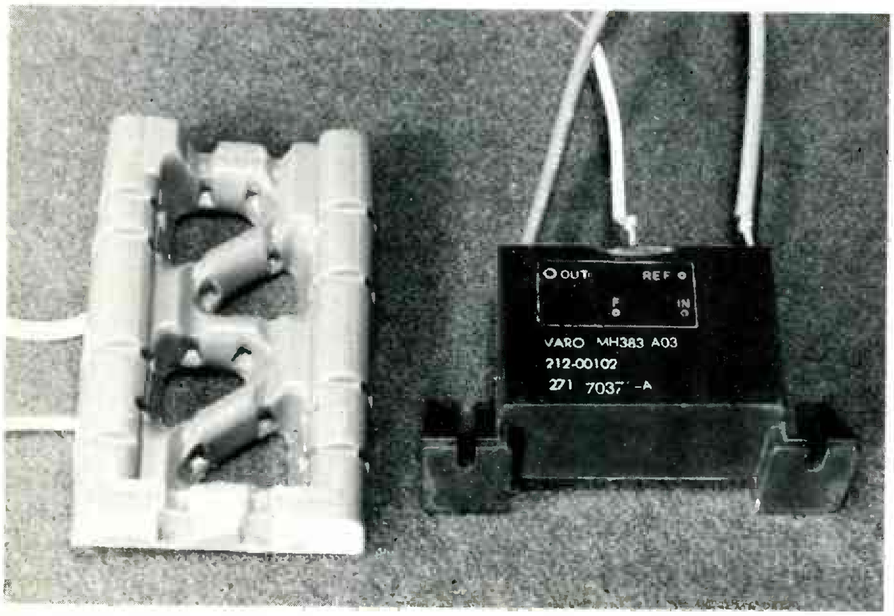


Fig. 1 Two of the several types of high-voltage rectifier and filter assemblies used in new Zenith color TV receivers.

Automatic Tint Controls

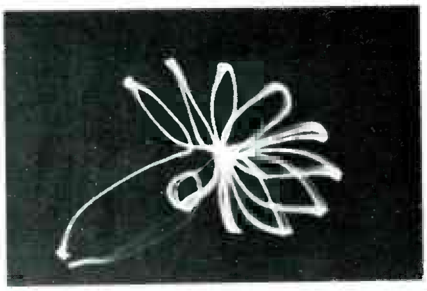
Automatic tint control (ATC) circuits are intended to offset the undesirable and frequent changes in tint, or hue, caused by variations in the broadcast signal. Because green or purple skin colors are the most displeasing flesh tints, all of the ATC circuits increase the amount of orange in the picture. Color-bar patterns, when the ATC is switched on, show as many as four orange bars instead of the usual one. Because some false hues will result from any ATC action that broadens the range of orange skin tones, only enough ATC should be used to keep the flesh tones relatively consistent and of an acceptable hue.

When servicing ATC-equipped receivers, remember that ATC action will change the null, or crossover, points of the color-bar signal viewed on a scope connected to the CRT, or the actual color-bar pattern viewed on the screen of the picture tube.

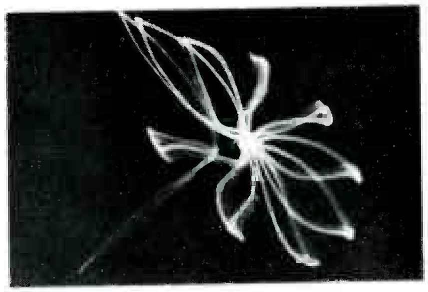
Magnavox and Admiral ATC

The ATC system in the new Magnavox T951 color TV chassis changes the phases of the yellow or red chroma signals to a 57-degree orange, which is satisfactory as skin color to most people. This is accomplished by gating on and off two transistorized channels, each of which has fixed amounts of phase shift. This correction signal then is combined with the normal chroma signal just before it is applied to the demodulators.

Vector patterns offer the fastest and most dramatic proof of this circuit action, as shown in Fig. 2. With the ATC switch in the FULL position, the first three petals are all at 57-degrees, and even petals 4 and 10 are moved nearer to 57-degrees. Petals 6, 7 and 8 are not affected at all; these are the hues in the cyan region. (Refer to page 26 of the October '69 issue of ELECTRONIC SERVICING for a more detailed explanation of this



(A) Normal vector pattern with the third petal at 90 degrees (red.)



(B) The first three petals all are at 57 degrees (orange) when the ATC switch is in the FULL position.

Fig. 2 Vector patterns illustrating Magnavox's ATC action.

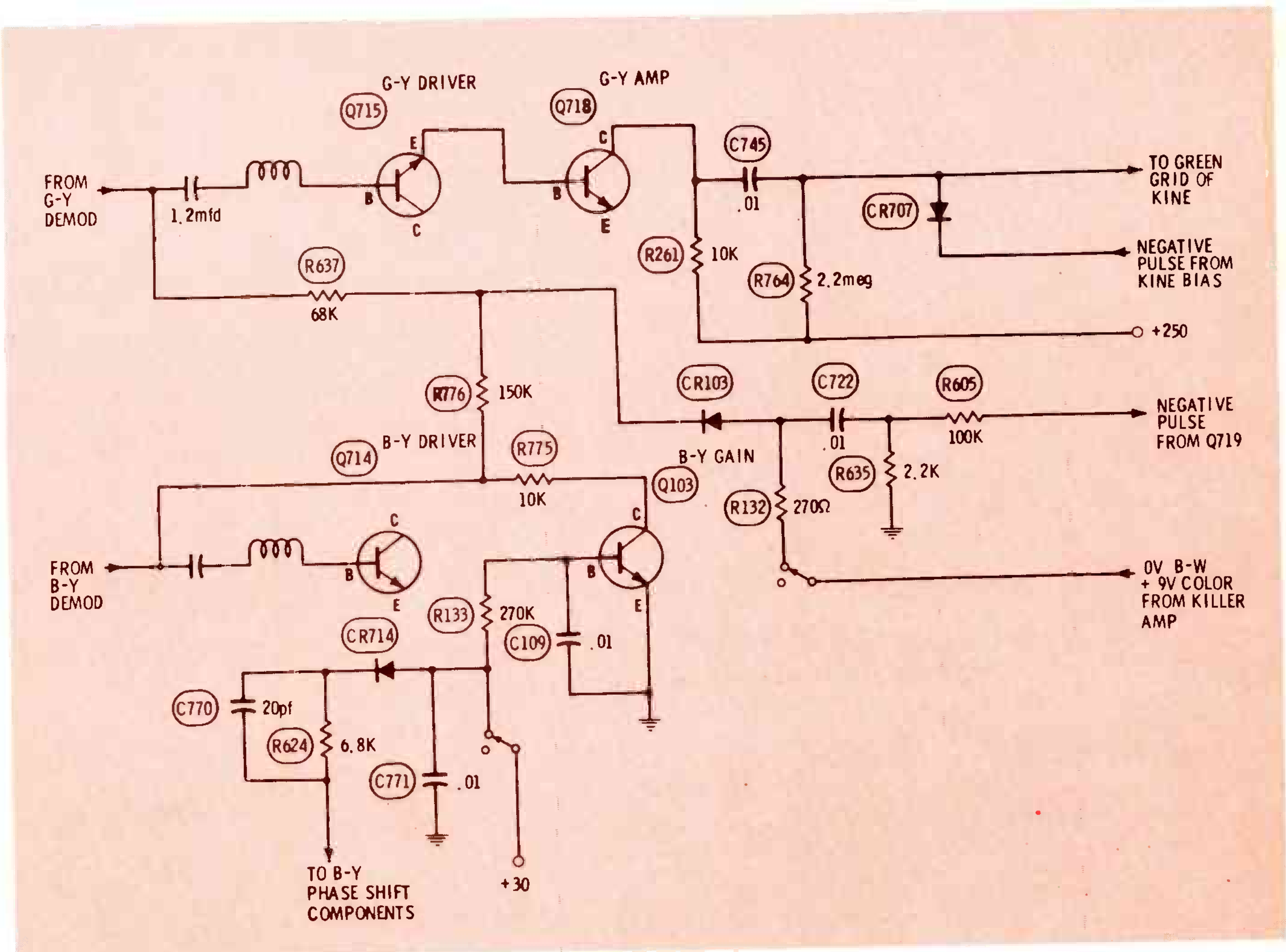


Fig. 3 The switching action of diodes and one transistor controls the ATC circuit of the RCA CTC44 chassis.

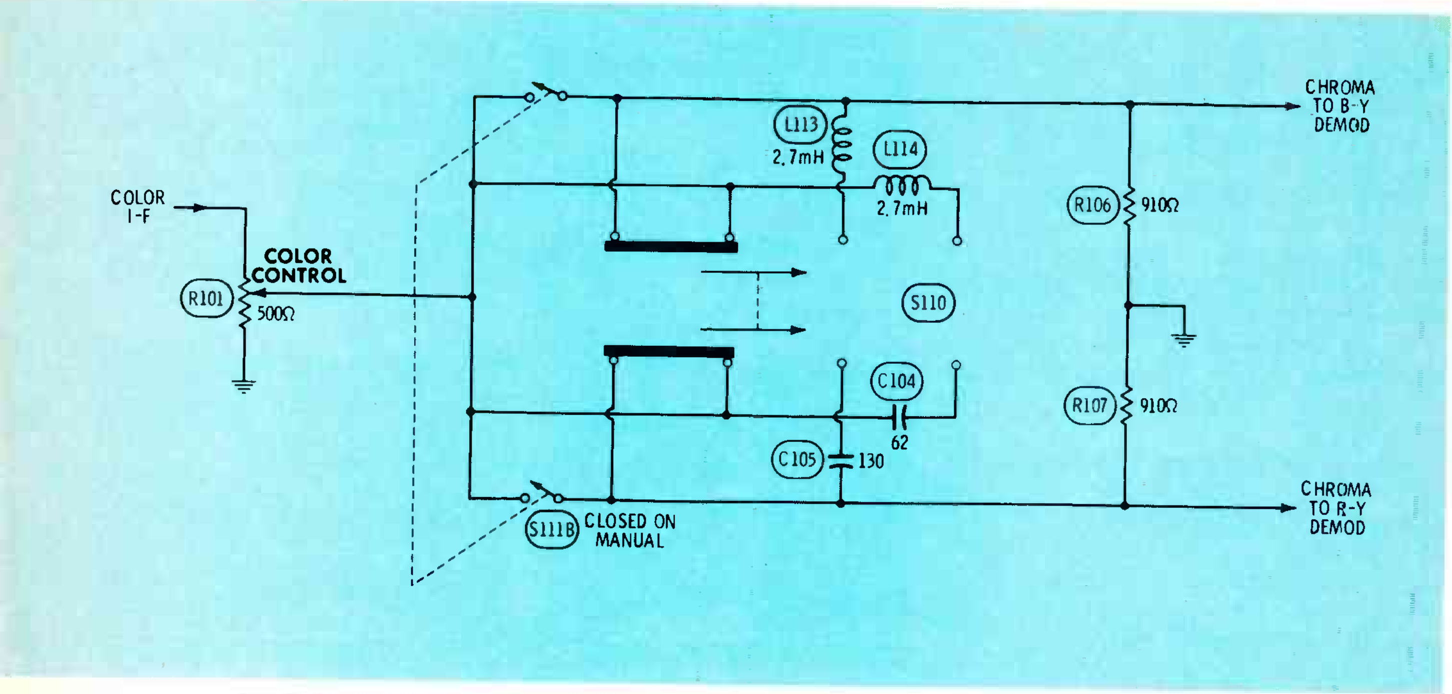


Fig. 4 Schematic of the Customatic Tint Lock circuit included in the General Electric KE-2 chassis.

particular ATC system.)

Magnavox color TV chassis T950 employs an ATC circuit, the operation of which is based on the same principle as that used in their other models, but in which several significant changes have been incorporated.

Chroma signals from the color control are applied to the base of QA5. Output from the collector supplies the main 3.58-MHz signal to the demodulators, while the signal from the emitter goes through "Partial" and "Full" switching diodes (controlled by DC voltages) to the Red and Yellow gate transistors. It is important to notice that QA5 is the stage whose gain is eliminated by the color killer. A varicap (or varactor) diode is used in the phase-shifting network of the Preference Control. The diodes and varicap apparently are used to avoid signal radiation or degradation that could be caused by the long leads between the ATC board and the front panel, if direct switching were used.

Admiral's Color Monitor employs almost the same circuit as the one found in Magnavox color chassis T951, except a chroma driver (emitter-follower) is inserted before the "Partial" and "Full" switch and the gate transistors.

RCA Accu-Tint

An analysis of the version of the RCA Accu-Tint (A-T) system used in the CTC39X color chassis was presented in an article which begins on page 30 of the July '70 issue of ELECTRONIC SERVICING. As explained in that article, three basic changes occur in the chroma channel when the A-T switch is turned to the ON position. These changes are:

• The phase of the 3.58-MHz car-

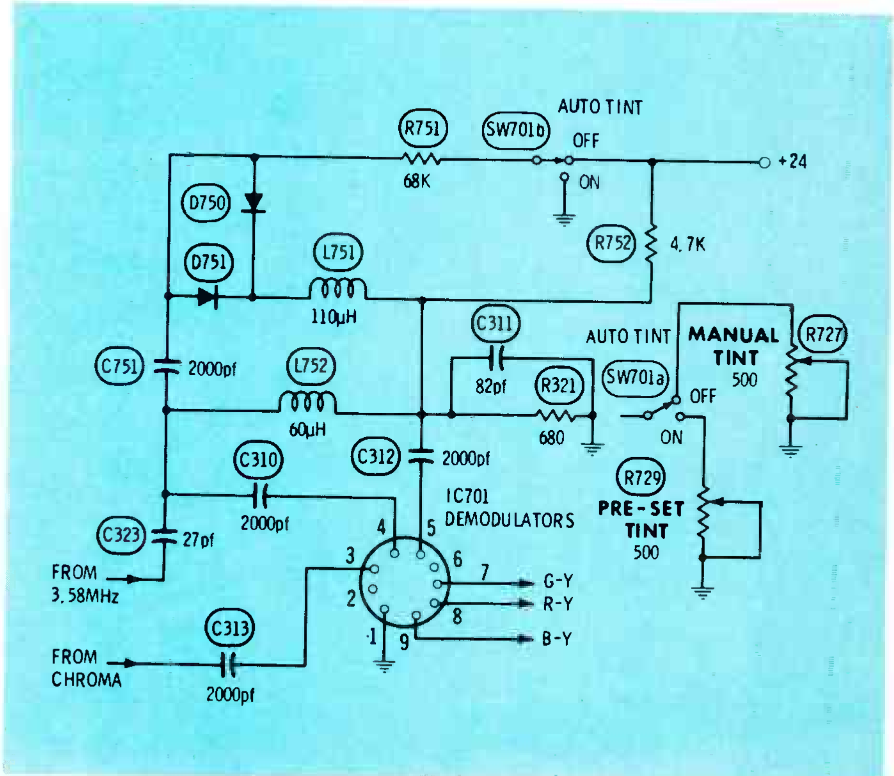


Fig. 5 The Auto Tint circuit designed into Electrohome's C9 chassis employs diode switching.

rier applied to the B-Y chroma demodulator is changed so that the output from this demodulator is separated from the R-Y signal by 124 degrees. Previously, beginning with their CTC16 chassis, RCA has used 105 degrees as normal phase difference between B-Y and R-Y signals. When a color-bar pattern is viewed on the screen of the TV and the Accu-Tint is switched to the ON position, the blue bars move about a half bar to the right (away from the red bars). This multiplies the number of color bars that are orange, or nearly orange.

- The output from the B-Y demodulator circuit is reduced about 33 percent.
- The hue, or gray-scale, of the b-w screen is changed from the normal blue-white to a brownwhite (sepia). This "warming" of the screen color "temperature" occurs only when the A-T switch is in the ON position during reception of a color signal (color killer inoperative).

These same changes occur in the chroma section of the RCA all-solid-state CTC44 chassis, but are the result of different ATC circuit actions. The schematic in Fig. 3 shows this part of the chroma circuit. When Accu-Tint switch S112 is turned to the ON position, +30 volts is applied to the anode of CR714, and, because its cathode is returned to ground through R624, L710 and the secondary of the tint transformer, it is forward biased and becomes a near-short circuit. This action connects C770 and R624 (through C771) in parallel with phase-shift components C758 and R778, which increases the phase shift of the 3.58-MHz signal that is applied to the B-Y demodulator.

The same +30 volts which is applied to the anode of CR714 also is applied, through R133, to the base of Q103. This forward-biases Q103, and the near-zero collector-to-emitter resistance grounds R775, reducing the output from the B-Y demodulator.

Warming of the screen color temperature is accomplished by adding opposing pulses to the grid clamp diodes connected to the green and blue control grids of the CRT. The +9 volts that appears at the collector of Q705 the killer amplifier transistor, when a color program is received is applied through S112 and R132 to the anode of CR103. This positive voltage forward biases CR103, which passes the clamping pulse (obtained from R-605, R635 and C722) on to R637 and R776. The negative pulses through R637 and R776 are amplified and inverted by the G-Y and B-Y amplifiers and finally applied to the anodes of CR707 and CR-708, which are connected to the green and blue grids of the CRT, respectively. The positive-going pulse on the green grid of the CRT and the anode of CR707 adds to the negative-going clamping pulse at the cathode of CR707 and drives the grid a few volts less positive than it would be without ATC action. Identical action takes place at CR708 and the blue grid of the CRT. Consequently, the brightness of both green and blue is reduced, while red remains the same.

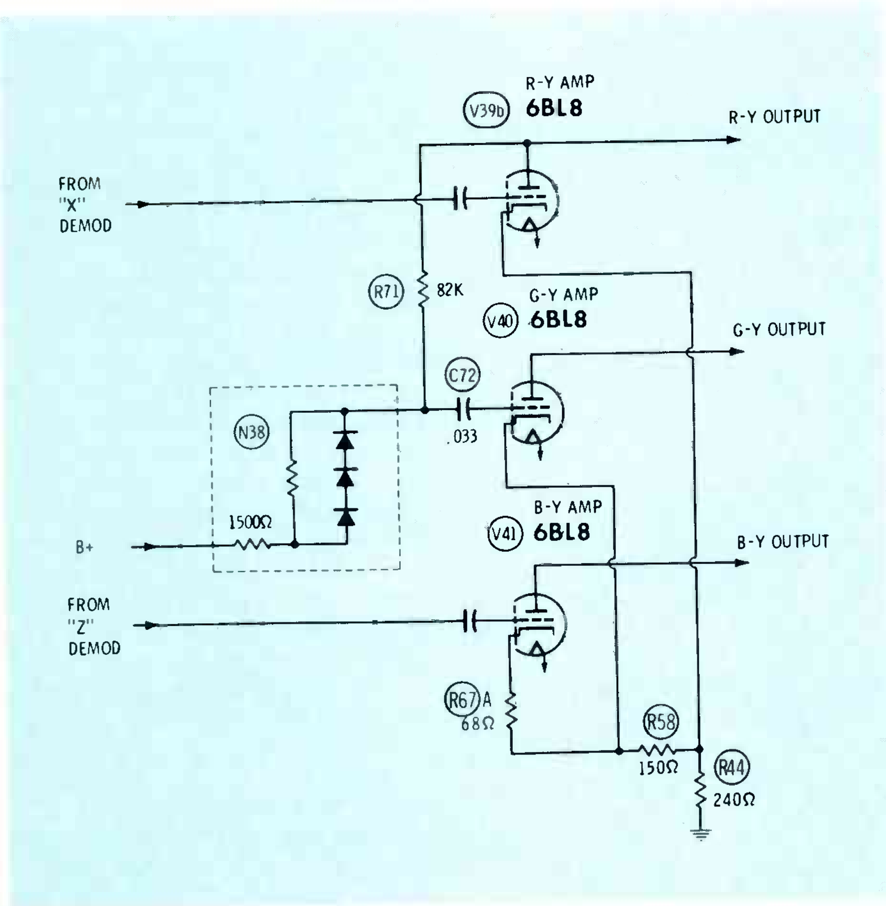


Fig. 6 A new type of matrixing is used in the production of the G-Y signal in Philco's 21ST90 chassis.

GE Customatic Tint Lock

Phases of the chroma signals applied to the B-Y and R-Y demodulators of the GE KE-2 color chassis are changed by the switch positions of the Customatic Tint Lock circuit. "Manual" and "Automatic" pushbuttons on the tilt-out control panel switch on the AFC and ATC functions in the "Automatic" position, and switch them off in the "Manual" position. Switching of the ATC action is shown in Fig. 4. In addition, S110 can be adjusted for no ATC action (110 degrees between R-Y and B-Y demodulators), moderate action (130 degrees) or maximum action (150 degrees).

Because of the weaker signal and the shorter length of lead, less radiation occurs when the chroma signal, instead of the 3.58-MHz carrier, is phase shifted by ATC adjustments.

Electrohome Auto Tint

Diode switching is used in the Electrohome hybrid chassis C9 to change the phase of the 3.58-MHz carrier applied to the integrated-circuit chroma demodulator, as shown in Fig. 5. The ON position of the Auto Tint switch (SW701, a front panel control) also switches in factory pre-set color and tint controls. These pre-set controls can be readjusted by a TV technician, if the customer is not pleased with the factory setting.

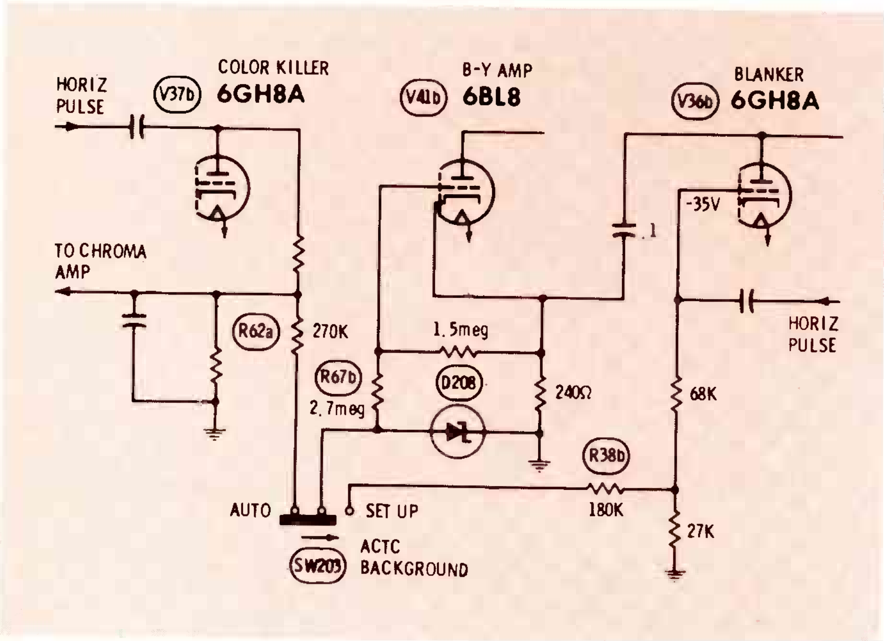


Fig. 7 Killer action in the Philco 21ST90 chassis during reception of color signals also changes the screen color to sepia.

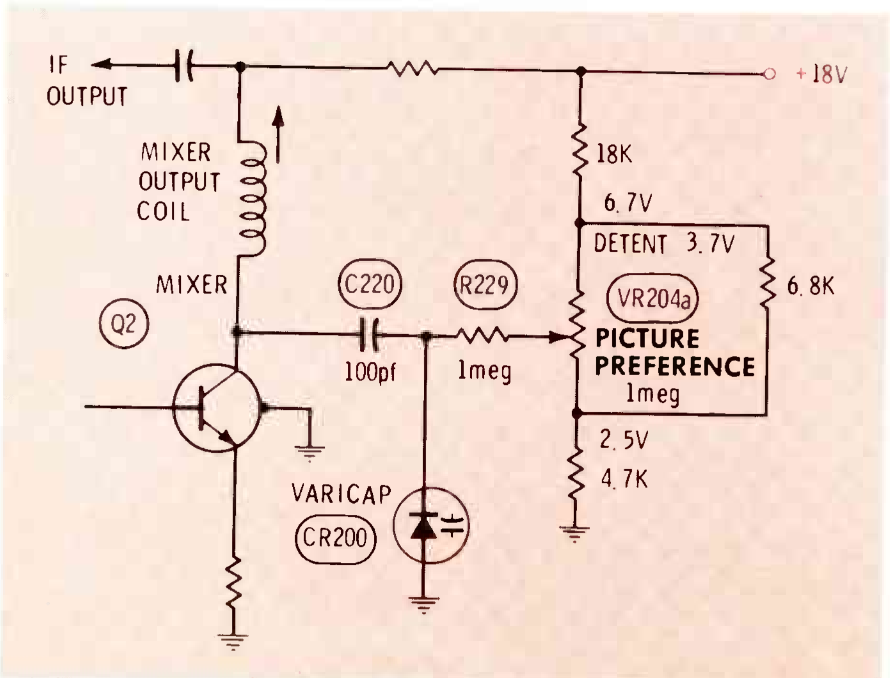


Fig. 8 A slight change of IF alignment by varicap tuning in the Philco 21ST90 chassis gives an effect similar to video peaking.

In the OFF position of SW701, the cathodes of D750 and D751 are more negative than the anodes; consequently, both diodes are a near-short, and L751 is connected in parallel with L752.

When SW701 is placed in the ON position, R751 is grounded and no DC voltage is applied to the anodes of the diodes. Because about +5 volts still is applied to the cathodes, the diodes are reverse biased, opening the circuit so that L752 is the only reactive element in the phase-shifting network. Consequently, the phase change is less than that produced with the switch in the OFF position.

Outputs from the R-Y and B-Y demodulators differ by 105 degrees in the OFF position of the Auto Tint switch and by 125 degrees in the ON position.

Philco Auto Tint

Philco does not have a switch or control for changing demodulator phasing, color balance or screen color of its new color receivers, but some of these features are built in.

Circuit features which produce actions that correspond roughly to a change in demodulator phasing are shown in Fig. 6. Most of the G-Y signal is developed in the common cathode circuit of the three tubes. R58 has been added to make the cyan hues less blue, and R67A slightly reduces the B-Y output. The G-Y amplifier needs additional signal from the R-Y stage to give proper matrixing, and this is obtained easily through R71. However, a better color reproduction of degraded picture information is produced if the R-Y signal fed through R71 is more negative than positive. The diodes and resistors in network N38 supply such a logarithmic voltage. Philco product information states that the interim quality of skin color is greenish; however when the tint control is readjusted to produce correct orange face hue, the green hues will have less blue contamination.

Philco also has an Automatic Color Temperature Control (ACTC) circuit which makes the raster color more sepia during reception of color signals. Fig. 7 shows the simplified schematic. Color-killer voltage is used to "identify" b-w or

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color programs for the circuit, and an ACTC set-up switch (SW203) is provided to switch in a standard voltage in place of the killer voltage, which might be undependable because of signal conditions during the adjustment.

In the SET-UP position of SW-203, a small amount of negative voltage, taken from the grid of the blinker tube, is supplied to the grid of the B-Y amplifier. To establish the desired b-w color temperature, the ACTC control is placed in the SET-UP position, and the screen color, or gray-scale, is adjusted in the usual way using the CRT drive and screen controls. Then the ACTC switch is returned to the AUTO position, in which the same amount of voltage established in the SET-UP position is supplied the grid of the B-Y amplifier by the color killer when b-w programs are received. Thus, the b-w screen color is the usual blue-white.

Because no negative voltage is generated in the color-killer circuit during reception of color signals, the grid of the B-Y amplifier is less negative than during b-w reception or when the ACTC switch is in the SET-UP position. The less-negative grid causes the B-Y plate to become less positive, and because the blue grid of the CRT is coupled direct to the B-Y plate, less blue is seen in the raster and picture. Part of this same effect also is transferred to the green, because of the common cathode connections. Less blue plus slightly less green makes the raster more orange, to emphasize skin hues.

The next Philco feature to be discussed is not strictly an ATC circuit (see Fig. 8), yet it is intended to relax the rigid grip that automatic fine tuning has on the b-w picture quality. In the VHF tuner, a varicap diode is used to change the tuning of the mixer-output IF coil when the reverse voltage on the diode is changed by means of the Picture Preference Control (PPC), which is located on the front panel.

Color quality is changed very little by this feature because, as Philco states, the change in alignment is stopped before the color is degraded. A detent is provided, and the receiver has been factory aligned with the PPC control set at the detent. Visible effect on the picture quality is somewhat the same as that produced by a video peaking control, with normal sharpness obtained at the detent. However, it is possible that better vertical and horizonal locking might be obtained on weak or poor signals with the PPC control set to smear slightly the b-w detail, compared to normal locking obtained with a video peaking control.

Zenith Auto-Tint Guard

Several of the new Zenith models use the circuit shown in Fig. 9 to improve the varying skin hues produced by some color broadcasts. Operation is straightforward: The demodulation angle between R-Y and B-Y is increased when SW204 is closed and connects C262 in parallel with C1016.

Plug-in Circuits

The expanding use of plug-in circuit boards, panels or modules could prove to be one potential source of help in relieving the added burden imposed on TV technicians by miniaturization and the added complexity of solid-state designs.

Motorola Quasar removable panels and Zenith Duramodules (shown in Fig. 10) are well known and seem to have been well accepted.

RCA for some time has been testing the module concept in selected models of their b-w receivers. Recently, RCA announced their CTC49 all-solid-state portable color TV chassis, which uses eleven modules. The locations of these modules and other major parts are shown in Fig. 11. Fig. 12 shows the socket on board PW300 with its associated module (MAC) removed. Sound module PM22 and its socket can be seen in the background.

Pre-CRT matrixing for each color is accomplished in the three MAD modules. Fig. 13 shows both the original type, which uses conventional discrete components, and the newer version, which is an encapsulated "computer card" type that eventually will replace all the original versions of all the modules. RCA states that the latter type gradually will be phased into production during the next few months.

Warranty on the different brands of modules varies. Motorola still has a replacement warranty on the entire panel. Zenith warrants only the individual parts on the Dura-

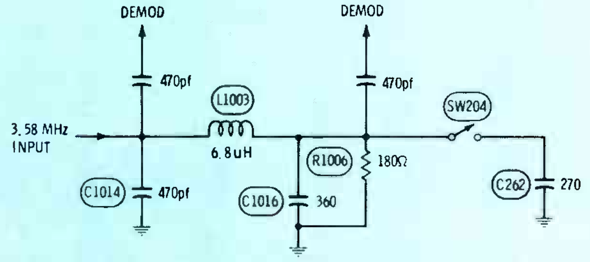


Fig. 9 The Automatic Tint Guard circuit in Zenith 40BC50 and 12B14C50 chassis adds a capacitor to the circuitry to alter demodulator phasing.

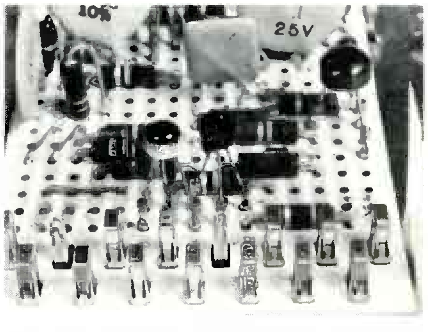


Fig. 10 Plug-in Duramodule used in Zenith's 4B25C19 chassis also features plug-in transistors.

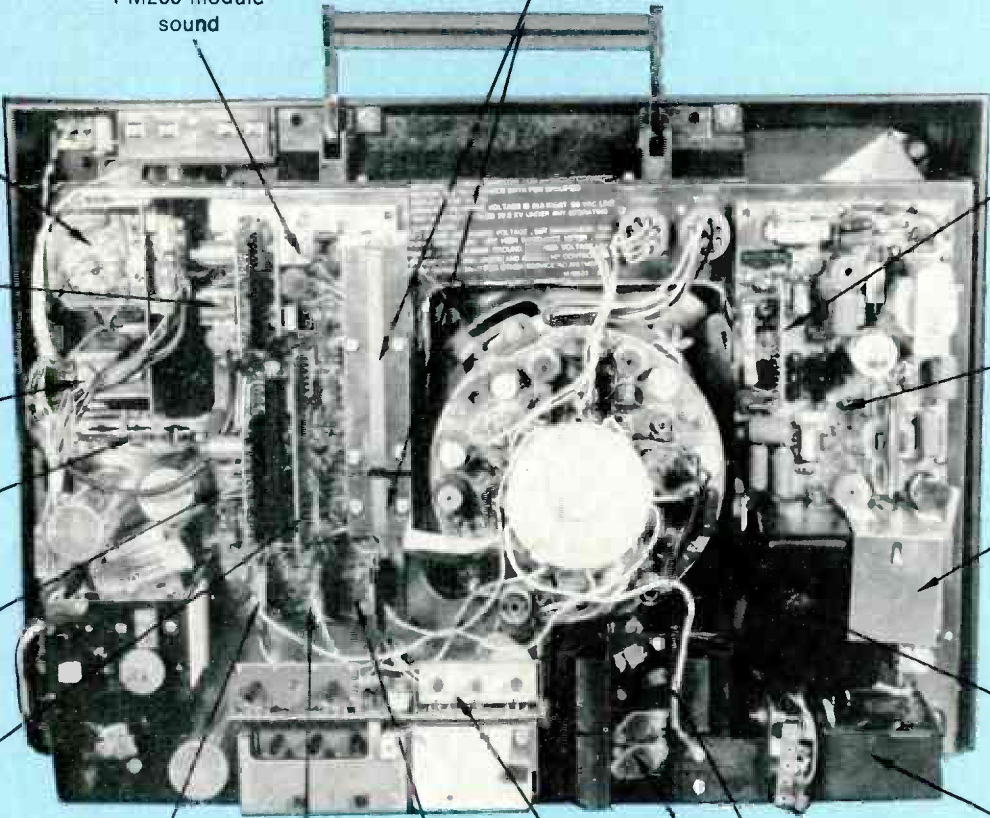


Fig. 11 Photo showing location of major components and the eleven modules that comprise the RCA CTC49 chassis.

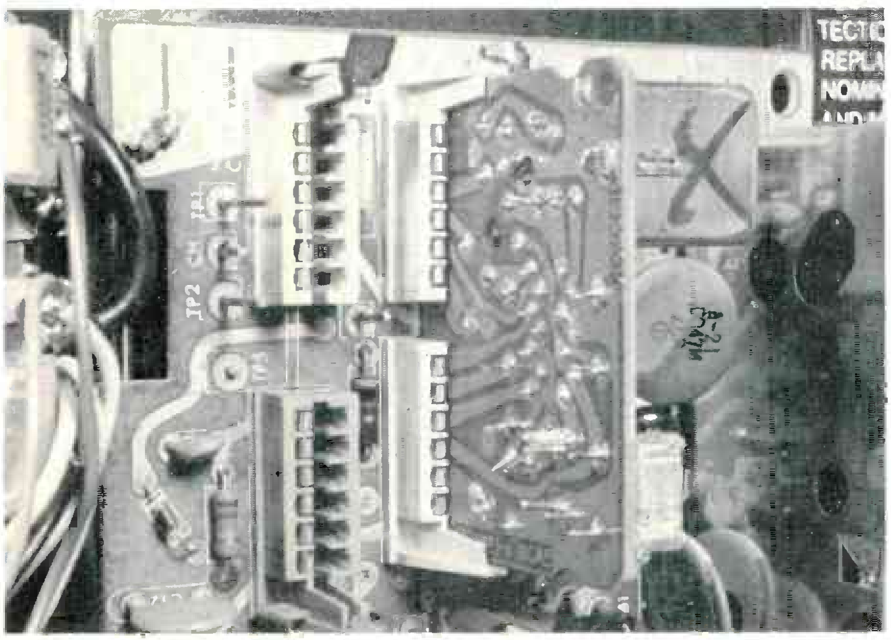


Fig. 12 Upper and lower sockets with module MAC removed from the RCA CTC49 chassis. Module PM200 and sockets are shown at right in background.

module (the transistors plug-in, as shown in Fig. 10). RCA provides a complete panel in exchange.

Motorola panels, Zenith Dura-modules and the present type of RCA modules can be serviced by normal troubleshooting and repair techniques if the modules are out of warranty, or if repair seems desirable for any other reason. RCA encapsulated modules cannot be repaired with reasonable effort; therefore, replacement is necessary.

High Voltage and Automatic Brightness Control

Fewer tube-type, high-voltage rectifiers and regulators are being used because of the possibility of radiation if the high voltage becomes abnormally high.

Fail-safe circuits, tripler and quadrupler rectifier assemblies with capacitors and semi-conductor diodes in one unit, elimination of the high-voltage DC shunt regulator tube and a search for new methods of high-voltage regulation are the order of the day.

Automatic Brightness Control (ABL) circuits help high-voltage regulation indirectly by preventing excessive CRT current and, thus, any excessive decrease in high voltage (which, if severe enough, causes a noticeable amount of picture blooming).

Extra Admiral Diodes

Several chassis which regulate horizontal sweep and high voltage by changing the negative voltage applied to the grid of the horizontal output tube have added an extra diode in series or parallel with the one necessary for pulse rectification. The ultimate in such cautious design is the circuit in Fig. 14, an Admiral design that employs four diodes in series-parallel. Failure of any one diode (or in certain specific failures, up to three diodes) will not affect the regulation.

High-Voltage Regulation

Sweep/high-voltage regulation and ABL circuits employed in Hitachi CFA-450 and CSU-690 models are shown in Fig. 15. T703 is a saturable core reactor which changes impedance in accordance with the load on the high-voltage circuit. The Japanese-to-American translation of specifically how this circuit functions was too garbled to understand, and the actual physical construction of the reactor, which obviously is of an unusual design, was not ascertainable from the material supplied us. The Hitachi service data says that the impedance of T703 varies as the current through it changes. Thus, LX winding of T703 is in parallel with the primary of T704, the high-voltage transformer. Any reduction in the impedance of T704 because of increased load should be offset by an increase in the impedance of LX.

Understanding the operation of the ABL circuit is relatively easy if you imagine that R724 is connected to ground instead of +120 volts, and then realize that the voltage at the low end of the high-voltage transformer secondary is the source of negative voltage which varies in direct proportion to the average amount of rectified current passing through the tripler.

(Also of help in understanding this circuit is the following rule, which was stated in the Shop Talk column in the September '70 issue of ELECTRONIC SERVICING: "When rectified DC is obtained from a diode, the polarity of the voltage will be negative if it is taken from the anode, and positive if it is taken from the cathode.")

In the Hitachi ABL circuit, the negative voltage at the junction of C723 and R724 partially cancels the steady DC voltage through R724 from the +120-volt source. The more CRT current, the lower the positive voltage that is applied to the CRT grids. Since the cathodes of the CRT are operated at a fixed positive voltage, the CRT is biased more negatively with increased CRT current; therefore, the CRT is prevented from drawing an excessive amount of current.

Zenith Automatic Brightness Limiter

The ABL system in Zenith 40BC50 and 4B25C19 chassis does not monitor the actual high-voltage current; instead, the operation depends upon the amount of ripple in the focus voltage supply. The more high-voltage current drawn from the rectifier-filter assembly, the higher this ripple will be. Ripple (AC content) from the focus supply voltage (see Fig. 16) is coupled through C277 (inside the rectifier assembly, in some cases) and R338 to the base of Q204, which has no

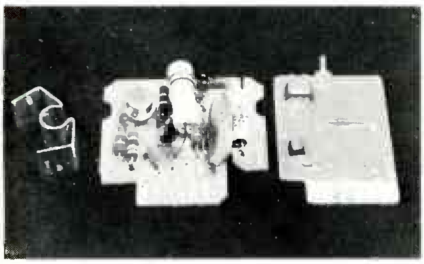


Fig. 13 Early-production MAD module and heat sink on the left, and a new type of encapsulated MAD module on the right.

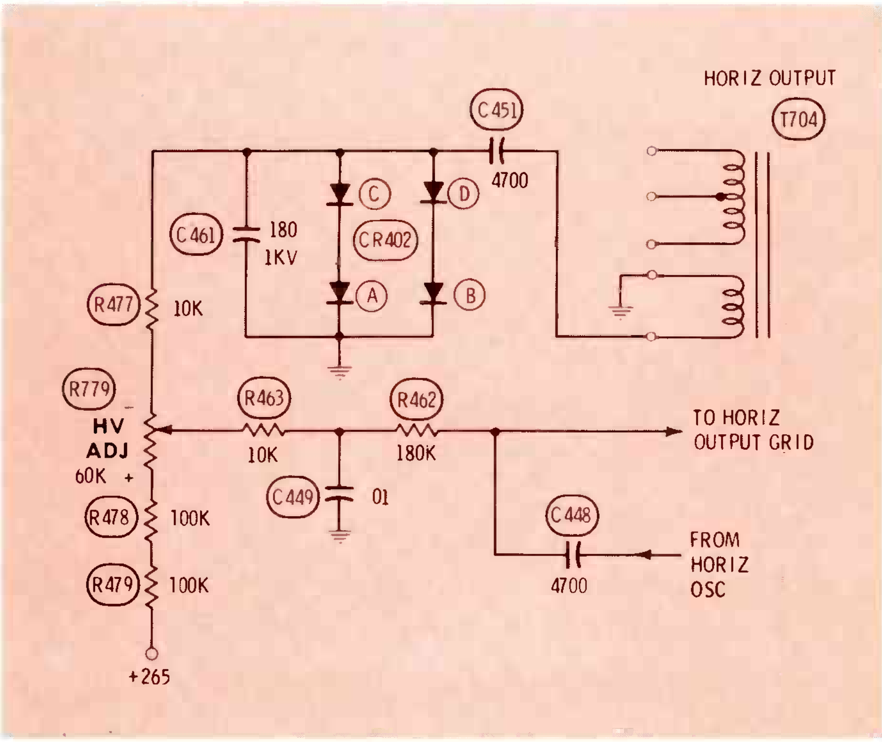


Fig. 14 To help insure adequate high-voltage regulation regardless of failure, four diodes are wired in series-parallel in the high-voltage regulator of Admiral's 19H10 chassis.

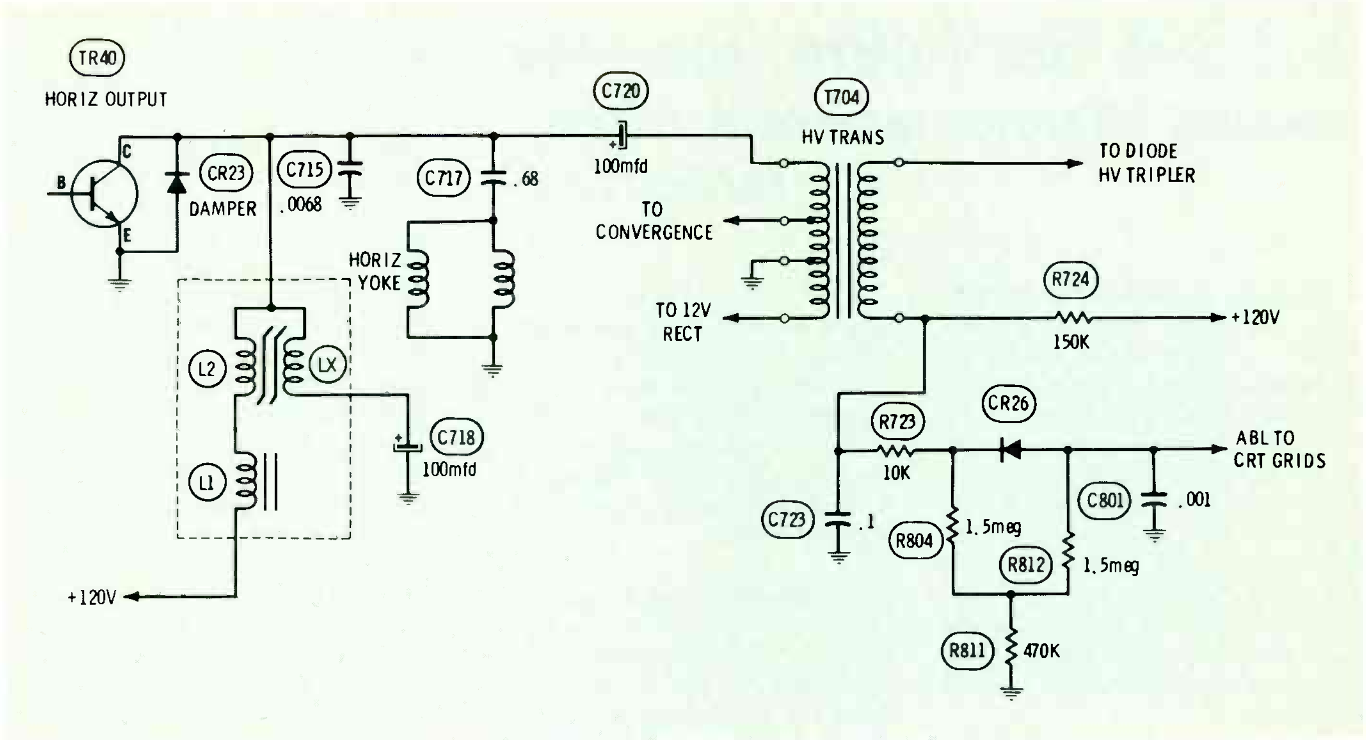


Fig. 15 Hitachi models CFA-450 and CSU-690 employ a saturable-core reactor as the high-voltage regulator. CRT current through the high-voltage tripler determines the amount of bias supplied the CRT by the automatic brightness limiter (ABL) circuit.

bias applied to it except for the ripple. If the ripple at the base is low, Q204 does not conduct and, consequently, the collector voltage, which is connected to a video amplifier stage, remains at almost the same value as the supply voltage.

When the ripple amplitude is high because of increased high-voltage current, Q204 is saturated by the large forward bias developed by the ripple, and the collector-to-emitter junction becomes a low-value resistance, which causes the collector voltage to drop, thereby increasing the negative bias on the CRT via the video amplifiers.

CRT current is limited to about 1.5 milliamperes by this ABL action.

Next Month

Because space available in this issue has not permitted discussion of all new circuitry and significant modifications of existing circuit designs used in the 1971 color chassis, this article will be continued next month, and for as many issues as necessary to insure complete coverage of this most-important topic. ▲

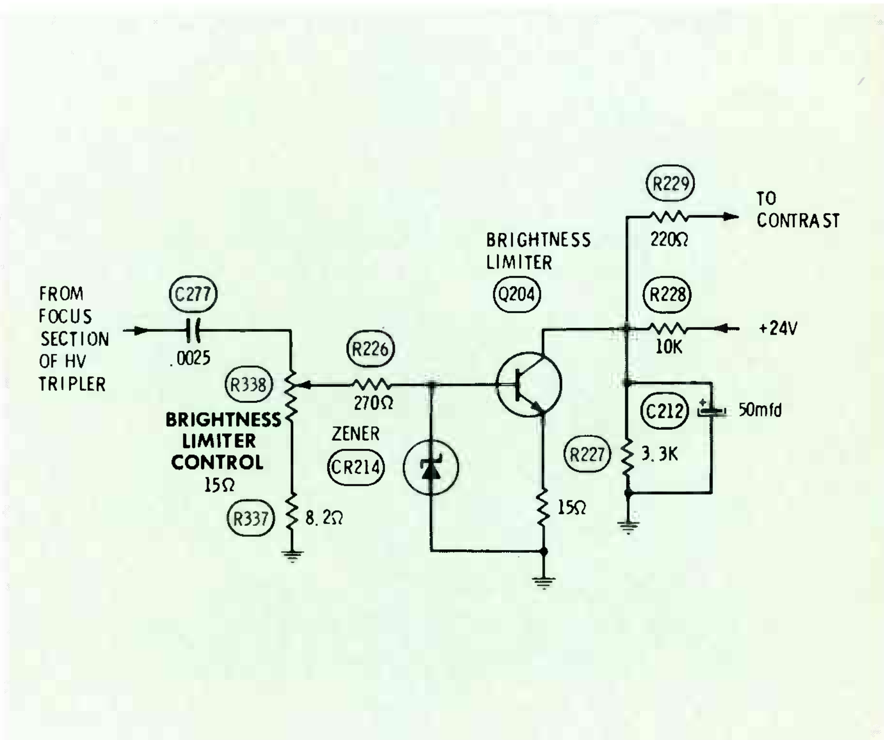


Fig. 16 The ABL circuit in Zenith's 40BC50 and 4B25C19 chassis senses the increased ripple amplitude of the focus supply voltage (resulting from excessive brightness). The change in ripple amplitude is used to control Q204, the collector voltage of which varies the conduction of the video amplifiers and, consequently, also varies the bias applied to the CRT. Q204 functions as both a rectifier and amplifier. The video amplifier voltage is directly coupled to the CRT, in the correct polarity to reduce the brightness level.

Dale's service bench

by Allan Dale

1-2-3-4 Servicing Adds up to improved efficiency because it reduces Service Time

A couple of books I saw recently made me think, "Wish I'd thought of that." They're about a carefully organized method of troubleshooting called **1-2-3-4 Servicing.**

Using this four-step system, you break down a set into four successively smaller divisions. Before you're through, you've run the trouble down to the faulty part. The idea works for anything—color set, amplifier, record player, cassette machine, radar. You apply the same principles no matter what kind of electronics.

Both books are published by Howard W. Sams & Co., Inc. They're written by Forest H. Belt. The titles are "1-2-3-4 Servicing Automobile Stereo" and "1-2-3-4 Servicing Transistor Color TV."

The 1-2-3-4 Servicing system works so well, I got permission to tell you about it briefly in this department. It's the most basic and effective method I've seen. Yet it includes some techniques you've been using for years. Anyway, look it over and try it. You'll find it highly effective.

Dividing Up A Set

The basic premise is "divide and conquer." You first consider the set as divided up into its various **sections.** Once you diagnose what section is faulty, you divide that section into **stages.** Having located which of those stages is defective, you divide that one stage into **circuits.** Now you can isolate the the faulty circuit, and divide it up into **parts.** By this divide/divide/divide method, you end up with only a few parts to test, one of which is sure to be the bad one.

The first important thing to know is what constitutes a **section.** The block diagram in Fig. 1 should help clarify it for you. Each section handles one kind of signal. For example, in the diagram a radio is shown divided into RF, IF, and audio sections. The TV set consists of RF, IF, video, sync, sweep, and audio sections.

Whenever the nature of the signal is changed, it goes into a different section. The RF section of a TV handles modulated station signals. Once their character is changed by conversion to an intermediate frequency, they enter another section—the IF section.

The same thing is true further along. The composite video signal is handled in the video section. Once the sound IF is extracted, a different section handles it. Ditto the sync. And sweep signals are in a section all their own.

You can get a little better idea of a section once you see how a section is divided up. It's broken down into whatever **stages** are in it.

For example, in Fig. 2A you see the RF section of a radio. The stages in it are an RF amplifier, an RF oscillator, and a mixer. All stages in the RF section handle RF signals.

The section in Fig. 2B is the audio section of an FM radio. Stages in this section are the audio amplifier and power output.

The FM detector occupies a special position. It's an **interface stage.** It takes the IF signal from the IF section, and changes its character. It "changes" modulated IF into plain sound signals. The FM detector interfaces the IF section to the audio section. In Fig. 2A, the mixer is the interface stage between the RF section and the IF section which follows.

A third example is shown in Fig. 2C. The video section of this b-w receiver has only one stage, the video amplifier. If it had more than one video amplifier, they'd all be part of the video section. The video detector is a multiple interface stage. It interfaces the IF section with the video section and with the audio and sync sections. It does **not**

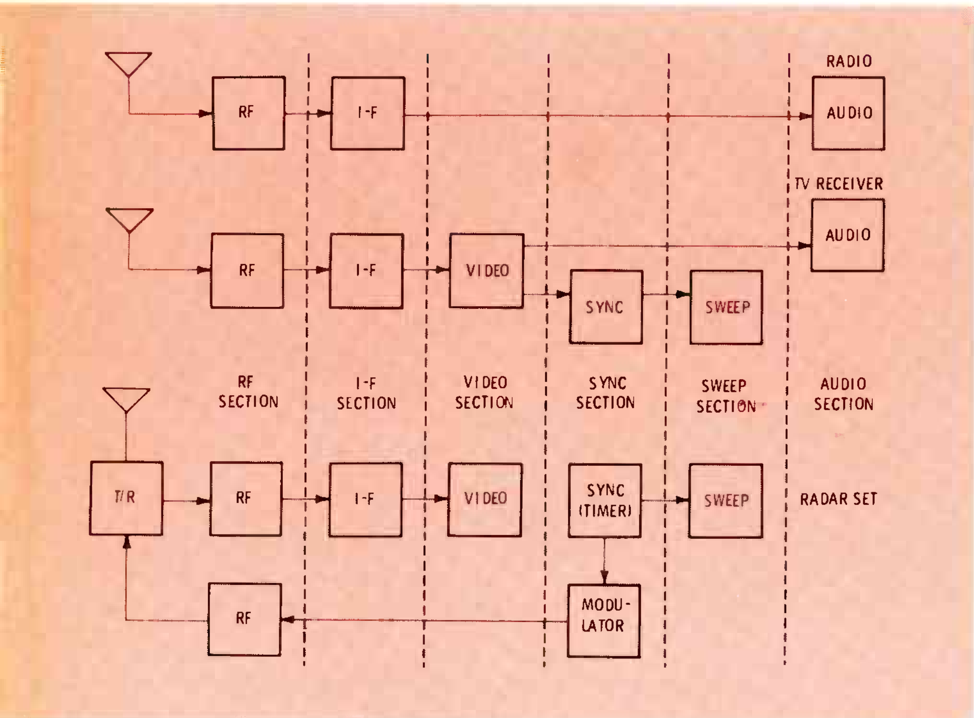


Fig. 1 Sections are the largest division of electronic equipment. Each section handles one kind of signal. When the nature of the signal changes, it's handled in a different section.

interface the audio, video, and sync sections with each other.

Stages break down into **circuits.** There's a tendency to call whole stages circuits, but it's a bad habit. A circuit is one group of parts that have a **specific function** within a stage.

Take a look at Fig. 3. It helps explain what circuits are. The pentode tube stage in Fig. 3A has four main signal circuits and five DC circuits. **Signal** circuits are input, output, and two bypass circuits. Circuits that supply **DC** operating voltages and currents are cathodes, grid, screen, suppressor, and plate circuits—one for each tube element.

The transistor stage in Fig. 3B has only three circuits of each kind (**signal** and **DC**). The signal circuits are input, output, and emitter bypass. Operating voltages and currents reach and leave the transistor through the base, emitter, and collector DC circuits.

Circuits break down into **parts.** You get a clearer understanding of circuits if you examine the parts in them. An individual part might be used in several different circuits, depending on how you're looking at the stage.

Fig. 4 shows labels for the parts in the stage of Fig. 3A. From a DC standpoint, R1 is a grid return resistor. Yet, if you consider signal, R1 is the input-circuit load. C1, for the signal, is input coupling; for DC, it's a blocking capacitor.

Consider the plate circuit. T1 and R3 form the DC path. The screen supply path shares R3. For signals, however, R3 doesn't even enter the picture. T1 is tuned by C4, and C3 is a bypass (sometimes called decoupling) capacitor. These three parts form the output circuit.

The screen DC circuit follows a path through common (plate and screen) supply resistor R3 and screen supply resistor R2. For signal, the screen has only a bypass circuit straight to ground, through C2.

The 1-2-3-4 Procedure

That tells you how to divide up a set. For 1-2-3-4 Servicing, you first divide into sections. Then divide sections into stages, stages into circuits, and circuits into parts. Realize, while you're at it, that you

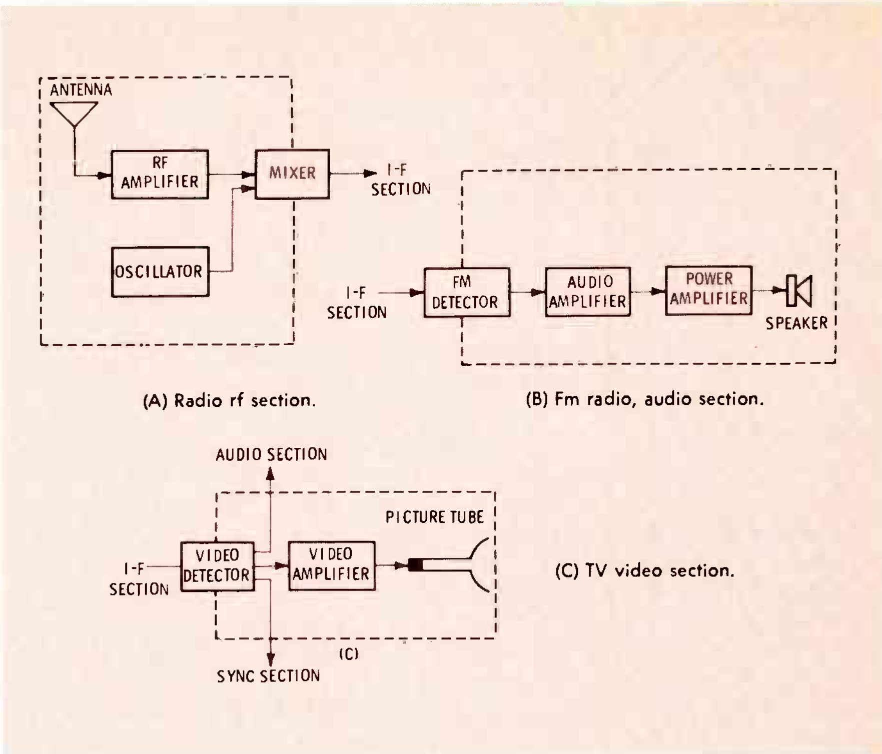


Fig. 2 Examples of how sections are divided into stages. Interface stages are the ones that change the signals, in preparation for feeding the signal on to the next section.

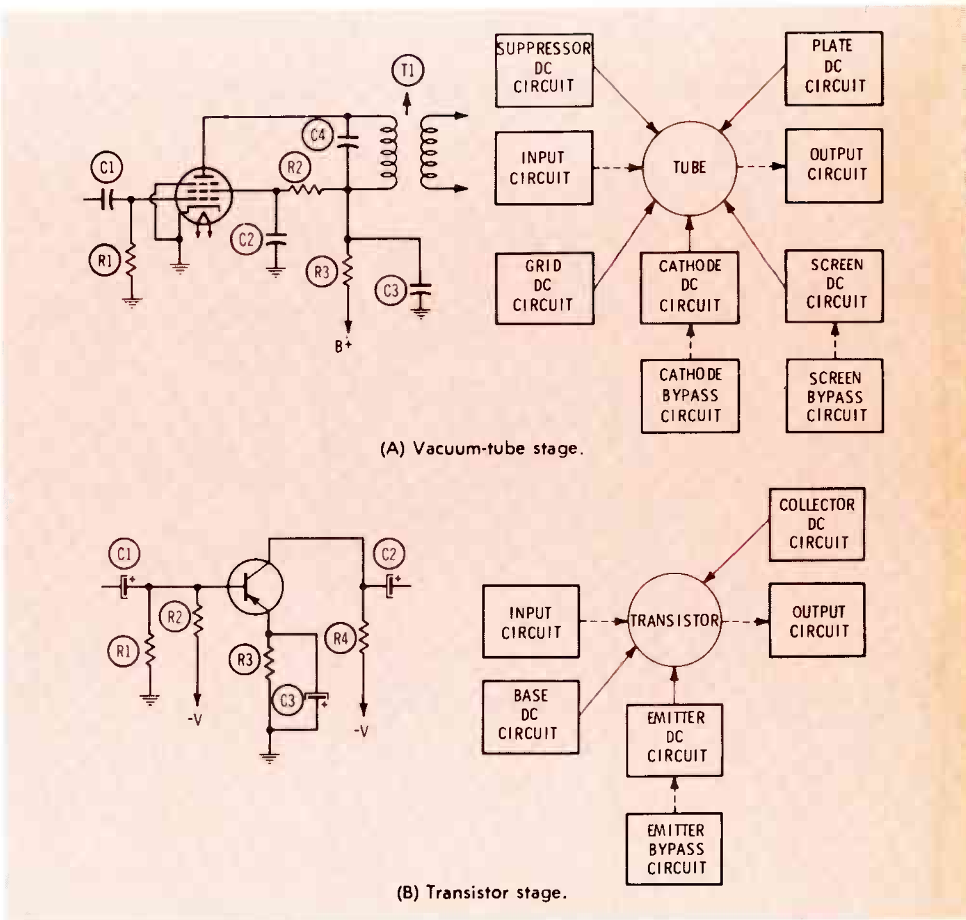


Fig. 3 Circuits in typical amplifier stages. Other signal circuits include feedback circuits, tuned circuits. Bypass circuits are often called decoupling circuits.

can do this with **any** piece of electronic equipment.

What then? Well, as you probably guessed, you don't have to divide up **all** the sections, stages, and circuits. What you do is first **diagnose** which section isn't functioning as it should. From there on, you only worry about the stages, circuits and parts **in that section.** There are several recommended diagnosis methods, but I'll get to them later. The point is that your first step is to **diagnose** which **section** is bad.

Knowing what stages are in the faulty section, your next move is to **locate** which stage isn't functioning properly. That's why you have to be able to recognize all the stages of each section. What you're doing at each step is narrowing down the amount of testing by eliminating parts of the chassis.

Having located the faulty stage, step three is to **isolate** which **circuit** in that stage isn't doing what it should. Specific tests help you do that. There are only a few circuits to check, because you test only the ones in the bad stage you've located during step two.

Finally, you **pinpoint** the defective **part** in that faulty circuit. To do it, you only have to test a few parts.

Now, review those four steps. (1) You diagnose the faulty **section,** so you don't have to worry about stages in other sections. (2) You locate the faulty **stage,** so you don't waste time on circuits in the good stages. (3) You isolate the faulty **circuit,** so you have only a few parts left to test. (4) You pinpoint the faulty **part,** and replace, repair or readjust it.

Ways To Do The Testing

Now all you need to know is the techniques for diagnosing, locating, isolating, and pinpointing. Then you can put 1-2-3-4 Servicing to work for you. You want **efficiency,** and the way to get that is with **quick tests.**

One thing may be a surprise: **You probably are familiar with most or all these tests.** 1-2-3-4 Servicing merely organizes them for you. Pick the tests or combinations of tests that suit you best for each step. No one test is best for all cases.

The chart in Fig. 5 gives the most effective methods for diagnosing the faulty **section.** It's relatively self-explanatory.

Familiarity with equipment is a big help, although not absolutely necessary. The chart tells how you can become familiar quickly. Another way to diagnosis is thorough observation—of how the set looks, sounds, smells, and feels, and of what symptoms are present. When you've completed this step, you should know in which section you can expect to find the faulty stage.

The chart in Fig. 6 names the best methods for locating the faulty **stage.** There are three groups: symptoms observation, signal tests, and DC tests.

Signal tests are carried out from stage to stage in the section you diagnosed as faulty. You can begin with injection tests at the output and work your way backward, or trace signals from the input up to where they become abnormal. This tells you which **stage** is faulty.

Some technicians prefer to make voltage tests on all stages in the faulty section. That's okay in some cases. But a lot of stages that test okay for DC still are faulty for signals. A combination of signal and DC tests usually is best.

Fig. 7 is the chart that tells how to isolate the faulty **circuit.** The tests are grouped into those for signal circuits and those for DC circuits. The lists in the chart remind you what circuits to check. Signal and DC tests for stages are described in Fig. 6, and they work as well in circuits. You go from circuit to circuit in the faulty stage.

Methods of pinpointing the faulty part are spelled out in Fig. 8. Again, the chart listings are self-explanatory.

Some technicians overlook the time-saving possibilities in the two

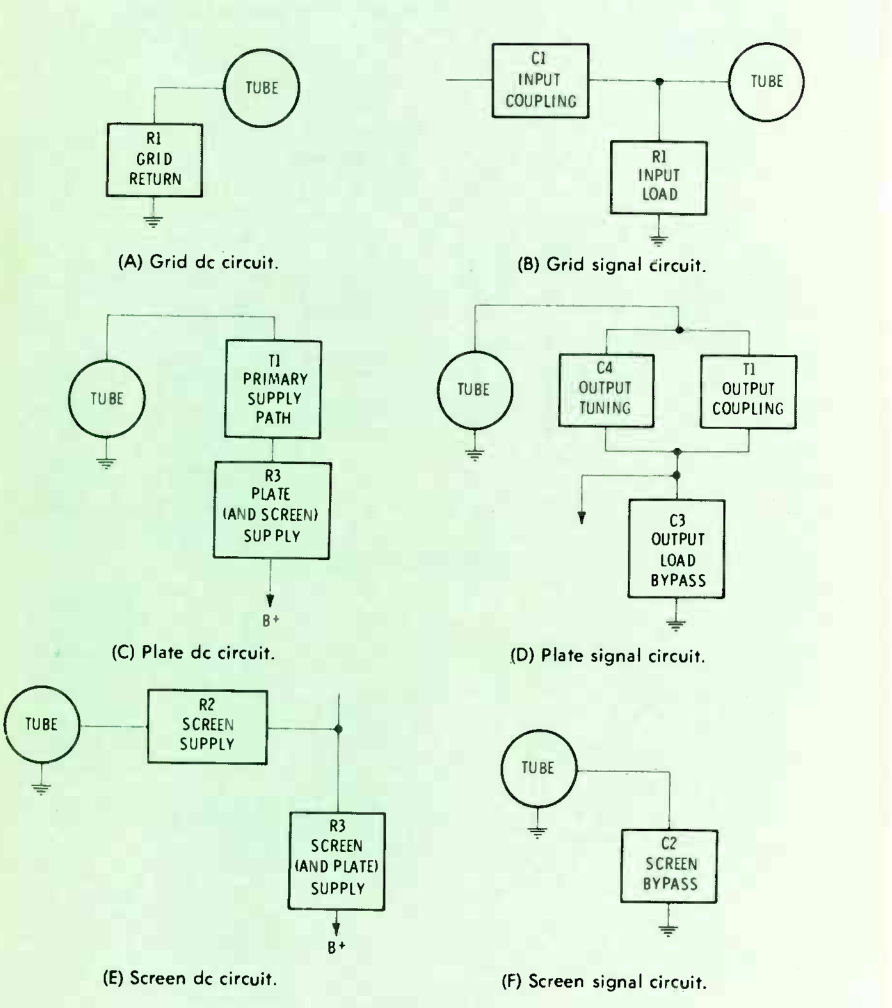
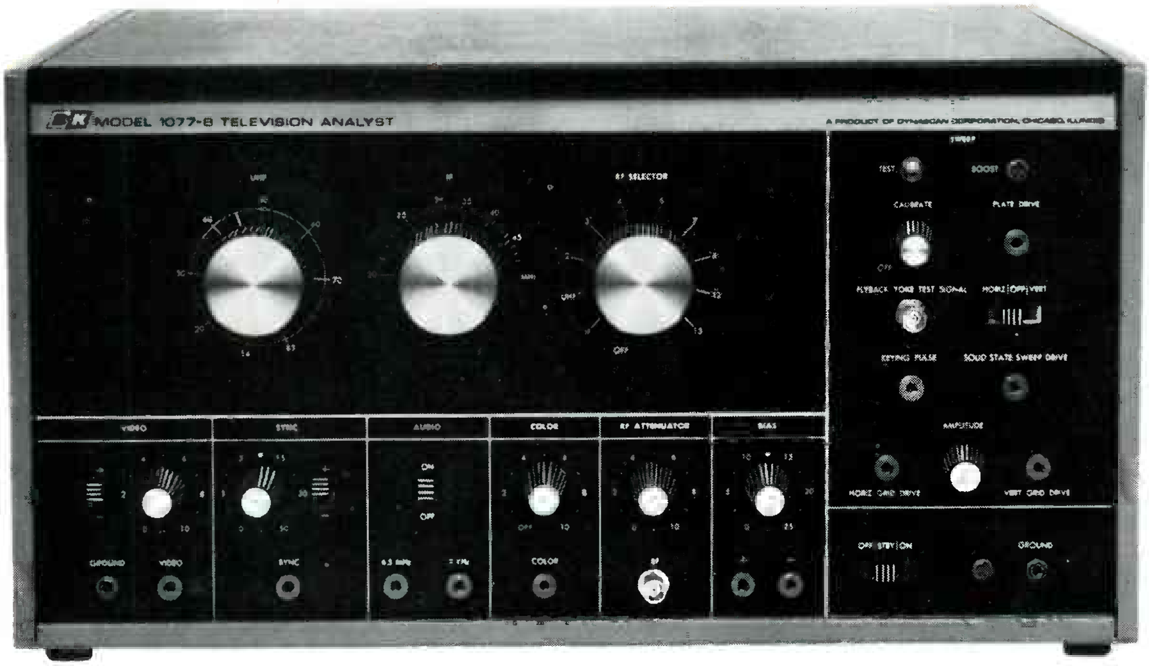


Fig. 4 Parts, the smallest division for 1-2-3-4 Servicing, often serve in more than one circuit. Examples are shown here for both signal and DC circuits in Fig. 3A.



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methods listed last. **Individual parts testing** is quick, after you've isolated the fault to one circuit. You're taught in electronics school not to make haphazard parts tests. But the key word is "haphazard." Testing the parts in only **one** circuit you know is faulty is not haphazard.

And substitution. It's not practical for expensive or hard-to-reach parts. But for small parts, substitution often is faster than testing. A commercial substitution box, with a variety of parts and values, can save you countless minutes—and eventually hours—of testing time.

Shortcuts

This method is so quick and direct in most cases, it seems silly to bother with shortcuts. But there are a few I'd like to at least mention. What often happens is that you move through a couple of steps at a time.

For example, look back at Fig. 3A. Suppose you've diagnosed a faulty IF section, and with the RF probe of a signal tracer are working your way through the IF stages. Probably, you're jumping from grid to grid, or maybe grid-plate-grid-plate and so on. At the grid of the pentode shown, signal is okay. But at the plate it's very weak. That locates the faulty stage, completing step two.

Checking the signal circuits in that stage, you find no further clue. But DC voltage checks at the screen and plate tell you the screen circuit is okay but the plate circuit is open. Merely isolating that faulty plate circuit also pinpoints the faulty part—the transformer. It's the only part that's in the plate but not the screen circuit. You've completed steps three and four simultaneously.

Other similar happenings occur. Suppose the signal is okay at the plate of the stage preceding Fig. 3A, but your tracer detects none at the grid of this pentode. The input coupling circuit must be open. You've virtually skipped step two. No need to worry about what stage; you've already isolated the bad circuit. What's more, you've pinpointed the faulty part—the capacitor is the only part in that input circuit. So, while working on step two, you've actually finished steps three and four.

The only rule about these shortcuts is: Don't vary from the sequence. Start with step one, and proceed to steps two, three, and four in that order. You'll find the whole procedure surprisingly fast. And any skips that occur **naturally** are bonuses.

Next Month

What better subject to follow simplified servicing than how to troubleshoot one of the toughest sections in the whole TV receiver? No one likes horizontal sweep or high-voltage problems. But everyone is confronted with them at one time or another. Next month, I'll tell you how I keep them from driving me up the walls. ▲

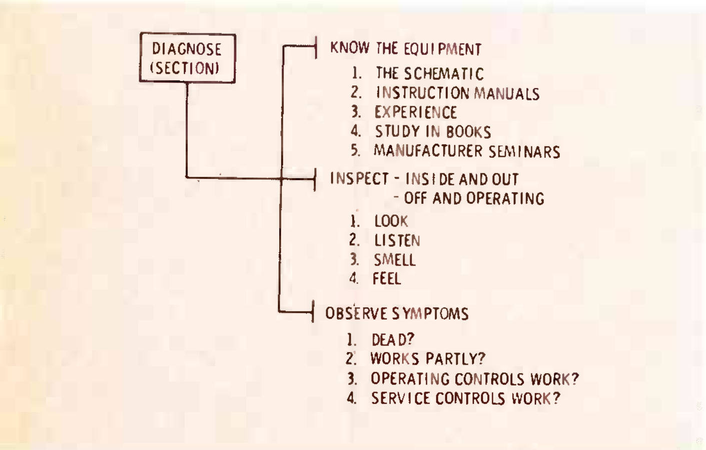

Fig. 5 Step One of 1-2-3-4 Servicing.

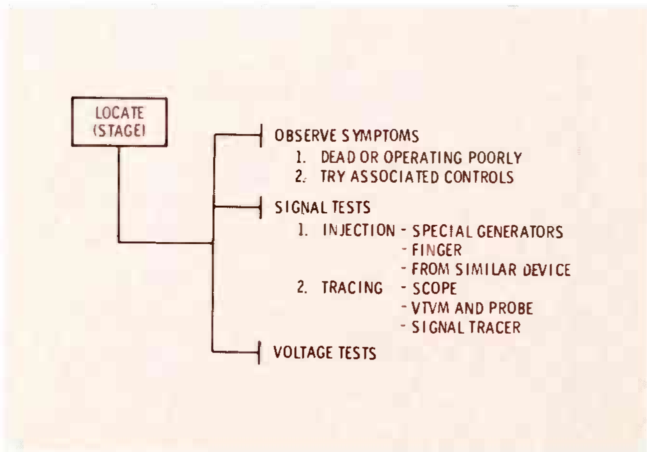

Fig. 6 Step Two of 1-2-3-4 Servicing

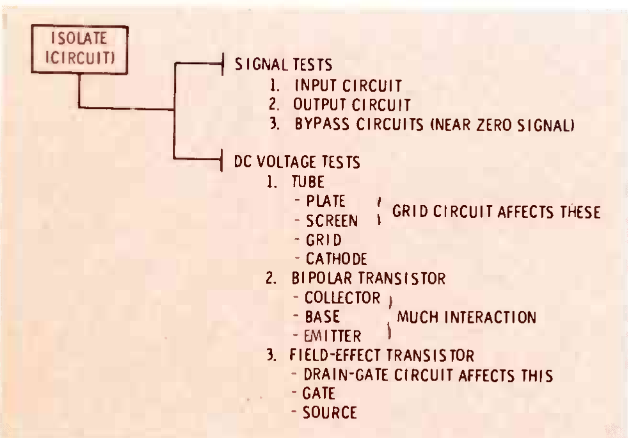

Fig. 7 Step Three of 1-2-3-4 Servicing.

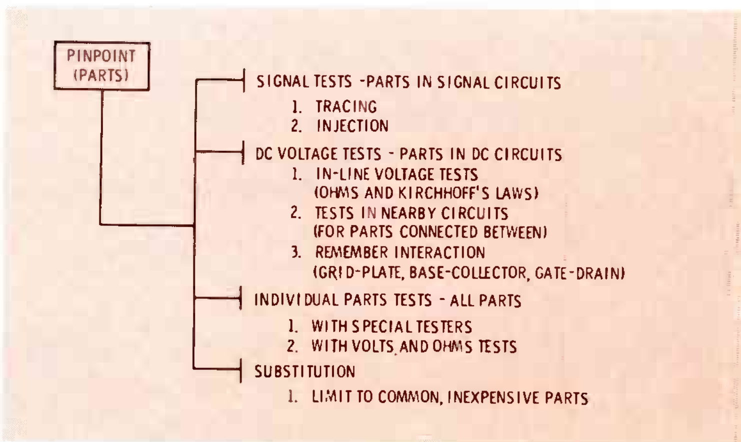

Fig. 8 Step Four of 1-2-3-4 Servicing.

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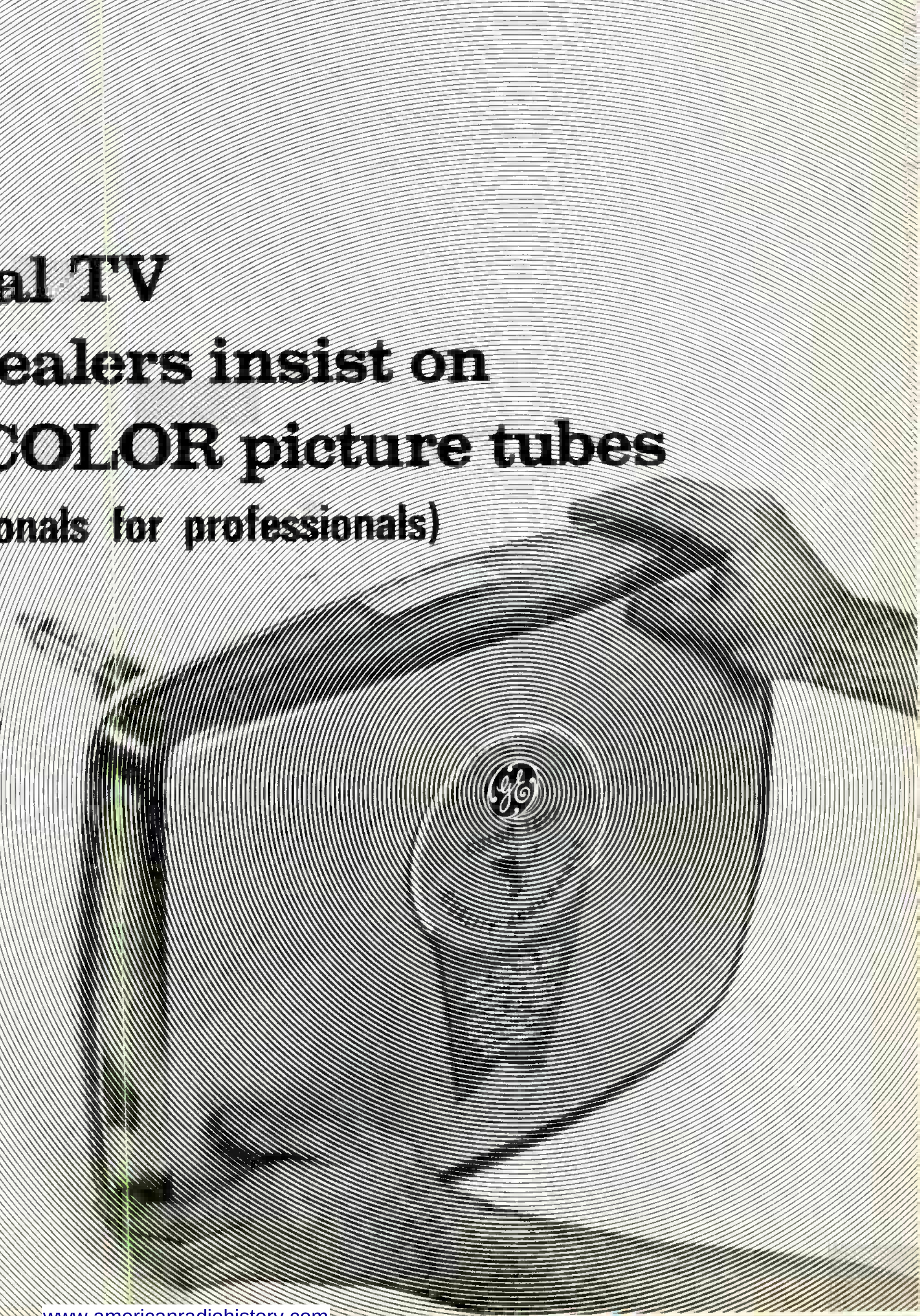


Troubleshooting video IF with sweep alignment gear

Part 1

New test equipment has simplified sweep alignment—and IF troubleshooting.

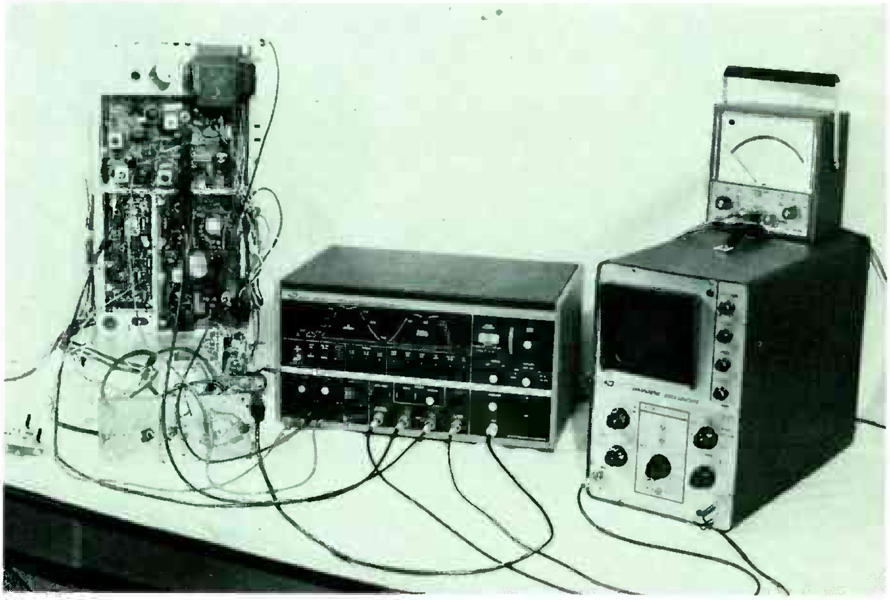


Fig. 1 With modern equipment, sweep alignment is much simpler than it was in the old days, when it took many instruments and a couple dozen connections to get hooked up and ready to view a response curve.

by Larry Allen

Nowadays, with color so popular, and with so many sets operating from cable TV and MATV systems, alignment is more important than ever.

Oh sure, a set can get by without it, some of the time. But TV characteristics such as adjacent-channel performance, color bandwidth, and chroma sync depend on correct IF alignment. Even today's high-gain, black-and-white sets don't look right unless the IF and RF stages are properly aligned. Most technicians will admit that half the sets they see could use an alignment touchup.

Simplifying Sweep Alignment

Of course, the reason some technicians pass over minor alignment is easy to understand. Sweep alignment takes time—or it once did. Also, it requires a lot of special equipment hookup—or it once did. And it demands you know the set rather intimately—or it once did. I keep saying "once did" because none of these is true anymore.

Take the time element. In earlier days, I used six instruments and several little gadgets to do a sweep alignment. My setup had a scope, sweep generator, marker generator, marker adder, VTVM, and dual bias box. It usually took 18 separate connections—and even more for a color alignment. No wonder some technicians hesitated. Hooking up and getting everything adjusted for that first response curve could take half an hour. In all fairness, that's too much time to spend for just a touchup.

And the equipment. Today, the instruments in Fig. 1 are all I need—a scope, a modern TV alignment generator, and a VTVM. Even for color, there are less than a dozen connections to make. Hookup and turn-on time: 10 minutes, if I'm not familiar with the TV chassis. And I don't have to figure out an octopus of interconnections between instruments.

And that brings to mind the problem I used to have with alignment: I needed to know the set, because almost nothing was standard. Now, I can align a strange set almost as quickly as I can a familiar one. There are two reasons: One, the instrument hookup is so simplified and standard, all I need is the chassis schematic so I can find the connection points. A layout chart, with the coils marked, is a help but not an absolute necessity. And two, the IF strips and tuners are fairly standard in chassis nowadays. Chroma sections are too, to some extent. You get familiar with standard alignment fairly easily. These factors make alignment much easier.

Troubleshooting Quick and Easy

But let's not get too far off the track here. This isn't basically an article on alignment. I'm writing about troubleshooting the IF strip.

Nevertheless, it's important that you know how easy TV alignment has become. Why? Because the fastest and most **uncomplicated** troubleshooting method I've ever found for IF stages is based on principles you use in alignment.

You may have to try this method to believe it. If you're like I was a few years back and avoid anything resembling sweep alignment, you'll find it hard to believe that word "uncomplicated." Really, the word fits. And because this way is so uncomplicated, it's also fast. You can spot almost instantly exactly what coil is bad, exactly which bypass capacitor is open, or exactly what trap isn't trapping. Can you do that with any other method?

Here, in a nutshell, is the secret: You set up a response curve of the IF strip with a sweep generator and scope. Using post-injection markers, you identify any improper peaks or dips by their location on the curve. Knowing the frequency of the bad spot on the curve, you can easily deduce what's causing it.

Think that's difficult? It isn't. Let me prove it's not, by an example. Then I'll tell you how to set up your own gear for a quick look at IF response.

The Case of the Dud Decoupler

This TV set came in looking like it needed alignment bad. It had all the ghosts and ringing you see in Fig. 2. No amount of fine tuning could get rid of the multiple images, although it did move them around a lot. And the sound had some buzz in it that fine tuning couldn't clear up.

Since I've had this modern alignment setup, there's no "getting-out-hooking-up, and turning-on" to do. I keep it connected and warmed up all the time. I just connect the two leads to my scope, and I'm ready to clip them to the chassis. In less than 5 minutes I am looking at a curve showing the response from IF input to video detector.

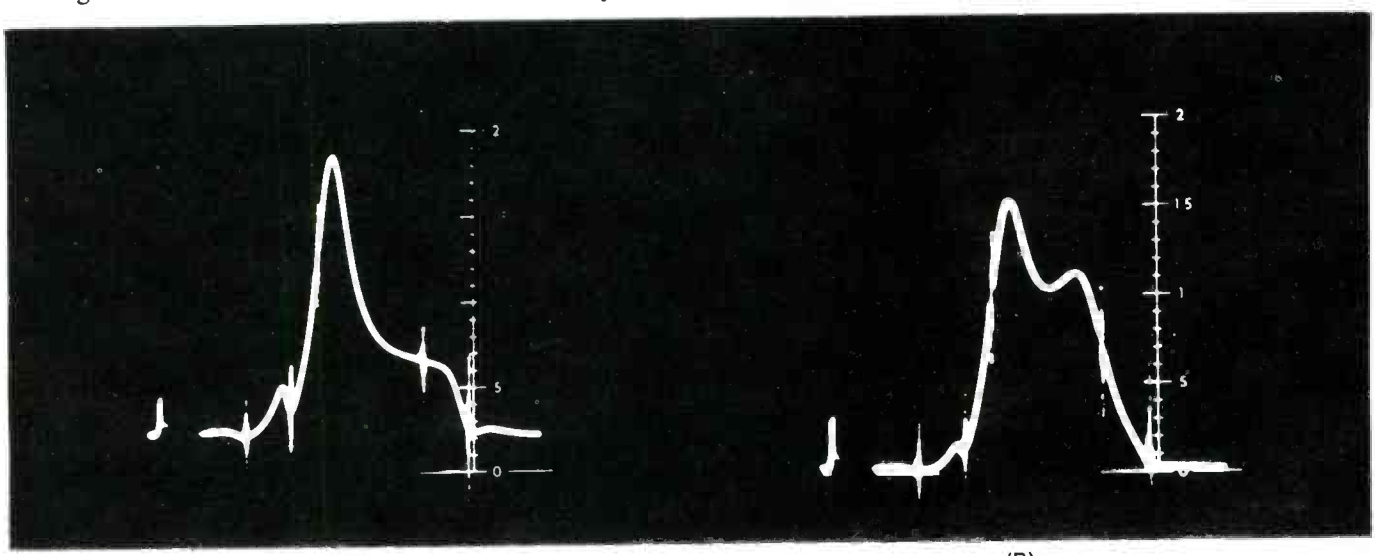
What I saw in this particular case is the waveform in Fig. 3A. I wasn't sure what the shape should be, so I got out the manufacturer's alignment instructions. I had alignment curves drawn. With the sweep generator connected at the mixer test point, the response curve at the video detector of this set should look like Fig. 3B.

Particularly note the five markers. I activated markers at 39.75, 41.25, 42.17, 45.75, and 47.25 MHz. These are at the adjacent picture, sound, chroma subcarrier, video and adjacent sound points on the overall response curve, respectively. In the generator I use, all these markers are crystal-controlled and extremely accurate.

Compare the two waveforms of Fig. 3. Note the differences, because they are what is important.

The left side of the curve in Fig. 3A seems okay. It's just about the same as the left side of 3B (the correct curve). The 39.75 adjacent-picture marker is at zero level at the left, and the 41.25 sound marker is in its slot near the beginning of the skirt. The 42.17 chroma subcarrier marker is hard to see on the steep left skirt, but it's there—about halfway up—in both curves.

Fig. 2 Typical screen symptom of very bad alignment in the IF strip. Fine tuning usually moves the ghosts around a lot but doesn't clear them up. Sound may have buzz, too.



(A) (B)

Fig. 3 The waveform at left (A) is the response curve the author saw when the set was first brought into the shop. The curve at right (B) is the correct one, after the trouble had been found and cured.

It's after the curve goes "over the top" that it changes shape. In the normal curve in Fig. 3B, the upper-frequency skirt of the curve is positioned so that the 45.75 video marker is about halfway down it. The right-hand peak is a little down-frequency from the 45.75 marker.

But in the bad curve of Fig. 3A, the response has dropped way down before it reaches the 45.75 marker. The down-frequency peak is no longer there. The only distinct peak remaining is the first one, just up-frequency from the 42.17 marker.

So, what conclusion do you draw from this? Well, for one thing, you can deduce that the IF strip gain is deficient from around 44.0 or 44.5 MHz on up past 45.75 MHz. Since tuned coils peak the gain at different frequencies across the IF response band, chances are one of the coils isn't peaking like it should.

You probably have reasoned that out for yourself. If so, you already have a fair grasp of this unique troubleshooting method.

Now, as I did, carry your reasoning a bit further. It'll save you "twiddling" around with several of the coils.

A schematic of two of the IF stages is drawn in Fig. 4. This is the popular "stacked" IF. That is, the two tubes are in series for B+. The plate of V1 goes to the cathode of V2 (through T2, R7, and R8). The plate of V2 goes to the 250-volt supply.

As far as IF signals are concerned, the stages are cascaded. Capacitors C1, C2 and transformer T1 couple signal to V1. T2 couples it on to V2. T3 takes it on to the stage that follows. The grid and cathode of V2 are well **above** ground for B+voltage, but C6 and C7 hold the bottoms of the T2 windings **at ground** for IF signals. Capacitors C4 and C9 do the same decoupling job for T1 (with L2) and T3.

Each transformer—often just called "IF coil"—is tuned to a different frequency. That's why this kind of IF strip is called stagger-tuned. Each transformer peaks a portion of the overall IF response. A fourth tuned transformer, beyond the third IF amplifier, isn't shown in this schematic.

The sketch in Fig. 5 shows the responses of T1, T2, and T3 side by side. The heavy line is their combined response. Notice how closely it resembles the curve in Fig. 3B. (The effects of traps L1 and L2 are included in the heavy line but are not drawn separately.)

In case you're wondering where I got the coil peaking frequencies, it was from the alignment data. The sheet doesn't always label each adjustment by frequency, but you can figure them out by noticing which markers the instructions say are affected by which adjustments.

Since the right side of the curve is affected, the coil **not** doing its job must be T2. The peaking frequency for T2 is 45.0 MHz. There are several possible defects. But you now know the trouble is in the immediate vicinity of T2.

The coil could be badly mistuned by a defect, or just by misalignment. But if it were tuned to some other frequency, there should be some sign of **overpeaking** somewhere else on the curve. So that isn't the trouble in this example.

The coil might be shorted or open. If it was open, however, you'd know by the DC voltage missing on pin 5 of V1. If T2 were shorted, it also would load down the trapping effect of the third winding; the response curve wouldn't look right at the 39.75 marker. Also, the tuning slug for that coil would produce no change in the curve as you adjust it.

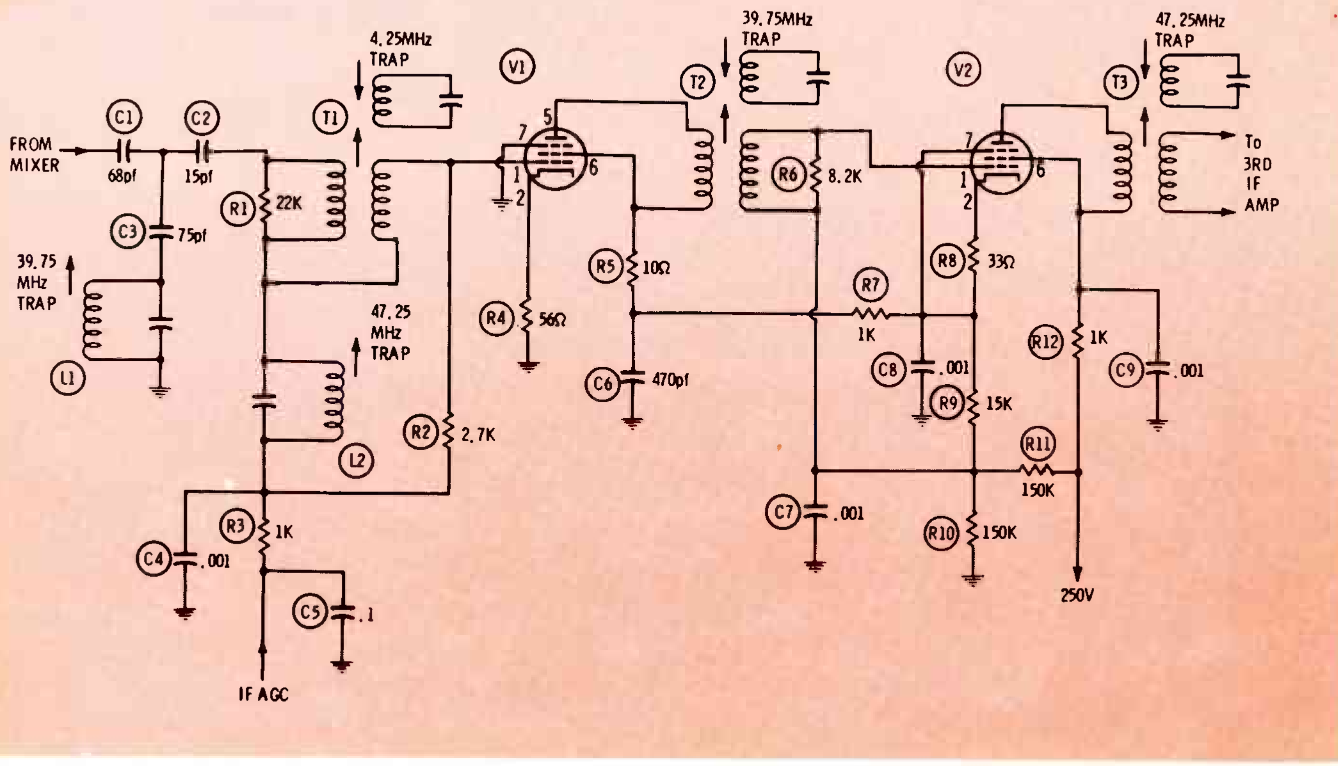


Fig. 4 Part of stagger-tuned IF strip that is used in many TV brands and models. This one is "B+ stacked" version, in which two tubes are in series across B+ line. Cathode and grid of V2 have high positive voltages.

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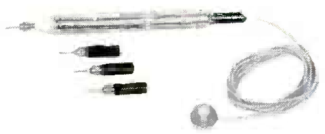

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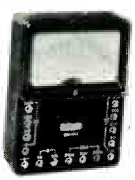

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The third possibility is an open C6 or C7. They must keep the bottom ends of the T2 windings grounded for IF signals. If either one opens, there's degeneration in that winding. It can't peak; in fact, it **cuts down** the IF gain at all frequencies, but more so at T2's frequency.

In the set on my bench, C6 was open. It left the primary of T2 more-or-less floating. The transformer couldn't efficiently pass the 45.0-MHz portion of the sweep signal, so the curve at that point was reduced from normal.

Just for added information, Fig. 6 shows what the response looks like if C7 opens. This defect causes the same degeneration at the 45.0-MHz portion of the curve. The drop-off isn't quite as bad, but it's enough to make correct alignment impossible. And it produces the same screen symptom you saw in Fig. 2.

Setting Up Your Own Equipment

You know how much trouble it would be to find that bad capacitor ordinarily. Once you saw the symptom, you'd probably check around the tuner. Finally, you'd spend a lot of time messing around with all the coils.

Eventually, you might notice T2 doesn't tune right. But even if you do, you might be tempted to replace the coil. And, of course, a new one would tune just as poorly. So you're better off by far with the visual troubleshooting method which uses the sweep setup.

You can do this special troubleshooting with **any** sweep alignment equipment. However, if you're not using post-injection for the markers, you ought to consider updating your instrument lineup. For years I used a marker adder, which is just a complicated way of doing the same thing: injecting the marker **after** the response curve has already been developed. The advantage is that the marker doesn't distort the curve, no matter how big you make it.

Your marker generator must be fairly accurate. That's why I like crystal-control . . . no fumbling around with the dials. And if you can show several markers at a time, you can visualize the frequency positions better. But you can manage with a single-marker, tunable generator. Just set the dial at each frequency, one at a time, and remember that marker's position on the curve.

No matter what instruments you use, I have one strong suggestion. As I said earlier, hooking them together is an aggravation as well as a time-waster. And they need to be warmed up 15 minutes, too. My suggestion: Keep your sweep-alignment gear all hooked up and turned on, at least on standby. It's also better for the instruments, because they are not alternately hot and cold.

If you only have one scope, it's okay to keep it separate for regular use. There are only two connections to make when you connect it into the sweep alignment setup, anyway.

Hooking the instruments together is a minor detail. If you haven't done it recently, the instruction manuals will remind you what goes to what. And if you're fortunate enough to have modern equipment, there's very little hookup to be done.

Analyzing Curve Shapes

If you hesitate to start using this professional troubleshooting method for IF's, it's probably because you haven't had any experience figuring out wrong curve shapes. This is something that usually is not covered in electronics school. You are taught only to recognize a **correct** curve when you get it.

I want you to feel more at home with this unique method. So, in the next issue, I'll take you through several actual cases that were solved using the sweep alignment method. In the process, you'll come to understand: (1) How to determine which coil should peak at what frequency, (2) how to recognize a response curve that's not shaped right, and (3) how to reason out what's wrong with the curve. ▲

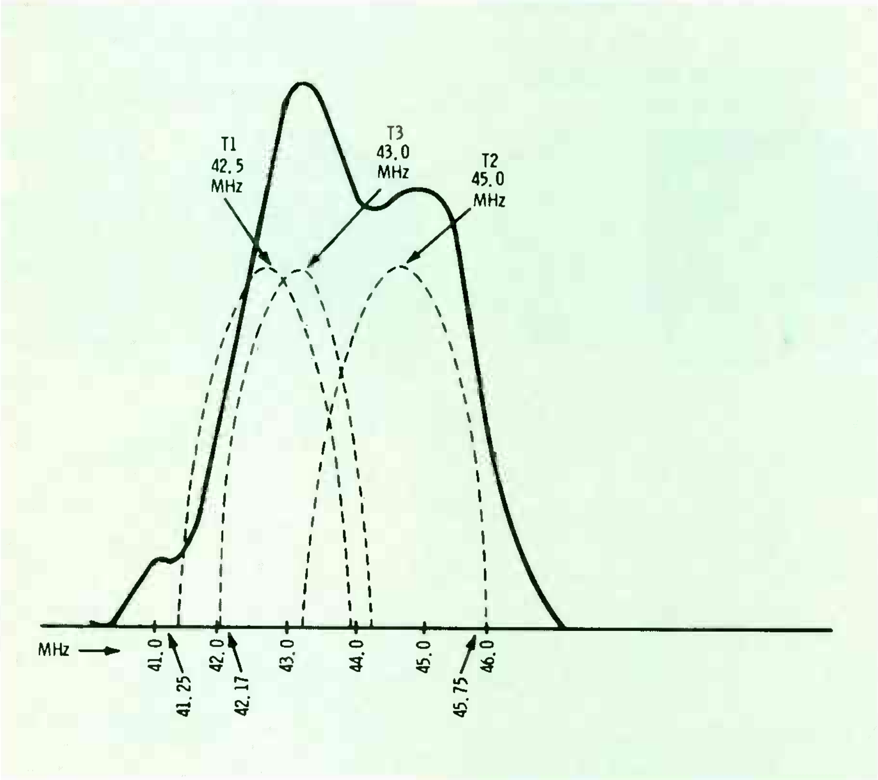

Fig. 5 Individual responses of stagger-tuned IF transformers combine to form IF response curve. Heavy line is the net response traced at all frequencies in the IF passband. It is the same curve you see traced by the sweep generator and scope in Fig. 3B.

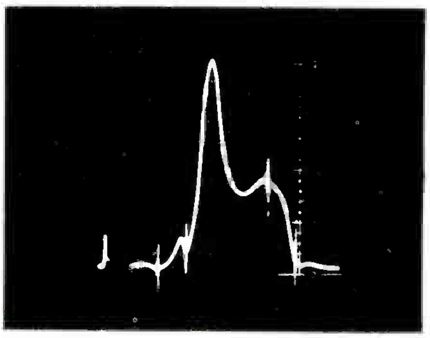

Fig 6 This is what the response curve of Fig. 3B would look like with decoupling capacitor C7 open; degeneration isn't quite as bad as with C6 open (Fig. 3A).

The All-Electronic Tuner

by Bruce Anderson

Until recently, all television VHF tuners had one thing in common: A shaft had to be rotated to change channels. All-electronic tuning has changed this.

In the following paragraphs we will discuss the actual process by which a channel is selected mechanically, point out some of the inherent deficiencies in the mechanical method, and then consider an alternative—electronic tuning.

The concepts of electronic tuning are still being developed, and, undoubtedly, new refinements will be forthcoming; however, one such system has been in existence for the past year in the RCA CTC47 chassis. While a consideration of this system might be principally of academic interest, since it was a limited-production design employed in a "prestige" receiver, it does merit some attention as a forerunner of things to come.

The Conventional Tuner

At the present state of the art, the superhetrodyne receiver is considered to be the only type of receiver suitable for television reception. For this reason, all tuners are basically similar. As illustrated in Fig. 1, the usual tuner configuration employs an RF amplifier, a mixer, and a local oscillator as its essential elements. The four tunable circuits are the input and output circuits of the RF amplifier, the input of the mixer, and the tank circuit of the local oscillator. The conventional tuner also has an input-matching circuit, or balun, which matches the impedance of the transmission line to the input impedance of the tuner; and an IF rejection filter, which prevents the entry of IF radiation into the RF amplifier; and a tuned circuit which develops the output voltage and matches the mixer to the IF strip.

To the servicing technician, the four tunable circuits might appear to be incremental parts of the RF amplifier, mixer, and local oscillator; however, their functions actually are quite separate from the functions of the active devices themselves. In this discussion, the RF amplifier, mixer, and local oscillator can be considered simply as black boxes, while the tunable circuits themselves are the real interest.

The tunable circuits take two forms. In some tuners a separate resonant circuit is used for each channel; in others an inductance is tapped at twelve points to make it resonant at each of the channel frequencies. (A total of 13 frequencies is required, one for each VHF chan-

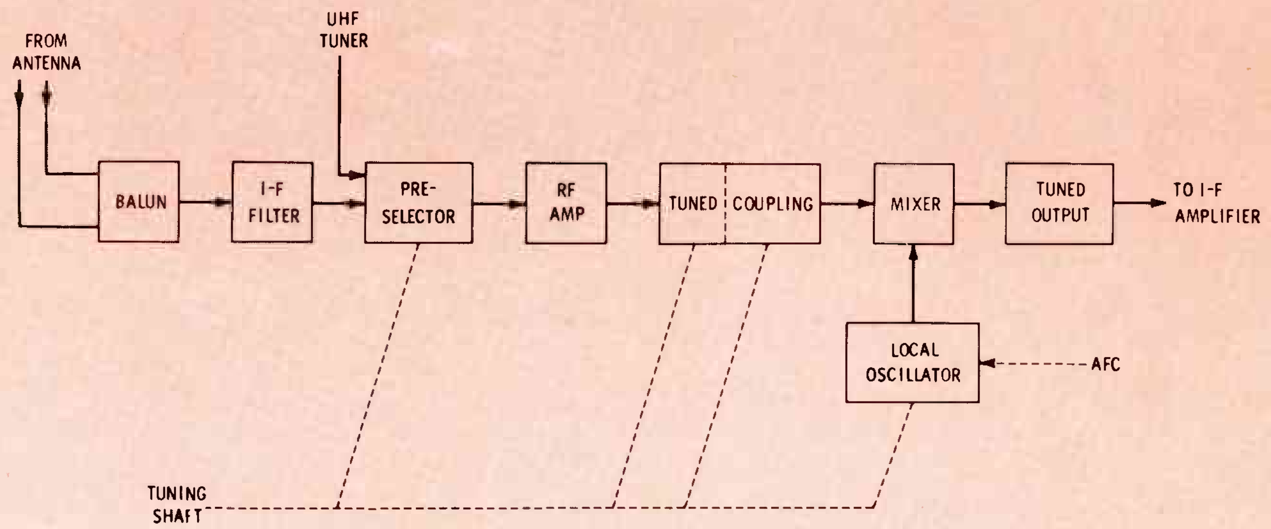

Fig. 1 Location of the tunable circuits in a typical conventional color television tuner.

Elimination of mechanical switching of signal circuits has been accomplished by replacing the bulky "mechanics" of conventional tuners with diodes, which are switched electronically.

nel and one for the output of the UHF tuner, which is normally at the IF frequency.) Regardless of which type of resonant circuit is used, a four-function, 13-position switch is required to select the proper tuner circuits.

It might come as a surprise to find that the shaft and knob of the tuner have three distinct functions. The first of these is to provide a link between the switches themselves and the hand of the individual who operates the receiver. This is called the "interface" function. The second function is to hold the switches in the position selected after the operator removes his hand. This is the "memory" function. Third, the shaft or knob is fitted with an indicating device to tell the operator which channel has been selected. This is the "indication" function. In the conventional tuner, these functions are seldom of any interest, but in an electronic channel-selection system, each function must be performed by an operating system, or the receiver cannot function.

The Electronic Switch

To change from mechanical to electronic tuning, it is necessary to substitute electronic devices for each of the four switches which select the taps of the tuned circuits. For the sake of simplicity, the arrangement of Fig. 2 shows only enough of a tuning system to allow the selection of two channels. Additional banks of diode switches are required for each remaining channel.

In Fig. 2, the switch, S1 could be a double-pole, two-position switch. If this system of tuner con-

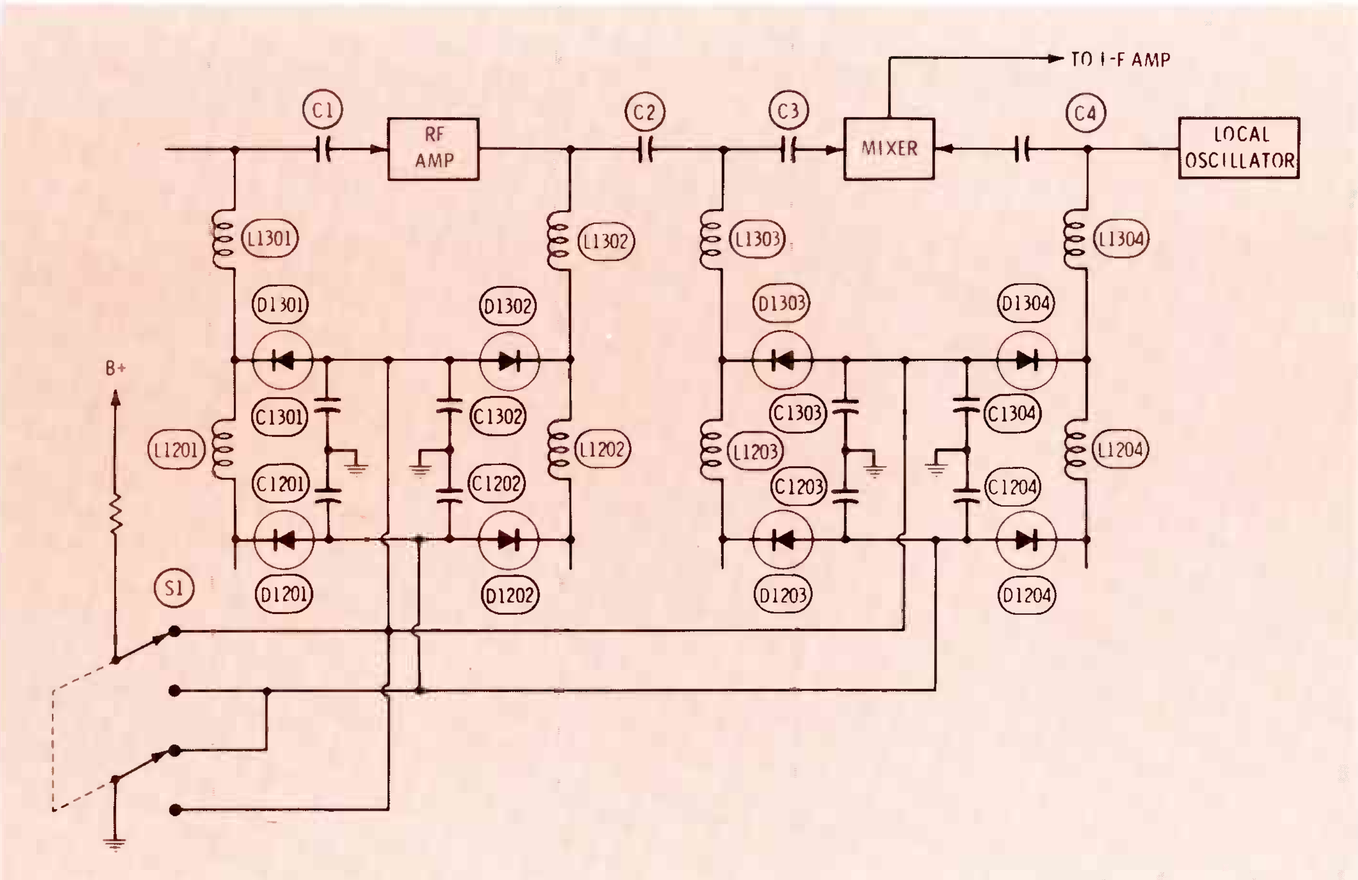

Fig. 2 Partial schematic of the electronically controlled tuner, showing the components for channels 12 and 13. An additional set of diodes and capacitors is used for each of the other channels.

trol were to be used, naturally, it would have thirteen positions, one for each channel. In the position shown, positive voltage is fed to the anodes of each of the 1300-series diodes, biasing them into conduction. The result is that the impedance of these diodes is made very low, effectively placing the lower ends of the 1300-series coils at RF ground through the 1300-series capacitors. This produces the same result as having a closed mechanical-switch contact in the same location as each diode.

Since the 1300-series diodes are forward biased, whatever voltage is applied to their anodes also appears at their cathodes (less the .7-volt barrier drop). The positive voltage is conducted to the cathodes of all the other diodes, 1201, 1101, 1001, etc., holding these diodes at cutoff. The grounding section of S1 is essential; without it, the anodes of the other-channel diodes would "float". If these diodes were allowed simply to "float", their interelement capacitance would vary, causing the tuning of the resonant circuits to drift. Naturally, this is true only of those diodes in channels higher than the one selected; the others are isolated from the resonant circuits by the conducting, on-channel diodes.

To equip a tuner having electronic channel selection with a fine-tuning knob is illogical to the engineer; to the prospective buyer, it would be absurd. Unfortunately, a conventional automatic fine-tuning circuit is inadequate in the electronic tuner.

All present-day AFT circuits depend on a variable capacitance connected across the oscillator tank to maintain the correct frequency. A simplified circuit is illustrated in Fig. 3. If the local oscillator tends to drift, the frequency of the video carrier from the mixer begins to shift. This causes an error voltage to be generated in the discriminator. The error voltage changes the effective capacitance of the diode and returns the local oscillator tank to the correct resonant frequency.

In a conventional tuner, the user expects to fine tune the local oscillator into the operating range of the AFT system when the need arises; in an electronic system he would not. Because of this, the range of the AFT system of the electronic tuner must be broad enough to preclude the oscillator ever drifting outside the range of correction, without sacrificing so much gain that tuning will be "sloppy" on some channels.

A characteristic of any variable-capacitance frequency control is that a given amount of capacitance change produces much more frequency change if the operating frequency is increased. Consequently, a given amount of corrective voltage will have much more effect on the high channels than it has on the low channels. In effect this causes the loop gain of the AFT system to increase as the operating frequency increases, making it difficult to design an AFT-controlled oscillator which will perform well on all channels.

The solution to this problem is to use separate local oscillators for the high-band and low-band channels. The circuit in Fig. 4 shows how this is done. By using the diode control voltage as the power source for the two local oscillators, band and channel are selected simultaneously.

Assume that channel 13 has been selected. The channel 13 diode is forward biased, placing the end of L1304 at ground through the capacitor connected to the anode of the diode. The remainder of the tapped inductance is out of the RF circuit, but DC power for the collector of Q1 is supplied through these windings, the channel-7 diode, R1, and L1.

If channel 9 were selected, the RF ground would still be supplied to the transistor through the balance of the inductor.

If a low-band channel were to be selected—channel 5, for example —Q1 no longer would be energized, but Q2 would be. The tuner circuit would consist of that portion of the inductor between the channel-5 diode and the collector of Q2; the balance of the inductor would provide the DC path for collector power. During UHF reception, a local oscillator is not required, so neither Q1 nor Q2 is energized.

Automatic frequency control of

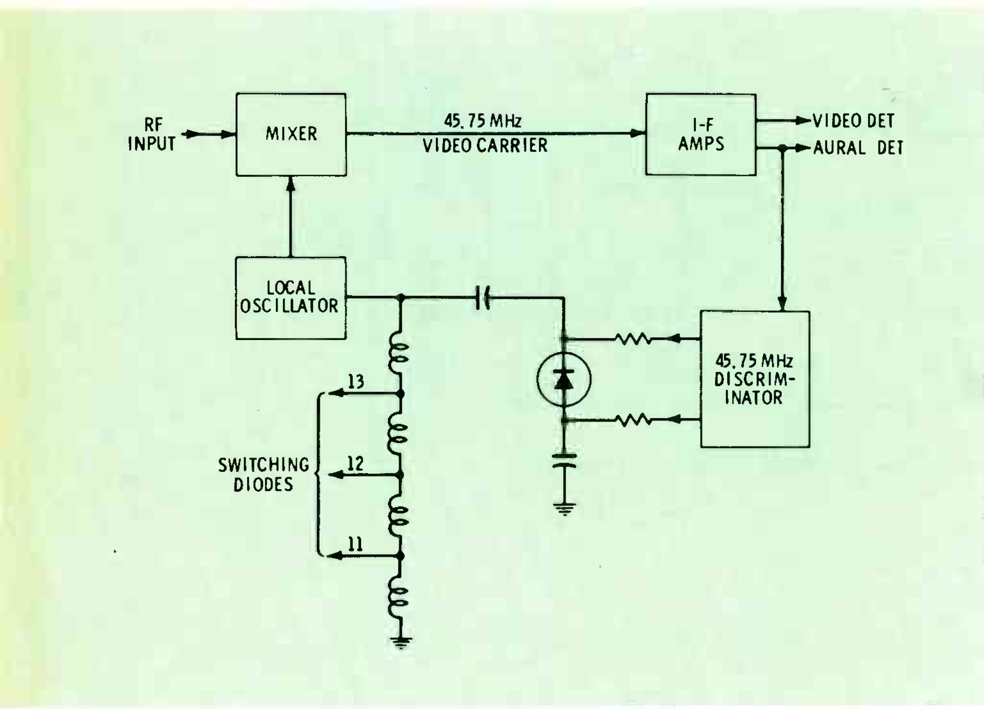

Fig. 3 The basic automatic-fine-tuning (AFT) loop.

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the oscillators is performed by the two varactors, VAR 1 for Q1 and VAR 2 for Q2. Each of these will have approximately the same amount of capacitance change for a given amount of control voltage; however, the two 2.2-pf capacitors in series with VAR 1 make the total variation in capacitance of this circuit considerably less than that produced by the swing of VAR 2 and its two 4.7-pf capacitors. At the centers of the upper and lower bands, the ratio of frequency change to voltage change is about the same for both oscillators.

Merits of the Tuner

Aside from the fact that the electronic tuner has appeal to the consumer because of its ease of operation, quiet operation, rapid action, etc., it also has advantages from the engineering point of view. Because there is no mechanical connection between the tuner and the control for it, the location of the tuner can be anywhere inside the cabinet. There are no more gear trains, detents, indicator drums, mounting assemblies, etc. It is entirely possible that, sometime in the not-too-distant future, the tuner will become simply another part of the main chassis.

Another advantage of the electronic tuner is that the actual switching of signal voltages is done without a mechanical device. Dirty switch contacts in the tuner have been a constant servicing headache since television was introduced. Obviously, the insides of the switching diodes cannot get dirty. Even if some type of mechanical switch were to be used to control the tuner, it would interrupt only a control voltage, not RF signals.

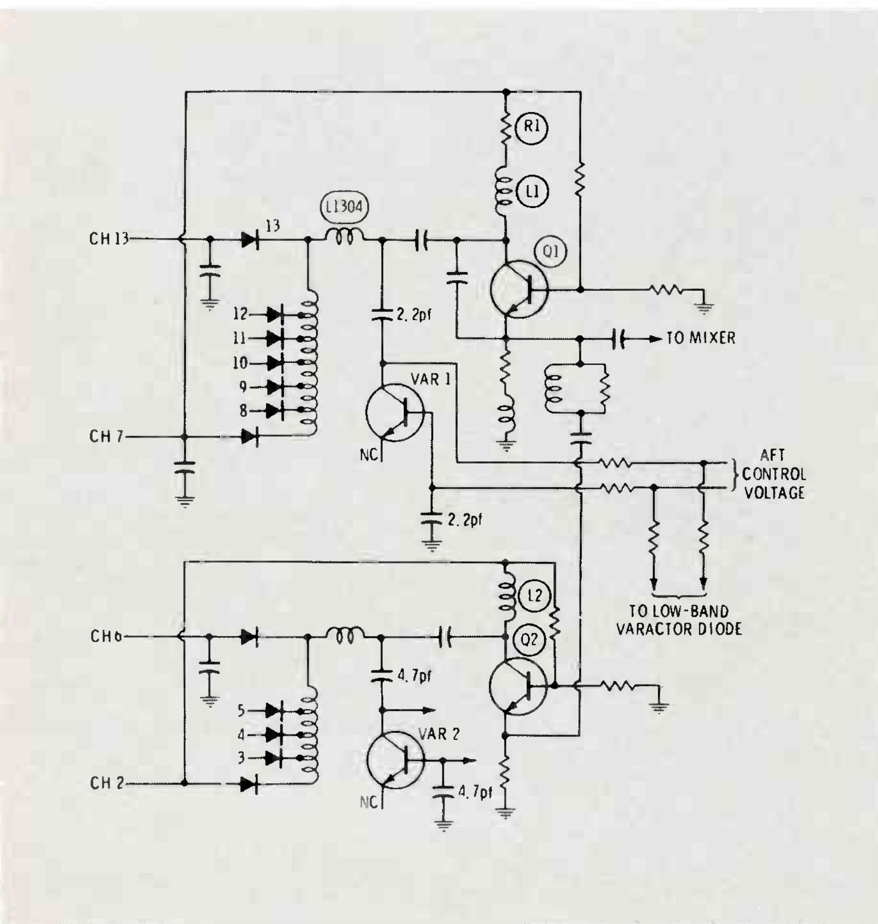

Fig. 4 The dual local-oscillator configuration, which is necessary to insure optimum AFT performance on all channels.

Interfacing

The simplest interface between an electronic tuner and the operator is a 13-position switch with two poles, one which energizes the diodes of the selected channel, and one which grounds the other 12 sets of diodes. The system would have the advantages of allowing the tuner to be located wherever it is convenient and of switching only a control voltage instead of RF signals. Operation of the switch could be reasonably rapid and quiet, although never approaching the limitations of the tuner itself, and a drive motor could be used for remote control.

By substituting an all-electronic control switch, the speed of operation can be increased to the point that channel selection appears to be instantaneous, and the system is completely silent. Of greater significance, the motor, always an undesirable feature in remote-control systems because of original cost as well as servicing problems, can be eliminated. The electronic system described here incorporates all these advantages, with the exception of cost. This is the first system to be produced; it is reasonable to expect that future designs will be simpler and more economical, just as the television receiver has become simpler and more economical over the years.

Summary

An electronically controlled tuner is much the same as a mechanically operated tuner, except that diodes are used to switch the tuner circuits. This has several advantages, including freedom of location of the tuner, no possibility of dirty or corroded switch contacts in the RF circuitry, and the aesthetic appeal of rapid and silent channel selection, limited principally by the control systems which might be used in conjunction with the tuner.

In the next of this series, the control system for the electronically controlled tuner of the RCA CTC47 chassis will be discussed. In preparation for that description, there will be a short discussion of binary numbers and their application to logic circuits. ▲

Circle 22 on literature card

test equipment report

High-Voltage Probe

Eico announces the Model HVP-5 high-voltage probe.

The HVP-5 reportedly measures voltage up to 30,000 volts with complete safety, and because it has a built-in voltmeter, eliminates the need for additional bulky equipment. Special barriers isolate the high-voltage tip from the probe handle and meter.

The HVP-5 sells for $22.95, wired.

Circle 50 on literature card

CRT Tester/Rejuvenator

B & K has announced release of the new Model 466 CRT Tester/Rejuvenator for b-w and color picture tubes. The 466 test CRT's for opens, shorts or leakage between elements, and rejuvenates guns and repairs shorted or leaky tubes.

Key CRT elements are connected to test points, with all others shorted to ground; this reportedly provides

greater accuracy and eliminates CRT damage. Heater, G1 and G2 voltages are continuously variable and metered. G1 voltage can be set with accuracy under all conditions, according to the manufacturer. Heaters are monitored at tube pins.

The 466 is supplied in a lightweight case measuring 13¼ inches X 9½ inches X 5¼ inches and weighs 8 lbs. The price is $129.95.

Circle 51 on literature card

CRT Checker and Rejuvenator

A picture tube color-tracking analyzer and rejuvenator, which is designed to check all color tubes in accordance with CRT manufacturers' recommended procedures, has been made available by Mercury Electronics Corp.

Model 880 contains universal sockets and adapters, including complete black-and-white sockets. Mercury states that each gun of a color tube is adjusted to cutoff before the beam current reading is taken, to simulate actual conditions in the television set. It also checks shorts or inter-element leakage.

The unit, which comes complete with a picture tube data book, sells for $79.95.

Circle 52 on literature card

(Continued on page 46)

Circle 23 on literature card

Insulation Tester

The new Hitachi E-17 insulation tester has been introduced by General Electric Supply Co., for the Japanese Products Corp.

The E-17 detects insulation leakage and breakdowns in motors, outdoor and indoor wiring, lighting fixtures, switchboards, receptacles, appliances, circuit breakers, cables and panels.

The E-17 is self-powered and weighs only 5½ lbs.

Test voltage outputs to 2,500 VDC are available. Prices start at $165.00.

Circle 53 on literature card

Solid-State Field-Strength Meter

A new solid-state, portable field-strength meter for cable TV (CATV) and master antenna TV (MATV) systems is available from JFD Electronics Corp.

The unit provides direct readings on all UHF and VHF picture and sound carriers. Inputs from 10 μv to 2 volts can be measured with a stated accuracy of ± 1.5 dB. The VHF frequency range is from 54 to 216 MHz, and the UHF frequency range is 470 to 890 MHz.

A special phone-scope jack is provided to give a detected signal output which can be used to drive a high-impedance crystal earphone, a tape recorder or an oscilloscope. The unit automatically turns off when the cover is closed.

Model 1720 operates on four 9-volt batteries. Price is $395.00.

Circle 54 on literature card

Portable Triggered Oscilloscope

Philips Electronic Instruments introduces a portable triggered-sweep oscilloscope, Model PM 3200.

The design of PM 3200 has eliminated the need for the following controls: DC balance, trigger stability, and manual trigger level. The instrument has a 10-MHz bandwidth, sensitive to 2mV/Div. The signal-derived triggering is automatic over the entire nominal 10-MHz bandwidth.

Model PM 3200 has two control settings: vertical amplitude and time base. A battery power pack also is available. The basic price is $495.00.

Circle 55 on literature card

Pulse Generator Adapter

The new Blulyne, Model APG-150, pulse generator reportedly allows the calibration of scopes at high frequencies (50-MHZ rise times), and the testing of amplifier frequency response, control chopper circuits, and any other electronic circuits that require fast rise times,

variable pulse widths and amplitudes.

The generator features variable pulse widths from 100 nanoseconds to 5 milliseconds, with added capaciance to 500 milliseconds (50% duty cycle maximum); pulse amplitude is variable from 0 to 12 volts, and rise and fall times are up to less than 20 nanoseconds, reports the manufacturer.

Two models are available: the APG-100, with 100-ohms output impedence and 0-6 volts amplitude, and the APG-150, with 50-ohms output impedence and 0-12 volts amplitude. Price of the APG-100 is $49.95; the APG-150 sells for $59.95.

Circle 56 on literature card

50K-ohm/Volt VOM

Unimetrics introduces the Omnimeter-50K, a 50K-ohm/volt VOM.

Specifications of the unit include: Mirror-scale meter, single-selector switch, easy access battery com-

partment, diode-protected meter movement and a pre-calibrated AC rectifier.

The Omnimeter-50K measures 4½ inches X 2⅜ inches X 5⅞ inches and weighs 22 ozs. with batteries. The price is $27.95.

Circle 57 on literature card

Solid-State Electronic Multimeter

A new solid-state electric multimeter has been introduced by Simpson Electric Co.

Model 2795 has 68 switch-selectable functions for measuring AC and DC voltage in 13 ranges, AC and DC current in 14 ranges, resistance in 6 low-power ranges, capacitance in 6 ranges, temperature in 2 ranges and output in 12 ranges.

The manufacturer reports a rated accuracy of ±1.0% for AC and DC.

The 2795 features an anti-parallox mirror dial and a linear scale for all AC/DC voltage and current measurements. Separate scales are provided for resistance, capacitance, temperature and decibels.

The new model 2795 is battery operated and sells for $230.00, complete with test leads, batteries and instruction manual. ▲

Circle 58 on literature card

Circle 25 on literature card

audio systems report

Speed-Test Strobes

A pair of tape player speed-test strobes in cassette and cartridge formats are available from Robins Industries Corp.

The function of the strobes is to help guard against the pitch changes that result from player speeds that are either too fast or too slow. Also, they can be used to determine sporadic speed changes: flutter, when the repeated speed change is fast; or wow, when the irregularity changes slowly.

Both units have integral strobe light and tape for testing by simply sliding the case into the player. Instructions are on the face of the case for ready reference. Operation is on standard house current.

The cassette version of the new Robins strobe, Model TSC-9, is built into a standard compact-cassette case and sells for $6.50. Its eight-track counterpart, Model TSC-8, comes in a standard cartridge case and sells for $7.90.

Circle 59 on literature card

Dual Voice-Coil Speaker

A new speaker, designated the 69HU8WD, has been introduced by Oaktron Industries, Inc.

Because of the unique double voice coil on the unit, special switching arrangements and wiring reportedly are not required. The dual voice coil enables use of both regular radio and stereo tape on the same speaker. This unit is 6 inches X 9

inches with a maximum depth of 3 3/16 inches. It has dual 8-ohm voice coils, rated for 10 watts.

The price is $12.80.

Circle 60 on literature card

Microphone for PA Systems

A new omnidirectional dynamic microphone for public-address system and recording-studio radio/TV applications has been introduced by Shure Brothers, Inc.

The Vocal Sphere Model 579SB is a low-impedance unit that reportedly delivers a peak-free, linear, wide-range response. Shure states that its uniformly omnidirectional pickup pattern minimizes unnatural voice coloration that often occurs when the speaker moves from side to side in front of the microphone.

Built-in wind and "pop" filters are incorporated in the unit. Handling and mechanical noises are sharply reduced by its shock-mounted, isolated cartridge. It reportedly is lightweight and well-bal-

anced, with a modified "ball" head and a ¾-inch body diameter. It features a built-in on/off switch and comes with a 20-foot detachable cable with a Cannon connector on the microphone end.

The price is $75.00. ▲

Circle 61 on literature card

Source guide to imported consumer electronic products

A source guide to imported consumer electronic products was published in the November '69 issue of ELECTRONIC SERVICING. Since then, we have learned of many new brands. After considerable research, we now have determined the manufacturer, importer and/or distributor(s) of these new brands and have included them all in this updated Source Guide to Imported Consumer Electronic Products.

This guide correlates the brand name of an imported product with the manufacturer, 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 of 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.

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 manufacturer, 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 Manufacturer/Importer/Distributor list beginning on page 56

Brand Name	Manufacturer, Importer and/or Distributor	Sams Coverage
ACME	251	yes
AFCO	3	no
AITC	200	no
AMC (Aimcee)	10	yes
AMC (York)	506	no
AMD	497	no
AGS	418	no
APF	4	no
Adell	7	no
Admiral	8	yes
Adonis	5	no
Advanco	9	no
Aimor	2, 47	no
Aircastle	411	yes
Aircorder	358	no
Airline	281	yes
Aiwa	11	yes
Aiwa (Rand)	359	yes
Aiwa (Selectron)	384, 385	yes
Akai (Camart)	62	no
Akai (Roberts)	364	no
Alaron	42	yes
Alfred	66	no
Alliance	13	yes
Allied	15	yes
Alpha	301	no
Alps	17	no
Ambassador	16, 268	yes
Amertone	18	no
Amico	132	no
Ampex	21	no
Angel	27	no
Annabel	42	no
Apolec	2	yes
Aristo	25	no
Aristocrat	38	yes
Aristo-Tone	25	no
Arrow	27	no
Arvin	29	yes
Astrex	473	no
Astrotone	230	yes
Audio-Lite	93	no
Audio Magnetics	34	no
Audio-Stereo	284	yes
Audion	36	no
Audiopak	33	no

Brand Name	Manufacturer, Importer and/or Distributor	Sams Coverage
Audiotape	33	no
Audition	496	no
Aud-I-Tone	205	yes
Audiovox	35	yes
August Moon	149	no
Auto Music	335	no
Automatic	37	yes
Autosonic	259	yes
Aztec	40	no
BASF	41	no
BSR	43	yes
Barkleigh	44	no
Baron	52	no
Baylor	481	no
Belaic	148	no
Belair (Hamway)	176	no
Belair (Mason)	261	no
Belair (Toko)	450	no
Belair (Toyo)	458, 459	no
Belaire	148	no
Belcor	46	no
Belcorder	176	no
Bell & Howell	48	yes
Benjamin	50	yes
Berlitz	32	no
Big Bem	452	no
Bigston	229	no
Billion	383	no
Birch	438	yes
Blaupunkt	53	yes
Boeing	52	no
Boman	58, 59	no
Bowman	58, 59	no
Bozak	122	no
Bradford	168	yes
Brand 5	365	no
Bravo	361	no
Brenell	140	no
Brightone	1	no
Broadmoor	56	yes
Browni	74	no
Bulova	57	yes
Bush	464	no
CBC	74	no
CEC	76	no
Caisonic	356	no
Califco	60	yes
Cameo	29	yes
Candle	63	yes
Capehart	65	no
Capri (Nason)	292	no
Capri (Toepfer)	446	no
Captain	502	no
Car Pal	35	no
Car Tapes	67	no
Cathedrel	492	no
Cathy	309	no
Channel	72	no
Channel Master	73	yes
Chemicon	300	no
Chinon	376	no
Cipher	269	yes
Citation	178	no
Clairtone	77	yes
Claricon	497	yes
Clarion	497	yes
Clark	79	no
Clasonic	78	no
Coach	103	no
Color Volt	404	no
Columbia	81	yes
Commodore	82	yes
Communica	453	no
Concertone (Monarch)	279	no
Concertone	83	yes
Concord	84	yes
Conion	85	no
Constant	64	no
Consul	158	no
Consul Delux	162	no
Contelcee	87	no
Continental	58, 59	no
Coral	88	no
Coronado	409	yes
Coronet	27	yes
Cortina	111	no
Corvair	466	yes
Corvette	273	yes
Country	221	no
Craig	90	yes
Crest	446	yes
Crest-Line	64	no
Crown	92	yes
Crown (Ansafone)	22	no
Crown (Industrial Supp.)	195	yes
Crowncorder	92	no
Curtis-Mathes	94	yes
Daltone	97	no
Dart	492	no
Data Packaging	98	no
Dec	96	no
Decca	99	yes
Dejay	100	no
Delmonico	101	yes
Dempa	102	no
Denon	302, 303	no
Denon (Sheraton)	389	no
Dia	311, 312	no
Dimension	441	no
Dokorder (Pengo)	343	no
Dekorder (Wilson)	494	no
Dolphin	104	no
Domino	312	no
Doral	164	no
Dorset	444	no
Douglas	406	yes
Drexel	105	yes
Dual	475	no
Durpoint	106	no
Dyn	107	no
Dyn-Sonic	107	no
Dynakits	108	no
Dynavox	109	no
Eagle	454	no
Ebner	140	no
Echo	224	no
Echo Radio	110	no
Edge	406	no
Editall	122	no
Eico	111	no
Eicocraft	111	no
Eiwa	112	no
Eiwacorder	112	no
Elac	50	no
Eldorado	80	no
Electra	113	no
Electro	114	yes
Electro-Brand	114	yes

Source guide, continued . . .

Brand Name	Manufacturer, Importer and/or Distributor	Sams Coverage
Electrohome	199	yes
Electrophonic	119	yes
Electro-Wipe	106	no
Elgin	120	yes
Elite	121	no
Embassy	123	no
Emerald	202	no
Emerson	124	yes
Emi	50	no
Empire	461, 126	no
Encore	61	no
Engineers	367	no
Englishtown	411	yes
Epicure	128	no
Espo	130	no
Essex	236, 237	yes
Estey	131	no
Ever-Play	171	yes
E-Z Splice	106	no
Fabulloyds	236, 237	no
Facom	155	no
Faircrest	141	yes
Fairfax	134	no
Fairmont	136	yes
Falcon Sergeant G-2	118	no
Fanon	137	yes
Fantavox	257	no
Fanuc	155	no
Federal	139	no
Fen-Tone	140	no
Ferrograph	122	no
Fidela	289	no
Fidelity	367	no
Fisher	142	no
Fix Tuned	144	no
Fleetwood	468	yes
Foster	146	no
Four Star	145	no
Fuji	150	no
Fuji Ricoh	152	no
Fujiden	153	no
Fujion	151	no
Fujitsu	155	no
Fujitsu Ltd.	154, 155	no
Funia	156	no
GC	157	no
GRT	159	no
GW	160	no
Galaxy	30	no
Garrard	161	yes
Gaytone	176	no
Geloso	19	yes
Gema	30	no
General	464	yes
General Electric	163	yes
Gibson Girl	365	no
Gidget	37	no
Global	164	yes
Globe	157	yes
Goer	166	no
Goer 8	71, 72	no
Golden Shield	165	no
Goodmans of England	121	no
Goodway	166	no
Gotham	167	yes
Granada	148	no
Grand Prix	74	no
Gregory	169	yes
Grenadier	125	no
Grundig	170	yes
Gusdorf	172	no
Guy Barry	136	no
HTV	175	no
Halco	174	no
Hammerlund	116	no
Harmon-Kardon	178	no
Harlie	177	no
Harp	147	no
Hatsune	180	no
Hemisphere	369	yes
Heritage	181	no
Hi-Delity	346	yes
Highsky (Paros)	203	no
Highwave (Delmonico)	101	yes
Highwave (Marvel)	260	yes
Hinode	182	no
Hit	181	no
Hitachi	184, 185	yes
Hitachi (New York Ltd.)	184	yes
Hitachi (Hitachi Maxwell)	183	yes
Hitachi (Thal)	445	yes
Hiwave	261	no
Hokuyo Musen	187	no
Honey Tone	30	yes
Hosho	84	yes
IEM	190	no
ISCO	195	yes
ITC (Ikegami)	192	no
ITC (Int'l. Transistor)	200	no
ITT	191	yes
Ideal	198	no
Imperial	193	yes
Imperial Delux	193	no
Impex	194	no
Inland	196	yes
Inmont-Cass/8	72	no
Intermart	197	no
Intersonic	201	no
Invico	69	no
Invicta	460	yes
Irish	202	no
J. B. Hunter	16	no
JFD	204	yes
JIL	207	no
JJJ	205	no
JVC	206	no
JVC (Delmonico)	101	no
Jade	360	no
Jaguar	294	yes
Japarc	208	no
Jeolco	210	no
Jerone Speer	492	no
Jensen	209	no
Juli-Corder	451	no
Juli-Phone	451	no
Juliette	455	yes
Juliette (Miami)	454	yes
KCK	211	no
KLH	212	no
Katone	215	no
Kaysons	217	no
Kensington	444	no
Kent	218	yes
Kenwood	219	yes
Kenwood (Trio)	470	yes
Keystone	32	no
Kilts	103	no
Kitaron	222	no

Brand Name	Manufacturer, Importer and/or Distributor	Sams Coverage
Kits	223	no
Kleen-Sweep	106	no
Kodam	224	no
Koronette	143	no
Korting	4	no
Koss	225	no
Koss-Acoustech	225	no
Koss-Rek-O-Kut	225	no
Kowa	226	yes
Koyo	227	yes
Kron	193	no
Kroy	506	yes
Kuba	348	no
Kupi-Tone	493	no
Kyocera	228	no
LIC	240	no
L.W.E.	6	no
Lafayette	230	yes
Lamie	429	no
Lark	61	no
Leader	231	no
Lear Jet Stereo 8	232	yes
Le-Bo	233	no
Levtron	481	no
Lexington	352	yes
Liberty	234	yes
Lion	235	no
Little Pal	251	no
Lloyd's	236, 237	yes
Loben	447	no
Longines Symphonette	238	yes
Lord Barkleigh	44	no
Loyal	239	no
Lucky	240	no
Lulu	340	no
Luxtone	241	no
Lynn	242	no
McIntosh	122	no
MYM	245	no
Macrosonic	505	no
Magatone	311	no
Magnatone	131	no
Magnavox	248	yes
Magnecord	439	no
Magnifique	367	no
Magnus	249	no
Major	250	no
Majorette	250	yes
Mantone	251	no
Marantz	252	yes
Mar-Lin	253, 254, 255	no
Mars	256	no
Martel	259	no
Marvel	251	yes
Mascot	367	yes
Master Control	498	no
Mastercraft	262	yes
Masterwork (Columbia)	81	yes
Masterwork	263	yes
Matsushita	264	yes
Maxell	183	no
Mayfair	28, 45, 266	yes
Mecca	258	no
Megatone	5	no
Melodian	220	no
Melo-Sonic	492	no
Mercury (Pax)	267, 341	no
Message Minder	54	no
Metex	312	no
Metro	270	no
Mexko	353	no
Micro	272	no
Microsonic	356	no
Midland	273	yes
Miharu	274	no
Mikado	275	no
Mingon	429	no
Mini-Swinger	438	no
Miny (Tape Players)	258	no
Miny	313	no
Miracord	50	yes
Miradon	348	no
Mirandette	14	no
Mitsubishi	276	yes
Mitsumi	277	no
Miyakawa	278	no
Mody-Kit	55	no
Monarch	279	yes
Monarch (BSR)	43	yes
Monacor	279	yes
Mondo	280	no
Moore	317	no
Morse	282	yes
Mortone	202	no
Motorola	283	yes
Muntz Stereo-Pak	284	yes
Murata	285	no
Musicolor	286	no
Muskat	49	no
NAC	291	no
NAL	314	no
NACO	313	no
NDK	305	no
NGK	287	no
NTK	287	no
Nakamichi	289, 290	no
Nanaola	456	no
Nassau	437	no
National	339	yes
Nec (Kanematsu)	213	yes
Nec (Nippon)	304	yes
Nemco	288	no
Net	295	no
Newell	2	no
Nichicon	298	no
Nikka	75	no
Nitto	310	no
Nivico (Challenge)	69	no
Nivico (Delmonico)	101	no
Nobility	296	no
Nocturne	178	no
Nordmende	419	yes
Norelco	315	yes
North American	313	yes
Novel	150	no
NuVox	316	no
OKI	70	yes
OMGS	313	yes
Ocean	173	no
Ocean & Transonic	467	no
Olson	321	no
Omgs	313	yes
Omron	333	no
Onkyo	337	no
Oral	334	no
Orion	336	yes
Orion (Fried Trading)	148	yes
Ortofon	122	no

Source guide, continued . . .

Brand Name	Manufacturer, Importer and/or Distributor	Sams Coverage
Oscar	95	no
Pacific	338	no
Panasonic	339	yes
Panger	441	no
Paros	203	no
Pax	267, 341	no
Peerless	342	yes
Pencorder	352	no
Penncrest	344	yes
Perfection	345	no
Perpetuum-Ebner	122	no
Pet	375	no
Petely	346	no
Peter Pan	438	no
Petite	419	yes
Philco	347	yes
Philips	492	no
Phoenix	61	no
Pianola	399, 59	no
Pickering	349	no
Pioneer	350	no
Plata (Dyn)	107	yes
Plata (Kaysons)	217	yes
Playtape	91	no
Poly-Planar	247	no
Poly-Sonic	247	no
President	342	no
Princeton	26	no
Qatron	354	no
Quickmount	247	no
Radiant	356	no
Radiomaster	357	no
Raleigh	217	yes
Ranger	441	yes
Realistic	355	yes
Realtone	360	yes
Record-Matic	106	no
Recoton	361	no
Rembrandt Antennas	12	yes
Rhapsody	42	yes
Rising	187, 188	no
Rivera	293	no
Roberts	364	yes
Roberts Ross	445	no
Robette	179	no
Robin	261	yes

Brand Name	Manufacturer, Importer and/or Distributor	Sams Coverage
Robins	365	no
Rolecor	366	no
Romar	351	no
Ross	367	yes
Rota	363	no
Rotacorp	363	no
Rotel	366	no
Roxy	318	no
Royal	250	yes
Rozinante	368	no
Rutherford	94	yes
Ryth-O-Matic	492	no
SD	427	no
SMK	400	no
Samac	382	no
Sampson	199	yes
Sandhurst	5	no
San-ei Instrument	370	no
Sankoh	372	no
Sankyo	20	no
Sanrin	373	no
Sansui	377, 378	yes
Sanyo	379	no
Satellite	51	yes
Saxony	463	yes
Scene	166	no
Scene Tuner	72	no
Scotch	244	no
Scott	380	no
Seavox	148	no
Seeburg	381	no
Selecto	106	no
Seminole	374	yes
Sentry	32	no
Setico	386	no
Shamrock	202	no
Shannon	103	no
Sharp	387	yes
Sharpe	122	no
Sharpe (Scrintrex)	388	no
Sheraton	389	yes
Sherwood	390	no
Shibaden	391, 392, 393, 394	yes
Shimadzu	395	no
Shin-Shirasuna	398	no
Shure	401	no

Brand Name	Manufacturer, Importer and/or Distributor	Sams Coverage
Silver	398	no
Singer	402	yes
Shin-ei	396	no
Skandia	403	no
Skyfon	322	no
Skymaster	296	no
Solo-Phone	401	no
Sonics	405	no
Sonoco	407	no
Sonoramic	365	no
Sony-Superscope	423	no
Sony	408	yes
Sound	308	no
Sound 'N Color	111	no
Soundesign	360	yes
Sovereign	389	no
Spica	420	yes
Spico	410	no
Spinola	406, 412	no
Sportmaster	463	yes
Squealer	72	no
Stanbrooke	444	no
Standard	414, 415	yes
Stanford	416	no
Stanton	122	no
Starfire	253	no
Star-Lite	262	yes
Startone	189	no
Stereo-Magic	417	no
Stellar	31	no
Stereo-Dyn	107	no
Stereo Dynetic	401	no
Stereomatic	5	no
Sterling	418	no
Stewart	242	yes
St. Moritz	251	no
St. Mortiz	251	no
Sublime	358	no
Summit	420	no
Sun Bird	207	no
Sun Bird (Katoh)	214	no
Sun Glass	19	no
Sunny-vox	397	no
Sunsonic (Sankei)	371	no
Sunsonic (Sunsonic)	421	no
Suora	105	no

Brand Name	Manufacturer, Importer and/or Distributor	Sams Coverage
Super Dynamic	427	no
Superex	422	yes
Superscope	424	no
Supersonic	411	yes
Supre-Macy	246	yes
Sylvania	425	yes
Sylvano	24	no
Symphonette	238	yes
Symphonic	426	yes
Synchronex	356	no
TDK	427	no
TDK (Cassette)	427	no
TMK	460	no
TWI	468	no
Tact (Fried)	148	no
Tact (Hamway)	176	no
Taico	428	no
Takt	430	no
Tamradio	431	no
Tamura	432	no
Tandberg	433	yes
Taya	457	no
Teac (Teac)	434	no
Teac (Repair Center)	362	no
Technicorder	320	no
Tel	441	yes
Telecon	435	no
Telefunken	436	yes
Tele-Tone	438	yes
Telex	439	no
Telex-Phonola	486	no
Telmar	440	no
Telmar (Martel)	259	no
Tempest	39	no
Ten (Fujitsu)	155	yes
Ten (Sanyo)	379	yes
Ten Brand	35	no
Tenna	441	no
Tennac	442	no
Tennamatic	441	no
Tenphonic	443	no
Thorens	122	no

Brand Name	Manufacturer, Importer and/or Distributor	Sams Coverage
Three-Star	292	no
Tobi-Sonic	28, 45, 266	no
Toho	452	no
Tokai	448	no
Tokai (Japan)	449	no
Tokai (Audiovox)	35	no
Toko	450	no
Tonecrest	271	yes
Tonemaster (Broadmoor)	56	yes
Tonemaster (TAC)	464	yes
Tonex	61	no
Toshiba	456	yes
Toshiba (Trans World)	466	yes
Toshri	138	no
Townley	127	no
Trancel	466	yes
Transcriber	465	no
Transette	273	yes
Transicorder	307	no
Transonic	466	yes
Transworld	117	no
Trio	469	no
Triumph	471	no
Tropicana	47	no
Troubador	125	no
Truetone	489	yes
Tussah	472	no
Twin XX Twenty	247	no
USAC	476	no
Uher	259	yes
Ultra-82	480	no
Unelco	473	no
Unicord	19	no
Unidyne	401	no
Unimetrics	230	yes
Union	474	no
Unisphere	401	no
United Audio	475	no
Valencia	207	no
Valiant	477	yes
Vantage	133	yes
Velk	478	no

Brand Name	Manufacturer, Importer and/or Distributor	Sams Coverage
Venice	319	no
Versatek	123	no
Vesper	448	yes
Viking	439	no
Vikoa	480	no
Viscount	86	yes
Vision	481	no
Vista	90	yes
Voca	482	no
Vornado (Automatic)	37	no
Vornado	483	yes
Wald	484	no
Waltham	485	no
Waltham (Int'l.)	199, 369	yes
Watts	122	no
Wealth (Funai)	156	no
Wealth (Toyomenka)	460	no
Weather Ear	123	no
Weltron	488	no
Webcor	487	no
Westinghouse	490	yes
Wharfedale	491	no
Wilco	379	yes
Wilson	494	no
Windsor	495	no
Winston	460	no
Wollensak	243	no
XAM	384, 385	no
Yamaha	499	yes
Yamatake-Honeywell	501	no
Yaskawa	503	no
Ye	500	no
Yec	507	no
Yew	504	no
York	506	yes
York (N.Y. Transistor)	297	yes
Zenon	508	no

Complete Manufacturer/Importer/Distributor list beginning on page 56

Manufacturer/Importer/Distributor List

1. A & A Trading Co.
23 East 26th St.
New York, N.Y.

2. ABC Import & Export
47 West 30th St.
New York, N.Y.

3. AFCO Electronics, Inc.
P.O. Box 973
Oakland, Calif. 94604

4. APF Electronics, Inc.
515 Madison Ave.
New York, N.Y. 10022

5. A & S Trading Co.
124 West 30th St.
New York, N.Y. 10001

6. Acoustron Corporation
2418 Bartlett
Houston, Tex. 77006

7. Adell International, Inc.
43700 Adell Blvd.
Novi, Mich. 48050

8. Admiral Corporation
3800 West Cortland St.
Chicago, Ill. 60647

9. Advance Transistor Co.
1225 Broadway
New York, N.Y.

10. Aimcee Wholesale Corp.
1440 Broadway
New York, N.Y. 10018

11. Aiwa International Corp.
One East Wacker Drive
Chicago, Ill. 60611

12. All Channel Prod. Corp.
47-75 48th St.
Woodside, N.Y.

13. Alliance Mfg. Co., Ltd.
Lake Park Blvd.
Alliance, Ohio

14. Allied Impex Corp.
300 Park Ave. South
New York, N.Y.

15. Allied Radio Corp.
111 N. Campbell Ave.
Chicago, Ill. 60680

16. Allied Stores Purchasing
401 Fifth Ave.
New York, N.Y. 10016

17. Alps Electric Co., Ltd.
c/o Kanematsu-Gosho (USA), Inc.
One Whitehall St.
New York, N.Y. 10004

18. Amerex Trading Co.
417 Fifth Ave.
New York, N.Y. 10016

19. American Geloso Electronics, Inc.
251 Park Ave. South
New York, N.Y. 10010

20. American Sankyo Corp.
95 Madison Ave.
New York, N.Y. 10016

21. Ampex Consumer Equip. Div.
2201 Lunt Ave.
Elk Grove Village, Ill. 60007

22. Ansafone of New York
41 East 11th St.
New York, N.Y.

24. Apex Repair Center
1141 Broadway
New York, N.Y.

25. Aristo-Tone Electronics
240 Fifth Ave.
New York, N.Y. 10001

26. Arlans Dept. Stores, Inc.
393 Seventh Ave.
New York, N.Y. 10001

27. Arrow Trading Co.
7 West 26th St.
New York, N.Y.

28. Artic Import Co.
(Bee Electronics)
(Mayfair Electronics Corp.)
666 West Kinzie St.
Chicago, Ill. 60610

29. Arvin Industries, Inc.
1531 13th St.
Columbus, Ind. 47201

30. Associated Importers
34 Dore St.
San Francisco, Calif.

31. Astra Trading Co.
175 Fifth Ave.
New York, N.Y. 10010

32. Atlas Rand Corp.
One Keystone Rd.
Paramus, N.J.

33. Audio Devices, Inc.
235 East 42nd St.
New York, N.Y.

34. Audio Magnetics Corp.
14600 S. Broadway
Gardena, Calif. 90247

35. Audiovox Corp.
156 Fifth Avenue
New York, N.Y. 10010

36. Audion Corp.
200 Fifth Ave.
New York, N.Y.

37. Automatic Radio Sales
Two Main St.
Melrose, Mass.

38. Automotive Assoc.
551 Fifth Ave.
New York, N.Y. 10017

39. Azad International
22 West 27th St.
New York, N.Y.

40. Aztec Sound Corp.
2140 South Lipan St.
Denver, Colo.

41. BASF Systems, Inc.
Crosby Drive
Bedford, Mass. 01730

42. B&B Import & Export Co.
15755 Wyoming Ave.
Detroit, Mich. 48238

43. BSR (USA), Ltd.
Route 33
Blauvelt, N.Y. 10913

44. Barker Stores
815 Hutchinson River Pkwy.
Bronx, N.Y. 10465

45. Bee Electronics
666 W. Kinzie St.
Chicago, Ill.

46. Belcor Corp.
457 Chancellor Ave.
Newark, N.J.

47. Bell Electronics
1180 Broadway
New York, N.Y. 10009

48. Bell & Howell Co.
7235 North Linder
Skokie, Ill. 60076

49. Bel-Mar, Inc.
1942 N.E. 151st St.
North Miami Beach, Fla. 33160

50. Benjamin Electronic Sound Co.
40 Smith St.
Farmingdale, L.I., N.Y. 11735

51. Best of Tokyo
11 West 42nd St.
New York, N.Y.

52. Boeing Electronics Co., Ltd.
1-9, Ryocho Sakata-City
Yamagata, Japan

53. Robert Bosch Corp.
40-25 Crescent St.
Long Island City, N.Y. 11101

54. Boston Worldwide
148 State St.
Boston, Mass.

55. Bowman Electronics
155 East First Ave.
Roselle, N.J.

56. Broadmoor Industry, Ltd.
530 Santa Rosa Dr.
Des Plaines, Ill. 60018

57. Bulova Watch Co.
630 Fifth Ave.
New York, N.Y. 10020

58. California Auto Radio, Inc.
9426 Stewart & Gary Rd.
Downey, Calif. 90241

59. California Auto Radio, Inc.
1229 South Woodruff St.
Downey, Calif.

60. California Trading Co.
P. O. Box 3164
Torrance, Calif.

61. Caltrade Mfg. & Trading Co.
360 Ninth St.
San Francisco, Calif. 94103

62. Camart Products
Repair Center
1845 Broadway
New York, N.Y.

63. Candle America, Inc.
1457 Venice Blvd.
Los Angeles, Calif. 90006

64. Canton-Son, Inc.
12 West 27th St.
New York, N.Y.

65. Capehart Corp.
770 Lexington Ave.
New York, N.Y. 10021

66. Capin Mercantile Corp.
109 Nelson Ave.
Nogales, Ariz. 85621

67. Car Tapes, Inc.
320 West Ohio St.
Chicago, Ill. 60610

68. Cardinal Electronics
5069 Broadway
New York, N.Y.

69. Challenge Corp.
150 Fifth Ave.
New York, N.Y.

70. Chancellor Electronics, Inc.
457 Chancellor Ave.
Newark, N.J. 07112

71. Channel Marketing, Inc.
26 Springdale Road
Cherry Hill, N.J. 08034

72. Channel Marketing, Inc.
342 Madison Ave.
New York, N.Y.

73. Channel Master
Ellenville
New York, N.Y.

74. Charles Brown & Co.
1170 Broadway
New York, N.Y. 10001

75. Chiyoda Electronic Co., Ltd.
3-9, Soto Kanda 3-chome,
Chiyoda-ku
Tokyo, Japan

76. Chuo Denki Co., Ltd.
1767 Aza Higashidaria,
Higashi Matsuyama
Saitama, Japan

77. Clairtone Electronic Corp.
681 Fifth Ave.
New York, N.Y. 10022

78. Clarion Shoji Co., Ltd. (USA)
2306 Cotner Ave.
Los Angeles, Calif. 90064

79. David Clark Co., Inc.
360 Franklin Street
Worcester, Mass. 01604

80. A. Cohen & Sons, Inc.
27 West 23rd St.
New York, N.Y. 10010

81. Columbia Records Corp.
51 West 52nd St.
New York, N.Y. 10019

32. Commodore Import Corp.
507 Flushing Ave.
Brooklyn, N.Y. 11205

83. Concertone, Inc.
3962 Landmark St.
Culver City, Calif. 90230

84. Concord Electronics Corp.
1935 Arnacost Ave.
West Los Angeles, Calif. 90025

85. Coney Onkyo Co., Ltd.
1-23, Iwaya Kita-machi 5-chome,
Nada-ku
Kobe, Japan

86. Consolidated Merchandising Corp.
520 West 34th St.
New York, N.Y. 10001

87. Continental Telephone
Answering Devices
17 West 46th St.
New York, N.Y.

88. Coral Audio Corp.
8-9, Soto-Kanda 3-chome,
Chiyoda-ku
Tokyo, Japan

89. Craig Panorama, Inc.
2302 East 15th St.
Los Angeles, Calif. 90021

90. Craig Corp.
Cardinal Electric
5069 Broadway
New York, N.Y.

91. Craigston Corp.
1115 Broadway
New York, N.Y.

92. Crown Radio Corp.
755 Folsom St.
San Francisco, Calif. 94107

93. Curtis-Electro Lighting, Inc.
1536 South Paulina St.
Chicago, Ill. 60608

94. Curtis-Mathes Sales Co.
414 Elizabeth Ave.
Newark, N.J. 07112

95. Daishin Electric Ind. Co., Inc.
2-5 Ohmori-minami, Ohta-ku
Tokyo, Japan

96. Daiwa, Ltd.
1, Nihonbashi, Edobashi
2-chome, Chuo-ku
Tokyo, Japan

97. Dalamal & Sons
107 Franklin
New York, N.Y. 10002

98. Data Packaging Corp.
205 Broadway
Cambridge, Mass. 02139

99. Decca Distributing
445 Park Ave.
New York, N.Y. 10022

100. Dejay Industries
90 North Washington St.
Boston, Mass.

101. Delmonico International
50-35 56th Rd.
Maspeth, L.I., N.Y. 11378

102. Delta International, Ltd.
Box 1946
Grand Junction, Colo.

103. Dictotape, Inc.
9090 Krier Place
Brooklyn, N.Y. 11236

104. Dolphin Sansho, Ltd.
11-13, Shimoigusa 5-chome,
Suginami-ku
Tokyo, Japan

105. Drexel Radio Corp.
P. O. Box 15156
New Orleans, La.

106. Duotone Co., Inc.
6875 S.W. 81st St.
Miami, Fla. 33143

107. Dyn Assoc. Importers, Inc.
270 West 22nd St.
Hialeah, Fla. 33010

108. Dynaco, Inc.
3060 Jefferson St.
Philadelphia, Pa. 19121

109. Dynavox Electronics Corp.
40-05 21st St.
Long Island City, N.Y. 11101

110. Echo Tsushin Kogyo Co., Ltd.
29-9, Shimo Sueyoshi 1-chome,
Tsurumi-ku
Yokohama, Japan

111. Eico Electronic Instr. Co., Inc.
283 Malta St.
Brooklyn, N.Y. 11207

112. Eiwa Sangyo Co., Ltd.
6-11, Nishi Shinbashi 2-chome,
Minato-ku
Tokyo, Japan

113. Electra Radio Corp.
30 West 23rd St.
New York, N.Y.

114. Electro-Brand, Inc.
210 West Chestnut
Chicago, Ill. 60610

115. Electrohome, Ltd.
809 Wellington St. North
Kitchener, Ontario, Canada

116. Electronic Assistance Corp.
20 Bridge Ave.
Red Bank, N.J. 07701

117. Electronic Ind., Inc.
901 Daniel St.
Kenner, La. 70062

118. Electronic Research &
Development, Ltd.
6th Floor, Shiozaki Bldg. 7,
Hirakawa-cho 2-chome,
Chiyoda-ku
Tokyo, Japan

119. Electrophonic Corp.
9200 Atlantic Ave.
Ozone Park, N.Y.

120. Elgin National Watch Co.
841 West Jackson Blvd.
Chicago, Ill.

121. Elite Electronics
195 East Central Ave.
Farmingdale, N.Y. 11735

122. Elpa Marketing Ind., Inc.
Thorens & Atlantic Ave.
Garden City Park, N.Y. 11040

123. Embassy
5330 East 38th St.
Indianapolis, Ind. 46218

124. Emerson TV & Radio Co.
51 West 51st St.
New York, N.Y.

125. Empire Scientific Corp.
1055 Stewart Ave.
Garden City, N.Y. 11530

126. Empire Ultrasonics, Ltd.
1199 Broadway
New York, N.Y. 10001

127. The Englishtown Corp.
42 Broadway
New York, N.Y. 10004

128. Epicure Products, Inc.
185 Somerville Ave.
Somerville, Mass. 02143

129. Ercona Corp.
432 Park Ave. South
New York, N.Y. 10016

130. Espo Engineering Corp.
5334 West 65th St.
Chicago, Ill. 60638

131. The Estey Co.
Div. of Electro-Learner Corp.
Ziegler St.
Harmony, Pa.

132. Exhibit Sales Co.
South 3rd St.
Philadelphia, Pa. 19106

133. Fairfax Dist. Co., Inc.
1328 New York Ave. NW
Washington, D.C.

134. Fairfax Ind., Inc.
165 Ward St.
Paterson, N.J. 07505

135. Fairmont Electronics, Inc.
55 West 39th St.
Suite 506
New York, N.Y. 10018

136. Fairmont Electronics
12 Crescent St.
Holyoke, Mass.

137. Fanon Electronic Ind.
439 Frelinghuysen Ave.
Newark, N.J. 07114

138. Fedco, Inc.
P.O. Box 2605
Terminal Annex
Los Angeles, Calif. 90054

139. Federal Transistor Co., Inc.
519 South Broadway
Los Angeles, Calif. 90013

140. Fen Tone International
106 Fifth Ave.
New York, N.Y. 10011

141. J. M. Fields
111 Eighth Ave.
New York, N.Y.

142. Fisher Radio Corp.
11-40 45th Rd.
Long Island City, N.Y. 11101

143. Fisher Sonic Co., Inc.
405 44th St.
Brooklyn, N.Y.

144. Fix Tune Solid State Electronics
One West 30th St.
New York, N.Y. 10001

145. Fortune Star Products
1207 Broadway
New York, N.Y. 10001

146. Foster Electric Co., Ltd.
230 North Michigan Ave.
Chicago, Ill. 60601

147. L. K. Franklin Co.
8912 West Olympic Blvd.
Beverly Hills, Calif.

148. Fried Trading Co.
425 Bedford Ave.
Brooklyn, N.Y. 11211

149. Fuji Electronics Co., Ltd.
Nikko Mita Bldg., 26-4 Takanawa
1-chome, Minato-ku
Tokyo, Japan

150. Fuji Electrochemical Co., Ltd.
437 Fifth Ave.
New York, N.Y. 10016

151. Fuji Onkyo Co., Ltd.
15-13 Shimomaruko 1-chome,
Ohta-ku
Tokyo, Japan

152. Fuji Ricoh Co., Ltd.
1046-2 Ikebukuro Toshima-ku
Tokyo, Japan

153. Fujiden International Corp.
Hase Bldg., 25, Bingomachi
3-chome, Higashi-ku
Osaka, Japan

154. Fujitsu California, Inc.
16410 South Figueroa St.
Gardena, Calif.

155. Fujitsu Lto.
680 Fifth Ave.
New York, N.Y. 10019

156. Funia Electric Co., Ltd.
3004 West Logan Blvd.
Chicago, Ill. 60647

157. GC Electronics Co.
400 South Wyman St.
Rockford, Ill.

158. GCL Mercantile Corp.
36 Utter Ave.
Hawthorne, N.J. 07507

159. GRT Corp.
1286 N. Lawrence Station Rd.
Sunnyvale, Calif. 94086

160. GW Electronics, Inc.
1647-4 West Sepulveda Blvd.
Torrance, Calif.

161. Garrard
Div. of British Ind. Co.
Westbury, N.Y. 11590

162. General Consolidated
87 Dell Gen Ave.
Lodi, N.J.

163. General Electric
Electronics Park
Syracuse, N.Y. 13201

164. Global Import & Export
858 West Flagler St.
Miami, Fla. 33130

165. Golden Shield Corp.
680 Fifth Ave.
New York, N.Y. 10019

166. Goodway, Inc.
11401 Roosevelt Blvd.
Philadelphia, Pa.

167. Gotham Electronics, Inc.
170 Michael Dr.
Syosset, N.Y. 11791

168. W. T. Grant Co.
1441 Broadway
New York, N.Y. 10018

169. Gregory Amplifier Corp.
3650 Dyre Ave.
Bronx, N.Y.

170. Grundig Electronic Sales
Corp.
355 Lexington Ave.
New York, N.Y.

171. Gulton Ind.
212 Durham Ave.
Metuchen, N.J.

172. Gusdorf & Sons, Inc.
6900 Manchester Ave.
St. Louis, Mo. 63143

173. Hachiyo Electric Sound Co., Inc.
3-6, Higashigaoka 2-chome,
Meguro-ku
Tokyo, Japan

174. Halen Associates
125 Fifth Ave.
New York, N.Y. 10003

175. Hamamatsu TV Co., Ltd.
c/o Kinsho-Mataichi Corp.
80 Pine St.
New York, N.Y. 10005

176. Hamway Import Co.
40 West 29th St.
New York, N.Y. 10001

Manufacturer / Importer / Distributor List continued . . .

177. Harlie Transistor Prod.
393 Sagamore Ave.
Mineola, L.I., N.Y.

178. Harman-Kardon, Inc.
55 Ames Court
Plainview, New York 11803

179. Haskel Howard Co.
21 Hazelton Rd.
Yonkers, N.Y.

180. Hatsune Electric Ind. Co., Ltd.
Yatsurugi, Iwakure-cho, Niwa-gun
Aichi, Japan

181. Heritage International Trading
1330 Stuyvesant Ave.
Union, N.J. 07083

182. Hinode Electric Works
13, Kamiyama-cho, Kita-ku
Osaka, Japan

183. Hitachi Maxell, Ltd.
501 Fifth Ave.
New York, N.Y. 10005

184. Hitachi New York, Ltd.
333 North Michigan Ave.
Chicago, Ill. 60601

185. Hitachi Sales Corp.
New York Branch Office
666 Fifth Ave.
New York, N.Y. 10019

186. Hitachi Sales Corp. of America
48-50 34th St.
Long Island City, N.Y. 11101

187. Hokuyo Musen Kogyo Co., Ltd.
6, Shikishima-cho 4-chome,
Johto-ku
Osaka, Japan

188. Hokuyo Musen Co., Ltd.
80-26 138th St.
Kew Gardens, N.Y.

189. Hotta Clock & Watch Co., Ltd.
23-12, Ueno 5-chome, Taito-ku
Tokyo, Japan

190. IEM
187, Kominato-cho 3-chome,
Naka-ku
Yokohama, Japan

191. ITT Distributor Prod.
250 Broadway
New York, N.Y.

192. Ikegami Electronics Inds., Inc. of New York
35-27 31st St.
Long Island City, N.Y. 11106

193. Imperial Import Co.
1199 Broadway
New York, N.Y. 10001

194. Impex Electronics
213 South Robertson Blvd.
Beverly Hills, Calif.

195. Industrial Suppliers
755 Folsom St.
San Francisco, Calif. 94107

196. Inland Trading Co.
111 Hackensack Ave.
New Jersey

197. Intermart Corp.
147 West 42nd St.
New York, N.Y.

198. International Distributors, Inc.
1178 Pope St.
Memphis, Tenn. 38102

199. International Importers
2242 South Western Ave.
Chicago, Ill. 60608

200. International Transistor
1206 South Maple
Los Angeles, Calif.

201. Intersonic Corp.
P.O. Box 215
Rockaway, N.J. 07866

202. Irish Tape Div.
Morhan National Sales Co., Inc.
458 Broadway
New York, N.Y. 10013

203. Izumi Co., Ltd.
9-13, 1-chome, Meauro Honcho,
Meauro-ku
Tokyo, Japan

204. JFD Electronics Corp.
62nd St. at 15th Ave.
Brooklyn, N.Y.

205. J.J.J. Merchandise
15 West 26th St.
New York, N.Y. 10010

206. JVC America, Inc.
50-35 56th Rd.
Maspeth, N.Y.

207. Japan Industry, Ltd.
Kawazu Bldg., 4 Kitayacho,
Shibuya-ku
Tokyo, Japan

208. Jappac Co., Ltd.
21-21, Joban 9-chome, Urawi-shi
Saitama, Japan

209. Jensen Mfg. Div. The Muter Co.
5655 West 73rd St.
Chicago, Ill. 60638

210. Jeloco (USA), Inc.
477 Riverside Ave.
Medford, Mass. 02155

211. KCK Co., Ltd.
528 West Wellington Ave.
Chicago, Ill. 60657

212. KLH Research and Development Corp.
30 Cross St.
Cambridge, Mass. 02139

213. Kanematsu New York
One Whitehall St.
New York, N.Y.

214. Katoh Co., Ltd.
Oaawa Bldg., 2-13,
Motohama-cho,
Naka-ku
Yokohama, Japan

215. Katone Corp.
37 West 28th St.
New York, N.Y.

216. Kay Jewelers
1328 New York Ave., NW
Washington, D.C. 20005

217. Kaysons International Ltd.
250 West 57th St.
New York, N.Y.

218. Kent Overseas, Inc.
38 West 33rd St.
New York, N.Y.

219. Kenwood Corp.
69-41 Calamus Ave.
Woodside, N.Y.

220. Keystone Electronics Corp.
11, Hirakawacho 1-chome,
Chiyoda-ku
Tokyo, Japan

221. King Korn Marketing
Div. of Fullview Ind., Inc.
6001 North Clark St.
Chicago, Ill. 60626

222. Kitaron Electric Co., Ltd.
1-13, Arakawa 1-chome,
Arakawa-ku
Tokyo, Japan

223. Kits Industries, Inc.
729 Ceres Ave.
Los Angeles, Calif. 90021

224. Kodama Chemical Ind. Co., Ltd.
7-3, Soto Kanada 6-chome,
Chiyoda-ku
Tokyo, Japan

225. Koss Electronics, Inc.
2227 North 31st St.
Milwaukee, Wis. 53208

226. Kowa American Corp.
276 Fifth Ave.
New York, N.Y.

227. Koyo International Inc. of America
330 Madison Ave.
New York, N.Y. 10017

228. Kyocera International, Inc.
510 South Mathilda Ave.
Sunnyvale, Calif. 94086

229. Kyokuyo Electric Co., Ltd.
605, Oazo Idogi Ageo
Saitama, Japan

230. Lafayette Radio & Electronics
111 Jericho Turnpike
Syosset, L.I., N.Y.

231. Leader Instrument Corp.
24-20 Jackson Ave.
Long Island City, N.Y. 11101

232. Lear Jet Stereo, Inc.
13131 Lyndon Ave.
Detroit, Mich. 48227

233. Le-Bo Products Co., Inc.
71-08 51st Ave.
Woodside, N.Y. 11377

234. Liberty Trading Co., Ltd.
Nippon Bldg., 8, Ohtemachi
2-chome, Chiyoda-ku
Tokyo, Japan

235. Lion Electronics Corp.
194 South 8th St.
Brooklyn, N.Y.

236. Lloyd's Electronics Corp.
59 North Fifth St.
Saddlebrook, N.J. 07662

237. Lloyd's Electronics of California, Inc.
6651 East 26th St.
City of Commerce, Calif. 90022

238. Longines Symphonette
200 Myrtle Ave.
Larchmont, L.I., N.Y.

239. Loyal Sangyo Co., Ltd.
28-1, Sekiguchi 1-chome,
Bunkyo-ku
Tokyo, Japan

240. Lucky International
1155 Broadway
New York, N.Y. 10010

241. Luxor International
39 West 29th St.
New York, N.Y.

242. Lynn Stewart Co.
439 East Illinois St.
Chicago, Ill. 60611

243. 3M Company Mincom Div.
3M Center
St. Paul, Minn. 55101

244. 3M Company Magnetic Prod. Div.
3M Center
St. Paul, Minn. 55101

245. MYM Trans-World Corp.
1165 Broadway
New York, N.Y.

246. Macy's Dept. Store
Herald Square
New York, N.Y. 10001

247. The Magitron Co.,
Div. of Era Acoustics Corp.
311 East Park St.
Moonachie, N.J. 07074

248. Magnavox Co.
270 Park Ave.
New York, N.Y.

249. Magnus Organ Corp.
1600 West Edgar Rd.
Linden, N.J. 07036

250. Major Electronics Corp.
649 39th St.
Brooklyn, N.Y.

251. Manhattan Novelty Co.
263 Canal St.
New York, N.Y. 10013

252. Marantz Co., Inc.
8150 Vineland Ave.
Sun Valley, Calif. 91352

253. Mar-Lin Enterprises
1472 Broadway
New York, N.Y.

254. Mar-Lin Radio Corp.
45 West 27th St.
New York, N.Y. 10001

255. Mar-Lin West Ltd.
1515 Santee St.
Los Angeles, Calif. 90015

256. Mars Radio Corp.
79, Hanazonocho, Shinjuku-ku
Tokyo, Japan

257. Marshall Field & Co.
111 North State St.
Chicago, Ill. 60690

258. Maruwa Electronic & Chemical Co., Ltd.
1-18, Nishiura-cho, Higashi-ku
Nagoya, Japan

259. Martel Electronic Sales
1199 Broadway
New York, N.Y. 10001

260. Marvel International
30 East 42nd St.
New York, N.Y.

261. Mason Camera Corp.
1141 Broadway
New York, N.Y. 10001

262. Mastercraft Electronic Corp.
1115 Broadway
New York, N.Y. 10010

263. Masterwork Audio Prods.
1080 Graffle Rd.
Hawthorne, N.J. 07506

264. Matsushita Electric Corp. of America
200 Park Ave.
New York, N.Y. 10017

265. M.E. Parts & Repair
43-30 24th St.
Long Island City, N.Y.

266. Mayfair Electronics Corp.
666 West Kinzie St.
Chicago, Ill.

267. Mercury Record Corp.
35 East Wacker Dr.
Chicago, Ill.

268. Metasco
401 Fifth Ave.
New York, N.Y. 10016

269. Metric TV Parts
Repair Center
65 Lexington Ave.
Passaic, N.J.

270. Metro of California
4861 Santa Monica
Los Angeles, Calif. 90029

271. Metro Wholesale Corp.
53 West 43rd St.
New York, N.Y. 10036

272. Micro Seiki Co., Ltd.
19, Fujimicho, Itabashi-ku
Tokyo, Japan

273. Midland International Corp.
1909 Vernon St.
North Kansas City, Mo. 64116

274. Miharu Shoji Co., Ltd.
P. O. Box 4
Ellenville, N.Y. 12428

275. Mikado Electronics Corp.
34 Dore St.
San Francisco, Calif.

276. Mitsubishi Electric Corp.
119 East Lake St.
Prudential Plaza
Chicago, Ill. 60601

277. Mitsumi Electronics Corp.
11 Broadway
New York, N.Y. 10004

278. Miyakawa Shoko Co., Ltd.
13-1, Hagashi Azabu 1-chome,
Minato-ku
Tokyo, Japan

279. Monarch Electronics Corp.
7035 Laurel Canyon Blvd.
North Hollywood, Calif. 91605

280. Mondo Electronic Corp.
19-3, Kami Ochiai 1-chome,
Shinjuku-ku
Tokyo, Japan

281. Montgomery Ward
619 West Chicago Ave.
Chicago, Ill.

282. Morse Electron Prods.
9200 Atlantic Ave.
Ozone Park, N.J. 11416

283. Motorola, Inc.
9401 West Grand Ave.
Franklin Park, Ill. 60131

284. Muntz Stereo-Pak, Inc.
7715 Densmore Ave.
Van Nuys, Calif. 91406

285. Murata Corp. of America
Two Westchester Plaza
Elmsford, N.Y. 10523

286. Musicolor Prods. Visionics, Inc.
4332 Artesia Ave.
Fullerton, Calif. 92633

287. NGK Spark Plugs (USA), Inc.
4010 Sawtelle Blvd.
Los Angeles, Calif. 90066

288. Nagata Electric Mfg. Co., Ltd.
240, Hanakawaminamino-cho,
Nishiyodogawa-ku
Osaka, Japan

289. Nakamichi Research, Inc.
153, Suzukicho 1-chome, Kodaira
Tokoyo, Japan

290. Nakamichi Research (USA), Inc.
130 Woodbury Rd.
Woodbury, N.Y. 11797

291. Nakayama Denshi Co., Ltd.
13-5, Nishimagome 2-chome,
Ohta-ku
Tokyo, Japan

292. Nason Trading Co.
230 Fifth Ave.
New York, N.Y.

293. National Electronics
38-20 SE 8th St.
Miami, Fla.

294. National Silver Co.
241 Fifth Ave.
New York, N.Y.

295. Net Electronics
8315 East Firestone Blvd.
Downey, Calif. 90241

296. New York Merchandise Co.
32 West 23rd St.
New York, N.Y. 10010

297. New York Transistor Co.
New Jersey

298. Nichicon Capacitor, Ltd.
3941 North Pine Grove Ave.
Chicago, Ill. 60613

299. Nichimen Co.
60 Broad St.
New York, N.Y.

300. Nippon Chemical Condenser
Co., Ltd.
86-16 60th Ave.
Rego Park, N.Y. 11373

301. Nippon Alpha Electric Co., Ltd.
200 Park Ave.
New York, N.Y. 10017

302. Nippon Columbia Corp. of
America
Suite 1001-3
501 Fifth Ave.
New York, N.Y. 10017

303. Nippon Columbia Corp. of
America
6 East 43rd St.
New York, N.Y. 10017

304. Nippon Electric New York, Inc.
200 Park Ave.
New York, N.Y. 10017

305. Nippon Densan Co., Ltd.
Morita Bldg., 15, Shibanishkubo,
Hiromachi, Minato-ku
Tokyo, Japan

306. Nippon Gakki Co., Ltd.
10-1, Nakazawacho, Hamamatsu
Shizuoka, Japan

307. Nippon Sound Equipment
Co., Ltd.
55-1, Kamiishihara 3-chome,
Chafu
Tokyo, Japan

308. Nippon Sound Co., Ltd.
5-12, Shinsayama 1-chome,
Sayama City,
Saitama, Japan

309. Nissho Electronic Corp.
225, Hirano Babacho, Higashi
Sumiyoshi-ku
Osaka, Japan

310. Nitto Gramophone Co., Ltd.
5, Higashi Irifunecho,
Nishinari-ku
Osaka, Japan

311. Noam Electronics Corp.
60 West 45th St.
New York, N.Y. 10036

312. Noam Electronics Corp.
118-21 Queens Blvd.
Forest Hills, N.Y. 11375

313. North American Foreign
Trading Co.
1115 Broadway
New York, N.Y. 10010

314. North American Leisure Corp.
1776 Broadway
New York, N.Y. 10019

315. North American Philips Co.,
Inc.
100 East 42nd St.
New York, N.Y. 10017

316. NuVox Electronics
150 Fifth Ave.
New York, N.Y. 10011

317. OTC International, Inc.
205 West Wacker Dr.
Chicago, Ill. 60606

318. Ofuna Electronics Ind. Co., Ltd.
526, Kamikashio-cho, Totsuka-ku
Yokohama, Japan

319. Oikawa Kogeisho Co., Ltd.
9-9, Minamidai 5-chome,
Nakano-ku
Tokyo, Japan

320. Oki Electric Ind. Co., Ltd.
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New York, N.Y. 10017

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advertisers' index

antenna systems report

Indoor/Outdoor TV Antenna

The Winegard Company has introduced a new TV antenna which can be used inside as well as out.

The new Sensar antenna is 46-inches long, measures 6-inches at its widest point and reportedly performs as well as larger antennas up to 40 miles and more from TV transmitters.

The Model SR-20 has two flat "wing-like" anodized exterior signal collectors, with solid-state circuitry enclosed in an ultra-sonically sealed Cycolac housing, which, like the signal collectors, is totally weatherproof, according to the manufacturer.

Winegard has made available three mounts for easy installation. The first, the SRM, is a universal tripod roof mount measuring 30 inches high. The SWM is a combination wall, window and chimney mount, and the third, STM, is designed for travel trailers, mobile homes, houseboats, cruisers and other similar installations.

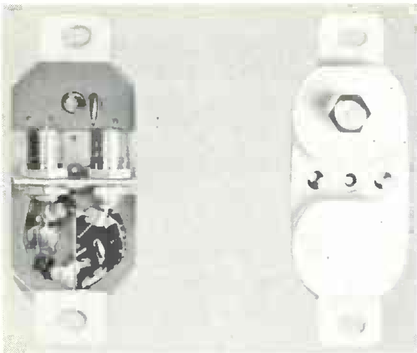
The list price for Model SR-20 is $49.88, complete with a 2-set power coupler.

Circle 62 on literature card

Tapoff/Line Stretchers

Two new combination MATV tapoffs and line extender amplifiers have been introduced by JFD Electronics Corp./Systems Division.

Model SL-6302 provides 13.5 dB gain at VHF frequencies (channels 2 through 13) and unity (1) gain at UHF frequencies (channels 14 through 83). Model SL-6312 provides 12.5 dB gain at UHF frequencies and passes VHF with unity gain. Both units provide an 82-channel "F" output tapoff.



Each unit can be cable-powered from any 17-volt DC, 24-ma source; however, they are designed primarily for use in JFD Smoothline cable-powered systems. The flush-mounted line extenders reportedly can be installed anywhere on an MATV trunkline.

The units both sell for $47.50 each.

Circle 63 on literature card

Antenna Preamplifier Series

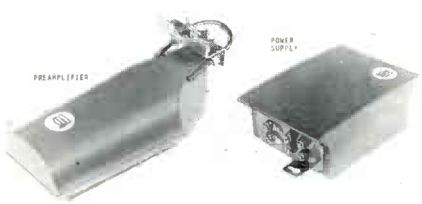
Jerrold Electronics Corp. has made available a complete line of its 4000 Series "Powermate-Plus" preamplifiers for antenna or mast-mounting, including super-gain and super-overload versions in both 300-ohm and 75-ohm models.

These units reportedly improve picture quality in locations of normally poor TV reception and give color pictures with greater contrast, less noise and less background snow.

Designed especially for master antenna television (MATV) and home distribution systems, the units are easy to install on antenna masts in conjunction with mating indoor-mounting power supplies, according to the manufacturer. Each device is housed in an unbreakable plastic cover that also forms a natural water shed, with electrical connections located on the underside of the outdoor preamplifier.

300-Ohm Models

Model 4238-S offers higher gain



and overload for VHF, UHF and FM amplification, and sells for $49.95. Model 4203-S is designed for VHF television and FM reception, and also passes UHF signals. It is list priced at $46.50. Model 4083 is a special model for UHF television that also passes VHF and FM, and sells for $38.25. All three models have two separate outputs from the power supply.

75-Ohm Models

Model 4287-S has a 300-ohm input and a 75-ohm output and is designed for all-channel reception. The price is $47.25. Model 4207-S is for VHF and FM, but also passes UHF television. Also equipped with a 300-ohm input and a 75-ohm output, it is list priced at $46.50. Model 4087-S7 is recommended for UHF television, although it also passes VHF and FM. It is equipped with 75-ohm output and input, and sells for $54.95. ▲

Circle 64 on literature card

Circle 30 on literature card

Simple X-Ray Detection Instruments For TV Service Technicians

Two simple X-ray detection devices you can build easily with conventional components.

by Richard K. Stoms
and Edward Kuerze

The development of instrumentation for measuring radiation exposure from electronic products is a major responsibility of the Division of Electronic Products, Bureau of Radiological Health. When adequate or suitable instruments for a particular application are not available, it is the responsibility of the Division's Radiation Measurements and Calibration Branch to develop them. This article describes the results of an effort to design simple and inexpensive instruments that could be used by service technicians to detect x-ray emission from television receivers.

The devices described in this article were designed to be constructed by television and electronic technicians without specialized radiation measurement instrumentation experience. The circuits can be built from commonly available, low-cost components. The use of one of these detection devices will enable a service technician to determine whether a television receiver emits excessive x-radiation and, hence, whether repair or adjustment is necessary.

The construction and use of these detection devices by service technicians will provide a partial solution to the problem of detecting excessive x-ray emission from television receivers which are now in the hands of consumers.

Robert L. Elder, Sc.D.
Acting Director
Division of Electronic Products
Bureau of Radiological Health

Purpose and Types Of Instruments

Because of the relatively high cost of instrumentation and the skills and radioactive sources needed to ensure calibration, the measurement of x rays emitted from home color television receivers has been restricted primarily to health agencies and television manufacturers. Television service personnel have not become involved in the problem other than to be advised to replace shunt regulator tubes with approved types, adjust high voltage to manufacturers' specifications, and ensure that all covers in the high-voltage section are properly installed. The question does arise as to whether the service industry should become more involved in making measurements of x-ray emission and taking any indicated corrective action. Measurements could be made on both sets housed in cabinets and chassis on service benches.

An instrument would be adequate if it were designed to indicate only whether x rays are emitted at a rate that approaches the 0.5 mR/hr rate specified as a limit by Federal regulation. The instrument need not be calibrated with a high degree of accuracy and, additionally, need not require a meter readout. Availability of such an instrument would enable service personnel to identify radiating sets and provide assurance that corrective action had reduced the radiation well below the specified 0.5 mR/hr.

This article describes two basic instrument designs. The first is a low-cost instrument capable of indicating whether a television receiver is emitting sufficient x rays to warrant corrective action. This instrument is easily assembled with low-cost components, many of

This article has been adapted from a U.S. Department of Health, Education and Welfare publication titled "Simple X-Ray Detection Instruments For TV Service Technicians." Copies of the publication can be obtained for $3.00 each from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151. Technical questions pertaining to X-radiation should be addressed to the Office of Information, Bureau of Radiological Health, 12720 Twinbrook Parkway, Rockville, Maryland 20852.

which are found in the ubiquitous "junk box". The instrument requires no calibration, and the readout is clear and unambiguous.

The second instrument is considerably more complex and designed for those who wish to construct a high-quality Geiger-quality Geiger-Mueller instrument for which checkout and calibration in terms of counts per minute require only commonly available service shop instrumentation.

Operation of Geiger-Mueller Tube

There are several methods one might choose to measure x rays emanating from television receivers. One of the best from the standpoint of sensitivity and economy uses a Geiger-Mueller (G-M) tube as the sensing device.

The G-M tube instrument may be broken down into three basic sections: the sensor, high-voltage supply, and readout. G-M tubes consist of a cathode, anode, and filling gas. The filling gas is usually a mixture of a noble gas and a quenching gas such as alcohol vapor or one of the halogens. If a positive voltage is applied to the anode, the electric field is highest around the thin-wire anode and decreases rapidly as the distance from the wire increases. This high electric field gradient around the wire permits operation in the Geiger region, as described below, with a lower applied voltage than would be the case with a thick-wire anode.

Quanta of ionizing radiation, such as x rays and cosmic rays, enter the tube, and a small percentage reacts with either the tube wall or the filling gas to produce free electrons in the gas. As the voltage on the anode is raised from the cathode voltage, some of the free electrons will be collected on the positive anode and some will recombine with gas molecules. As the anode voltage is increased further, more electrons will be collected and less will recombine. If the voltage is raised even higher, a point is reached where the electrons are accelerated to a high enough velocity to knock electrons (secondary elec-

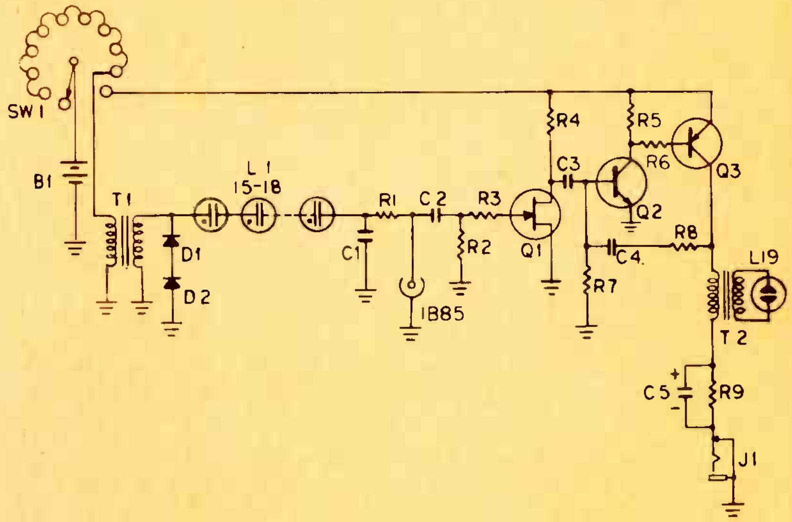


Fig. 1 Circuit diagram of circuit No. 1, a simple X-ray detection instrument.

Parts List For Circuit In Fig. 1

B-1	—	6 volt (4 AA cells)
R1	—	10 M ohm
R2, R3	—	100 k ohm
R4, R7	—	10 k ohm
R5, R9	—	1 k ohm
R6	—	560 ohm
R8	—	15 k ohm
C1	—	0.047 μfd 1600 V
C2	—	0.001 μfd 2 kV
C3	—	100 pfd
C4	—	0.1 μfd
C5	—	20 μfd 15 V
D1, D2	—	F8 Sarkes-Tarzian
Q1	—	2N5457 (MPF 103), or 2N4221 (Motorola)
Q2	—	2N635A, 2N697, 2N706, 2N1605, 2N3567, 2N3646 or 2N5133
Q3	—	2N404, 2N414, 2N652, 2N741, 2N1038, 2N1193, 2N3133, 2N3638, 2N3645, 2N5140 or MA206
T1	—	6.3 volt filament transformer (Allied 54-1416) or output transformer (Allied 54-1449) or input transformer 100/98500 ohm (Triad A-1X) or many others typical of the above.
T2	—	Same as T1, plus input transformer (Calectro D1-719) or input transformer 10 K/2 k ohm (Lafayette 99-6124).
L1 to L18	—	Ne-2
L19	—	Ne-2 or Ne-51
SW1	—	Any 3-11 position switch, "break before make".

trons) from the gas molecules with which they collide. Thus, more electrons are collected than were originally produced by the radiation. At an even higher voltage, the electrons reach such high velocities that they cause very many secondary electrons, which are in turn accelerated to high enough velocities to produce even more electrons. Thus, an avalanche of electrons is formed and the tube is said to be operating in the Geiger region. In this case, the final number of electrons collected is approximately a constant and independent of the number and energy of the original electrons produced by the radiation. It depends only on the applied voltage within the Geiger region.

The quenching gas operates in such a way as to cause the tube to revert to its previously deionized state after the avalanche occurs. At a sufficiently higher voltage, the G-M tube will go into a state of continuous discharge which generally produces permanent damage. (An additional and more detailed description of G-M tubes is given in the source of this article.)

Description of Circuits

Circuits for instruments useful to television technicians for indicating x-ray emission from television receivers have been designed with low cost and ease of construction as criteria. The Geiger tube chosen for the instruments to be described is the Victoreen 1B85 (available from many parts houses). The choice of the 1B85 is based upon its thin wall (36 mg/cm^2, aluminum) which permits measurements of low-energy x rays. The projected area is quite close to the 10 cm^2 over which Federal regulations specify that the x-ray exposure rate from television receivers be integrated.

The high-voltage supply for the 1B85 should provide between 800 volts and 1000 volts DC. This is the voltage range over which the tube will operate in the Geiger region. The current required from the high-voltage source is quite minimal. A 0.047-microfarad capacitor charged to 900 volts is sufficient to operate the G-M tube for over an hour at normal background count rates. The high-voltage supplies for the survey meters described need not be highly regulated since the variation in counting rate expected from the lowest to highest voltage over which the tube will operate is only about 5 or 6 percent. However, some form of regulation is provided, not so much to ensure accuracy in count rate, but to protect against a catastrophic overvoltage.

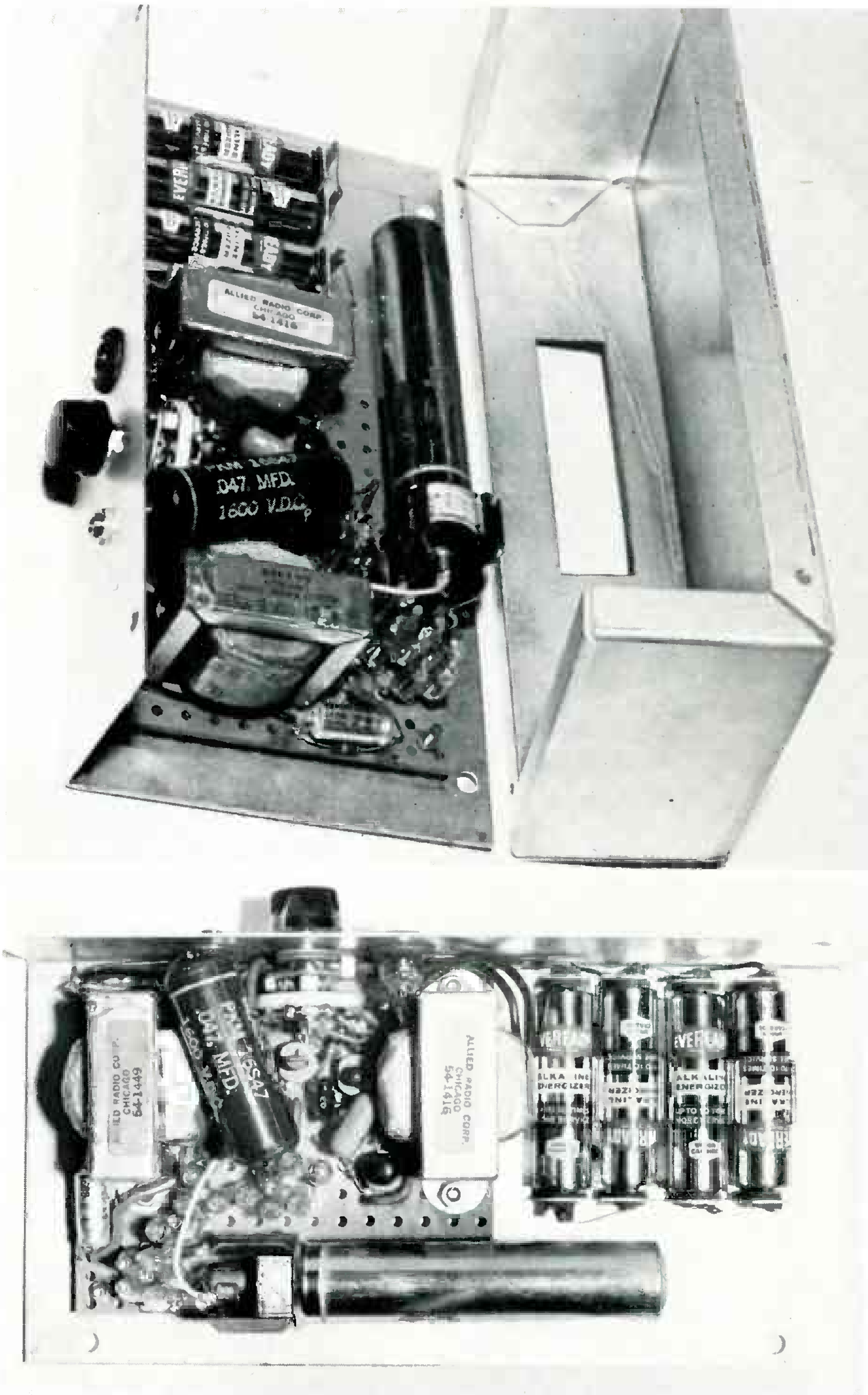


Fig. 2 Two views of an instrument built using the circuitry diagramed in Fig. 1.

The transformers and other components for these power supplies are rather common in "junk boxes". A large number of filament, output, or interstage transformers will work. Regulation is provided by a series of low-cost NE2 neon lamps. Readout of the number of pulses per unit time, which is related to the x-ray exposure rate, may take many forms. The exact form and design of the readout affect the accuracy. For personnel or shops not equipped with radiation standards or the specialized skills necessary to properly calibrate radiation instruments, high precision and accuracy are not attainable. That is not to say that the use of an uncalibrated G-M instrument is meaningless.

Any of the instruments to be described will determine whether a television receiver is emitting x rays and indicate in a general way the source of the x rays (i.e., picture tube or high-voltage component). In all known cases of x-radiation the emissions could be reduced to near zero by high-voltage adjustments (to manufacturers' specifications), replacement of either the shunt regulator or rectifier tubes, or in a few cases, replacement of high-voltage cages or covers which had been left off. These instruments can determine whether or not a television set emits significant radiation and whether or not corrective action has eliminated that radiation.

If the detection of significant x-ray emission rather than an accurate determination of x-ray exposure rate is our goal, then a meter readout is not necessary. Most people are familiar with the popping sound from a set of headphones or small speaker associated with the use of a G-M counter. This type readout is not accurate, but it will certainly indicate large changes in count rate. The average count rate due to normal background radiation will be between about 40 and 150 counts per minute, depending on geographical location, elevation, and possible presence of slightly radioactive materials.

An x-ray field of 0.5 mR/hr produced by a shunt regulator or high-voltage rectifier tube inside a television cabinet will produce a count rate in a 1B85 tube of about 4000 counts per minute. It is therefore obvious whether a television receiver is emitting x-rays with an exposure rate significantly above background.

Circuit No. 1

A very simple instrument is shown in Fig. 1. High voltage is developed by repetitively operating switch SW1. The transformer T1 can be selected from a wide range of filament, output, input, and interstage transformers that may be found in "junk boxes". Any of those shown on the parts list is adequate. Several operations of SW1 should suffice to charge capacitor C1 to its terminal voltage. Once capacitor C1 is charged, it will power the 1B85 for about an hour at background rates and over 10 minutes at 4000 counts per minute. This allows ample time to check a television set for radiation emission.

The phasing of the transformer T1 must be such that when SW1 is operated, the increasing current in the primary (low turns side), which occurs each time the wiper makes contact, induces a negative voltage at the high side of the secondary. This forward biases diodes D1 and D2 which clamp the T1 secondary to ground, and no voltage appears across the NE2 lamps. When the wiper moves off of a contact, current is suddenly cut off, producing a high positive voltage at the high side of the secondary. The diodes D1 and D2 are now back biased and the positive voltage is applied to the NE2 lamps. Note that SW1 is any type of rotary switch that has a "break before make" action. Thus, rotating SW1 will alternately close and open the primary circuit of T1. An 11-position, single-deck switch is desirable, although any number of positions will work well. SW1 should never be left in an intermediate position so that T1 primary current flows continuously, as this will rapidly discharge the batteries.

The voltage from an adequate transformer is sufficient to cause conduction in the string of NE2 lamps. Current through the lamps charges C1. When the C1 voltage is below the extinguishing voltage of the NE2 string, C1 will charge with every pulse. However, when C1 is charged to about the extinguishing voltage, the next pulse will charge it above this voltage. In this case, C1 will charge to a higher voltage during the pulse and then discharge back through the NE2 lamps until their extinguishing voltage is reached. Thus, the terminal voltage on C1 will be determined by the extinguishing voltage of the NE2 lamps.

In selecting a transformer, all one has to do is set up the high-voltage circuit as shown. An acceptable transformer will produce noticeable flashes in the NE2 lamps every time the SW2 is rotated. If no flashes occur, either the primary or secondary leads should be reversed. Also to provide some safety margin, 18 NE2 lamps should be used in selecting a transformer. D1 and D2 used by the authors are Sarkes-Tarzian F8 diodes at 800 volts peak inverse. They are avalanche protected which undoubtedly is the reason they work in this circuit. The voltage appearing across the combination is approximately the voltage on C1 (about 900 volts) plus the voltage required to ignite the NE2 string (about 1100 volts). This adds up to about 2000 volts. To allow for some safety margin, nonavalanche protected devices should be rated at about 3 kv peak inverse. Stacking nonavalanche-protected diodes in pulse circuits of this type does not usually prove satisfactory unless bleeder resistors are used. Bleeders in this circuit are not recommended.

As mentioned above, 18 NE2 lamps are used in selecting a transformer. Space should be provided on the circuit board for 18. The exact number to be used in the final circuit will depend on the specific lamps used. The method of selecting the final number is described below.

The high voltage is applied to the 1B85 through the anode load resistor R1. The value of R1 is not critical, and any value between about 1 megohm and 10 megohms can be used. The signal produced by a Geiger discharge at the 1B85 anode is a negative pulse as shown. Its amplitude and width are primarily functions of the high voltage, load resistor, coupling capacitor, and following-stage input impedance. Typically, it is about 2 volts peak and 20 microseconds wide with the values shown. Many service oscilloscopes will not reproduce it.

Q1 is an amplifier used to increase the signal level and invert the pulse to drive the monostable multivibrator Q2 and Q3. The use of a field-effect transistor (FET) in this stage is not mandatory although it performs the required function well with few components and without substantially loading the 1B85 output. A standard bipolar transistor properly biased and with an adequate frequency response will suffice in lieu of an FET.

Q2 and Q3 compose a one-shot or monostable multivibrator. Normally, R7 will cause Q2 to be cut off so that the voltage drop across R5 is zero. This in turn causes Q3 to be cut off. A positive pulse at the base of Q2, derived from the preceding stage (Q1), will start to turn Q2 on. The falling voltage at the collector of Q2 and hence at the base of Q3 will start Q3 to conduct. The increasing voltage at the Q3 collector is coupled to the Q2 base through R8 and C4 which further tends to cause Q2 to conduct. This positive feedback action will cause the collector current of Q3 to increase rapidly and remain until C4 becomes fully charged and positive feedback action ceases. This causes Q2 and Q3 to revert to the nonconducting state. The magnitudes of R7, R8, C4, and collector load of Q3 will determine the output pulse width.

A neon lamp and an earphone are shown in Fig. 1 for readout. Either or both may be used. The transformer T2 can be selected from a wide variety of types, some of which are shown in the parts list. The earphone is a low-impedance type generally sold with transistor radios, tape players, etc. Most speakers will also work quite well. Fig. 2 shows one way to assemble the meter and the method of mounting the G-M tube.

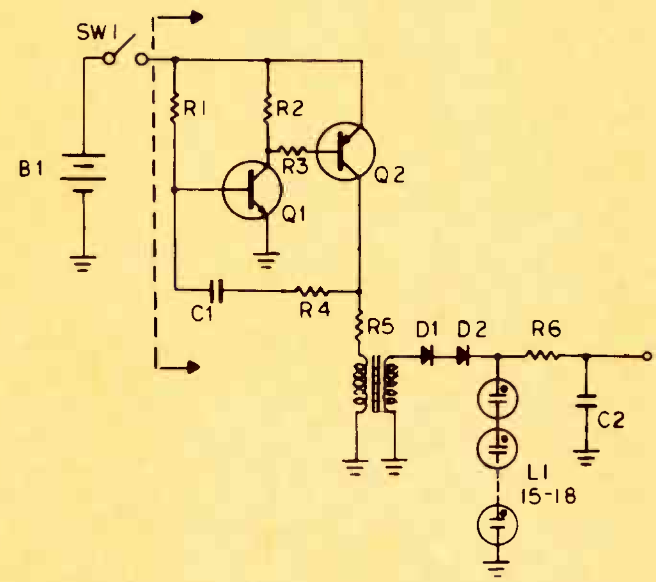


Fig. 3 Oscillator high-voltage supply employed in circuit design shown in Fig. 4.

Parts List For Circuit In Fig. 3

R1	—	See text
R2	—	1 k ohm
R3	—	560 ohm
R4	—	15 k ohm
R5	—	22 ohm
R6	—	100 k ohm
C1	—	0.1 μfd
C2	—	0.047 μfd 1600 V
D1, D2	—	F8 Sarkes-Tarzian
Q1	—	2N3567 (Fairchild)
Q2	—	2N3638 (Fairchild)
L1 to L15 or L18	—	Ne-2
Transformer	—	100 ohm/98.500 ohm (Triad A-1X)
Battery	—	12 volt

Circuit No. 2

For those who prefer not to operate a switch to obtain high voltage, the circuit of Fig. 3 will prove useful. This is not the most efficient circuit, but it does permit flexibility in the selection of components. The free-running multivibrator, Q1 and Q2, is quite similar to the one-shot multivibrator (MV) shown in Fig. 1. In fact, the only difference is that R7 in Fig. 1 is deleted and replaced by R1 in Fig. 3. R1 is selected so that Q1 conducts slightly. This slight conduction sends a signal through Q1 collector to Q2 base and hence through Q2 collector back to Q1 base. This positive feedback action turns Q2 on hard until C1 is fully charged and positive feedback action stops, at which time Q1 and Q2 turn off and the cycle is repeated. The on and off times of this circuit are not necessarily equal. With a fixed C1, the on time is determined primarily by R4 and the repetition rate by R1. The transformer is more critical than the one in Fig. 1 because Q2 cannot interrupt current as quickly as a mechanical switch nor can it supply as much current to the transformer as the switch.

The Triad A-1X transformer is effective in this circuit and is reasonably priced. Other transformers have worked but at the expense of a much higher battery drain, marginal voltage output, or considerably higher price. Note that the secondary operates into a standard halfwave rectifier circuit. D1 and D2 are Sarkes-Tarzian F8 diodes. The peak inverse voltage (PIV) in this case is limited by the breakdown voltage of the NE2 string (about 1200 volts). Earlier comments in regard to diode stacking also apply here, although the diodes now will have only about a 1200 PIV rating.

All the circuits, including the one in Fig. 4, should be enclosed in and grounded to a metal box since they are sensitive to electro-magnetic fields, especially that caused by the horizontal output circuit in a television receiver. A rectangular hole is cut in the side so that the G-M tube is exposed. The hole should be 2¾ by ¾ inch. If any RF sensitivity is evident, the hole may be covered with one layer of aluminum foil glued in place. It is recommended the high-voltage section be located as far from the input circuitry as possible.

The G-M tube poses some problems. "As received" it will have a black coating over the glass seal on the anode end. This coating can become scratched, allowing light to enter the tube. Light, especially sunlight, can cause ionization and hence the tube will count as though irradiated by x-rays. If the tube counts in the light but not in the dark, the paint should be removed with acetone or a paint remover and thoroughly cleaned with either acetone or high-purity alcohol. When dry, the glass seal should be recovered with a black silicone rubber such as GE RTV-103.

The tube may be mounted in a ¾-inch fuse clip which is grounded. The anode connection may be made with any type of grid connector that will fit a ¼-inch-diameter connector, or several turns cut from a spring can be pushed over the anode connector. Connection should not be made by soldering to any part of the tube.

The thin wall and low internal pressure make the tube susceptible to crushing and denting. No attempt should be made to remove dents, since a tube may work satisfactorily if the central wire is not disturbed or the tube did not suffer an air leak. If the dent damaged the tube, it cannot be repaired. The tube should be handled only at the anode end, especially when inserting the mounting clip.

As previously mentioned, provision should be made on the circuit board for 18 NE2 lamps. The high-voltage circuit should work with all 18 lamps in series. The G-M tube should not be connected to the high voltage until the entire circuit is finished. At this time, 5 of the NE2 lamps should be shorted out with a jumper so that 13 are in series (applies to either version of the high-voltage circuit), the G-M tube should be inserted, and the circuit turned on (operate SW1 in Fig. 1 circuit). The high voltage should be too low, and there will be no output indicated on either the NE2 or earphone. The circuit should then be turned off, the jumper reconnected to place 14 NE2 lamps in series, and the circuit turned on. This should be repeated, increasing the number of neons by one each time until an output indication is obtained from background radiation. It will be necessary to wait up to 15 seconds to determine if the tube is counting since the background count rate is low and random. One more NE2 should be added in series after counting starts.

A word of caution: the high-voltage capacitor should not be shorted when it is charged and transistor Q1 (Figs. 1 and 4) is in the circuit. The resulting sudden change in voltage can damage the gate of Q1. The transistor should either be removed if sockets are used or a lead should be connected from the gate to ground when working on the high-voltage circuit. An alternate method to bleed down the high voltage is to short it to ground through a 10-megohm resistor. This can be done with Q1 in the circuit.

Circuit No. 3

The circuits described above are adequate for the purpose of detecting x rays that may emanate from color television receivers. They are not capable of very accurate measurement of the count rate produced by a G-M tube.

The circuit shown in Fig. 4 is capable of more accurate measurement of G-M tube counting rate. The power supply shown in Fig. 3 is used to generate the high voltage. The transistor Q1 and monostable multivibrator Q2 and Q3 are as previously described except for a change in the collector circuit of Q3.

The accuracy of this count-rate meter depends on maintaining a fixed output pulse width with decreasing battery voltage The zener diode, D1, ensures a fixed pulse width under this condition.

The monostable output pulse is applied through D2 to an integrating circuit composed of Q4, R11, R12, R13, and C4. Q4 is a constant-current generator whose output is independent of the supply voltage, in this case the amplitude of the monostable output pulse. The current through Q4 is adjusted to apporixamately 0.8 ma by selecting R11. A 6-volt battery is connected to the cathode of D2 with the minus side of the battery grounded (no other voltages in circuit). R11 is selected so that a 0-1 ma meter connected across R12 and R13 reads about 0.8 mA. Changing the 6-volt battery to 12 volts should not change the 0.8 ma reading. Because of this and the zener diode D1, the supply voltage need not be regulated.

The input to the integrating network could be taken from the top of D1 rather than R9, but this

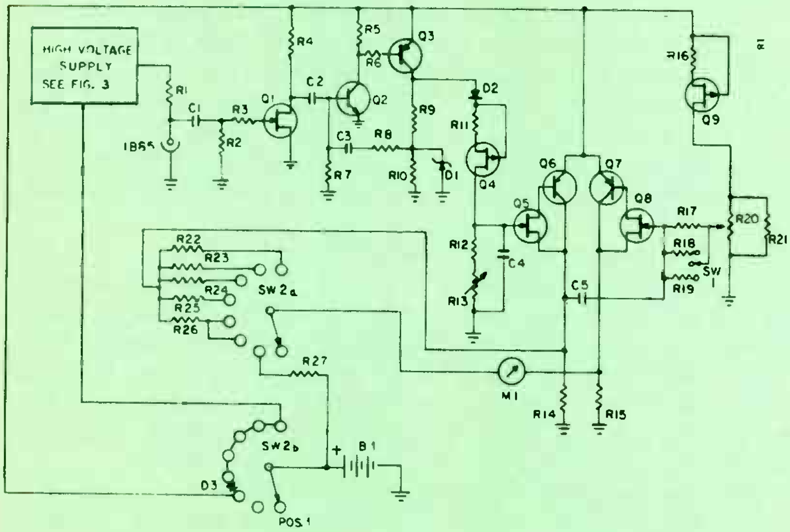


Fig. 4 Circuit diagram of Circuit No. 3, an X-ray detection device that provides more accurate measurement than the design shown in Fig. 1.

Parts List For Circuit In Fig. 4

R1	—	10 M ohm
R2, R3	—	100 k ohm
R4, R7	—	10 k ohm
R5-R14, R15	—	1 k ohm
R6	—	560 ohm
R8	—	6.8 k ohm
R9	—	100 ohm
R10	—	470 ohm
R12	—	82 k ohm
R13	—	50,000 ohm pot
R17	—	10 M ohm
R18	—	220 k ohm
R19	—	2.2 M ohm
R20	—	1,00 ohm pot
R11, R16, R18, R19, R21 through R27	—	See text
C1	—	0.001 μfd 2000 V
C2	—	100 pfd
C3	—	0.001 μfd
C4	—	0.1 μfd
C5	—	1 μfd paper
D1	—	1N713A
D2	—	1N914B
D3	—	1N99
Q1, Q5, Q8	—	2N5457 (MPF103) (Motorola)
Q2	—	2N5133
Q3	—	2N3638 (Fairchild)
Q4, Q9	—	2N4360
Q6, Q7	—	MPS. A66 (Motorola)
SW1	—	Single pole, double throw, center-off toggle switch
SW2	—	2 pole, 8 position rotary switch

would not provide any better regulation and would provide a lower voltage to the integrating circuit, limiting its range

In operation, C4 is charged by current pulses through Q4. Each pulse from the G-M tube results in a constant-amplitude (due to constant current Q5) and constant-width (ensured by D1) current pulse into C4. In other words, a constant amount of charge is delivered to C4 for each pulse. Constant current will flow into C4 with a voltage on C4 of the order of 6 or 8 volts. If, as is often done, C4 is charged through a resistor rather than a constant-current generator, the change in voltage on C4 is substantially different for various C4 voltages. R13 is provided to adjust the voltage output.

The C4, R12, R13 network cannot be loaded by a succeeding stage if proper operation is to be maintained. A high-impedance voltmeter is required to read the voltage on this network. A standard 10-megohm-input vacuum tube voltmeter (VTVM) is satisfactory but not very portable. Commercial FET voltmeters should prove adequate, and most are portable.

If such a meter is not available, the measurement can be made with the circuit shown connected to this network. Q5 through Q9 constitute an FET voltmeter. This circuit has several advantages. The input impedance is high, linearity up to about 8 volts (with a 12-volt supply) is excellent, and about any meter with 1-ma full-scale sensitivity or better may be used. A 10-ma movement could probably be used if R14 and R15 were to be reduced to 100 ohms. This is in contrast to most FET voltmeter circuits that require a 50- or 100-μa movement.

Q9 and R16 constitute a constant current generator. R16 is selected to produce a constant voltage drop of one volt across R20, which is used to set zero. R21 is shunted across R20 after the circuits have been completed and are operational. R21 is selected so that adjustment of R20 moves the pointer of the meter about plus or minus 20 percent when the selector switch is on "zero" position. In operation, a voltage will appear across R14 and R15 which is dependent on the characteristics of the specific transistors used. A voltmeter connected from R14 to R15, with the gates of both Q5 and Q8 grounded (or at zero voltage), will show that one voltage is higher. If the voltage on R15 is higher, the transistors should be interchanged so that R14 voltage is higher. This is done so that the zero adjustment R20 can bring the R15 voltage up to zero the meter.

When the voltage on the gate of Q5 is increased, the voltage on R14 also increases The voltage on R15 remains fixed so that the difference in voltage between R14 and R15 is a measure of the gate voltage of Q5. If the gate voltage of Q8 were to increase with that of Q5, the difference across R14 and R15 would be zero. The time-constant capacitor C5 couples fast changes in voltage to the gate of Q8 so that the meter reading for fast changes is zero, allowing only slow changes to cause a meter reading. Three ranges of "slowness" may be obtained with the time-constant switch SW1.

The selection of meter ranges will depend on the use of the instrument and on the selection of a meter movement. If, for example, ranges (full scale) of 1000, 3000, 10,000, 30,000, and 100,000 counts per minute are desired, the total range is 100 to 1. If a 50-millivolt meter movement is available, the upper voltage to be delivered by the integrating circuit and voltmeter circuit is 5 volts, which is well within their capabilites. A 100-millivolt movement would require a 10-volt upper range which could be obtained by an 18-volt supply voltage to the monostable multivibrator, integrating circuit, and voltmeter circuits. Meters with a higher millivolt requirement would necessitate restricting the ranges or arranging to switch in various values for R12 and R13 (or alternately R11).

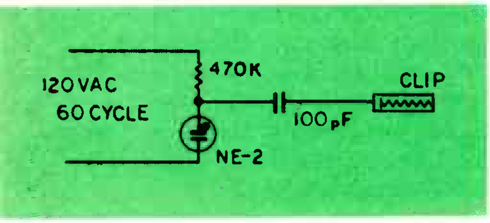


Fig. 5 Test pulse generator.

The instrument is calibrated (in counts per minute) by disabling the high voltage or by removing the G-M tube. Resistors in the meter circuit, R22 through R26, should be selected to provide full-scale meter readings for the desired set of full-scale input voltages at the O5 gate (e.g., 0.050, 0.150, 0.50, 1.50, and 5.0 volts full scale for the 1000 to 100,000 count-per-minute ranges mentioned previously). Input voltage can be obtained from a battery and potentiometer applied directly to the Q5 gate without disconnecting previous circuitry.

A pulse generator (negative pulse of about 0.5 to 2.0 volts peak with a rise time on the order of 0.1 microsecond and a width less than 100 microseconds) may be connected to the junction of R2 and R3. The pulse rate can be related to the meter reading by adjustment of R13. Only one point need be adjusted. The circuit in figure 5 is a convenient way to obtain 3600 counts per minute. The clip is connected to the R2-R3 junction. Usually no ground is required. If so, touching the chassis is usually sufficient.

The battery test resistor R27 on the range switch is selected to provide a full-scale meter reading with fresh batteries.

Operation of Instruments

Normal background count rates will probably fall between about 40 and 150 counts per minute. Any x-ray emission high enough to justify corrective action will increase this count rate substantially. If there is any question or doubt that the rate has increased, it has not.

In a conventional color television receiver, x rays are generated by the picture tube, shunt regulator, and high-voltage rectifier. Thus, a quick pass, say 30 seconds, across the picture tube face will suffice for this area. Some cathode ray tubes (CRT's emit x rays from the funnel. In some cases these will be transmitted through the cabinet. If the tube emits from the face, it will emit over most of the face area.

The regulator tube and rectifier are usually placed on the opposite side of the cabinet from the tuner. Hence, a pass around the rear, top, side, and, if accessible, the bottom of the set in the vicinity of the high-voltage components and CRT should be all that is necessary. Sometimes the x-rays exit in a narrow beam so that it is desirable to sweep as great a percentage of the surface in the high-voltage component area as possible. Until familiarity with the measurement is acquired, it is suggested that the instrument be moved across the surface at a rate of about 1 foot in 15 seconds.

Summary

A simple Geiger-Mueller tube instrument may be built with inexpensive components, many of which can be found in "junk boxes". The instrument avoids the problem of calibration and interpretation of results by not having a meter display. A neon lamp or earphone, or both, are used to indicate the presence of x rays. An increase in flash rate or sound-pulse rate indicates that a television receiver emits sufficient radiation to warrant corrective action. Any definitely noticeable increase of background count rate may be judged sufficient to require correction to reduce the radiation. The instrument will also locate the area from which radiation is being emitted, thus facilitating location of the radiation source.

For those wishing more detailed information about the x-ray field, a more complex instrument is described. This instrument can be constructed and calibrated in counts per minute using equipment found in all service shops.

Neither instrument is specifically adapted for large-scale production. Instead, the emphasis is placed on an instrument design that facilitates construction by service shops and technicians without specialized equipment. ▲

Circle 32 on literature card

productreport

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

"The Noise Eliminator"

Omega-t Systems, Inc. has announced "the noise eliminator", a noise blanker for use with CB and business-band radios.

For use on mobile or base stations, the noise eliminator, is placed between the antenna and receiver, and reportedly extinguishes external impulse noise, generated by automobile ignition systems, power lines, general electrostatic and radio hash, without interrupting the desired signal.

"The noise eliminator" increases side-channel rejection, which reduces splatter and bleed-over from adjacent channels, according to the manufacturer.

The unit's preselector control enhances the channel selection so the desired channel is amplified while others are attenuated. There also is a blanking threshold sensitivity control with a numbered log scale; this control includes an on/off switch.

The unit features 29 solid-state components, and operates on standard 12-volt DC power at 0.175 amps. The unit sells for $69.95.

Circle 65 on literature card

Hand Cleaner

A new hand cleaner which reportedly does not effect the dielectric strength of insulating materials and leaves no corrosive residue on hands to damage sensitive electronic components has been announced by CRC Chemicals.

(Continued on page 74)

vikoa CUSTOMIZED MATV POWER

Custom design without pilot engineering costs. Vikoa has the widest range of options available in the industry, fit the amplifier to your system, rather than fitting your system to an amplifier. 30 to 55db gain available, VHF and/or UHF, and +47dbmv to +60dbmv (one full volt) output capability. These completely modular amplifiers feature low noise figure, flat response, and the dependability of silicon solid-state devices mounted on military grade glass substrates. With attractive aluminum housing and cast end bells for rail type mounting, these low profile units can be mounted in the most inaccessible locations. For your next project get the best.

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Circle 33 on literature card

Electrical Antiseptic Hand Cleaner will effectively remove creosyl, insulating varnish, wire-drawing lubricant, ink, grease, oil adhesives and most other types of grime encountered by electronic technicians, according to the manufacturer, yet contains no harsh solvents or abrasives that irritate the skin. Skin conditioning lanolin and chloroxylenol, an antiseptic agent that inhibits bacterial growth, are included in the hand cleaner formula. Price is 55 cents per tube, or $6.00 per dozen tubes.

Circle 66 on literature card

Speaker Muting Relay

The new speaker muting relay, available from the Antenna Development Co., is designed for use in areas where two radio receivers each are tuned to different stations carrying unrelated information.

This device provides an automatic tuning system, to avoid background pick-up of one receiver while transmitting the source of the second receiver. According to the manufacturer, this device is connected to each of the two receivers and to the microphone. When the operator is speaking to one station, the receiver tuned to the second source is muted to allow conversation free of background crosstalk and to prevent feedback of power during transmission.

All components reportedly are en-

capsulated in the case to prevent malfunctioning from transmitted vibration. Also, the unit is hermetically sealed in a cadmium-finished case to prevent moisture seepage internally, rust externally. Maximum power is 5 watts continuous, and load resistance is 4 ohms.

The unit measures 2 inches X 2 inches X 1¼ inches, weighs 5 oz. and sells for $18.95.

Circle 67 on literature card

VHF Radiotelephone

Pearce-Simpson, Inc. has introduced the new BIMINI VHF, a VHF radiotelephone which transmits 25 watts of power.

The 8½-lb., 6-channel unit uses plug-in sockets and integrated circuits to facilitate on-board servic-

ing. A plug-in power lead is provided for easy removal and safekeeping. Also incorporated in the unit is a press-to-talk telephone handset and low-power switch.

The unit is priced at under $300.00. ▲

Circle 68 on literature card

catalogs literature

ANTENNAS

100. *Jerrold Electronics Corp.*—has released a 56-page full-line general distributor catalog which includes a guide to MATV systems and nearly 300 Jerrold products. The catalog price is $1.00.
101. *Jerrold Electronics Corp.*—Catalog S, titled "Systems and Products for TV Distribution," lists specifications of this manufacturer's complete line of antenna distribution products, including antennas and accessories, head-end equipment distribution equipment and components, and installation aids.

AUDIO

102. *Jensen Manufacturing Div.*—has issued an 8-page, catalog, No. 1090-E, which describes application of 167 individual speaker models. Special automotive, communications, intercom and weathermaster speakers, plus a complete line of electronic musical instrument loudspeakers are featured.
103. *Shure Brother, Inc.*—has published a 4-page brochure, "Professional Sound Systems in High Schools, Colleges, and Universities," No. AL 398, describing the company's Vocal Master Sound System and how it helps solve public-address problems.
104. *Telex Communications Div.*—has issued a new catalog, No. BI-2166-2, covering over 30 general communication and dictation headphones and other private-listening devices plus accessories. The 8-page, 2-color catalog includes production information, photographs and price.

COMMUNICATIONS

105. *Sonar Radio Corp.*—Catalog titled "Sonar Business Radio, FM Monitor Recivers and CB Equipment" lists specifications and prices of this manufacturer's line of transceivers, receivers and communications accessories.

COMPONENTS

106. *Loral Distributor Products*—has made available a 24-page electrolytic capacitor replacement guide. The catalog features replacement products by the original manufacturer part number.*
107. *General Electric Tube Department*—has released a new 52-page Entertainment Semiconductor Almanac, No. ETRM-4311F. The almanac contains approximately 20,000 cross references from JEDEC, or OEM part number to GE part numbers for universal replacement semiconductors, selenium rectifiers for color TV, dual diodes, and quartz crystals.*
108. *International Electronics Corp.*—has announced a 4-page folder featuring axial lead (TAD series) and upright radial lead (PCD series) low-voltage 85-degree C miniature aluminum electrolytic capacitors. Capacitance, voltage and size specifications are clearly shown for easy reference.
109. *Microtran Co., Inc.*—is offering a 32-page catalog which lists transformers, inductors, and torroids for both commercial and MIL construction. All transformers are shown with detailed ratings and outline drawings. Full pricing and quantity discount is also available.
110. *Motorola, Inc.*—has made available a HEP cross refference guide catalog No. HMA07 which lists replacements for over 27,000 different semiconductor device type numbers available through authorized HEP suppliers.
111. *Semitronics Corp.*—has a new, revised "Transistor, Rectifier, and Diode Interchangibility Guide" containing a list of over 100 basic types of semiconductors that can be used as substitutes for over 12,000 types. Include 25 cents to cover handling and postage.
112. *Stancor Products*—pocket-size, 108-page "Stancor Color and Monochrome Television Parts Replacement Guide" provides the TV technician with transformer and deflection component part-to-part cross reference replacement data for over 14,000 original parts.
113. *Sylvania Electric Products Inc.*—a 73-page guide which provides replacement considerations, specifications and drawings of Sylvania semiconductor devices plus a listing of over 35,000 JEDEC types and manufacturers' parts numbers. Copies are $1.00.*
114. *General Electric*—a 12-page, 4-color, illustrated "Picture Tube Guidebook", brochure No. ETRO-5372, provides a reference source for information about GE color picture tube replacements and tube interchangeability.*
115. *Workman Electronic Products, Inc.*—has released a 32-page, pocket-size cross reference listing for color TV controls. 105 Workman part numbers are listed in numerical order with specifications and illustrations of the part.*

TECHNICAL PUBLICATIONS

116. *Howard W. Sams & Co., Inc.*—literature describes popular and informative publications on radio and television servicing, communications, audio, hi-fi and industrial electronics, including their 1970 catalog of technical books on every phase of electronics.*
117. *Sylvania Electric Products Inc., Sylvania Electronic*

(Continued on page 76)

Components Div.—has published the 14th edition of its technical manual, which includes mechanical and electrical ratings for receiving tubes, television picture tubes and solid-state devices. The price of this manual is $1.90.*

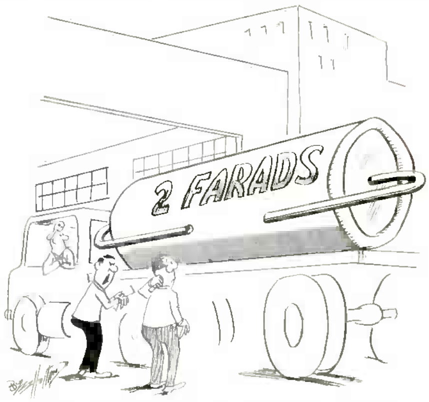
TEST EQUIPMENT

118. *B & K Mfg. Div., Dynascan Corp.*—is making available an illustrated, 24-page, 2-color Catalog BK-71, featuring B&K test equipment, with charts, patterns and full descriptive details and specifications included.*
119. *Eico*—has released a 32-page, 1970 catalog which features 12 new products in their test equipment line, plus a 7-page listing of authorized Eico dealers.*
120. *Mercury Electronics Corp.*—14-page catalog provides technical specifications and prices of this manufacturer's line of Mercury and Jackson test equipment, self-service tube testers, test equipment kits and indoor TV antennas.
121. *Sencore, Inc.*—has issued its 12-page, 1970 catalog, Form No. 517, which describes the company's complete line of test instruments, and features 5 new instruments, with performance data and prices included.*
122. *Triplett Corp.*—Bulletin No. 51570, a two-page technical bulletin which provides the specifications and price of Triplett's new Model 602 VOM.

TOOLS

123. *General Electric*—has issued 2-page brochure No. GEA-8927, describing the features of GE's new soldering iron.*
124. *Jensen Tools and Alloys*—has announced a new catalog No. 470, "Tools for Electronic Assembly and Precision Mechanics." The 72-page handbook-size catalog contains over 1,700 individually available items.
125. *Xcelite, Inc.*—has published a 2-page illustrated Bulletin N670, which introduces two new reversible ratcheting handles for use with more than 60 of the company's available Series "99" nutdriver, screwdriver and special purpose blades.*
126. *Xcelite Inc.*—Bulletin N770 describes this company's three new socket wrench and ratchet screwdriver sets.*

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



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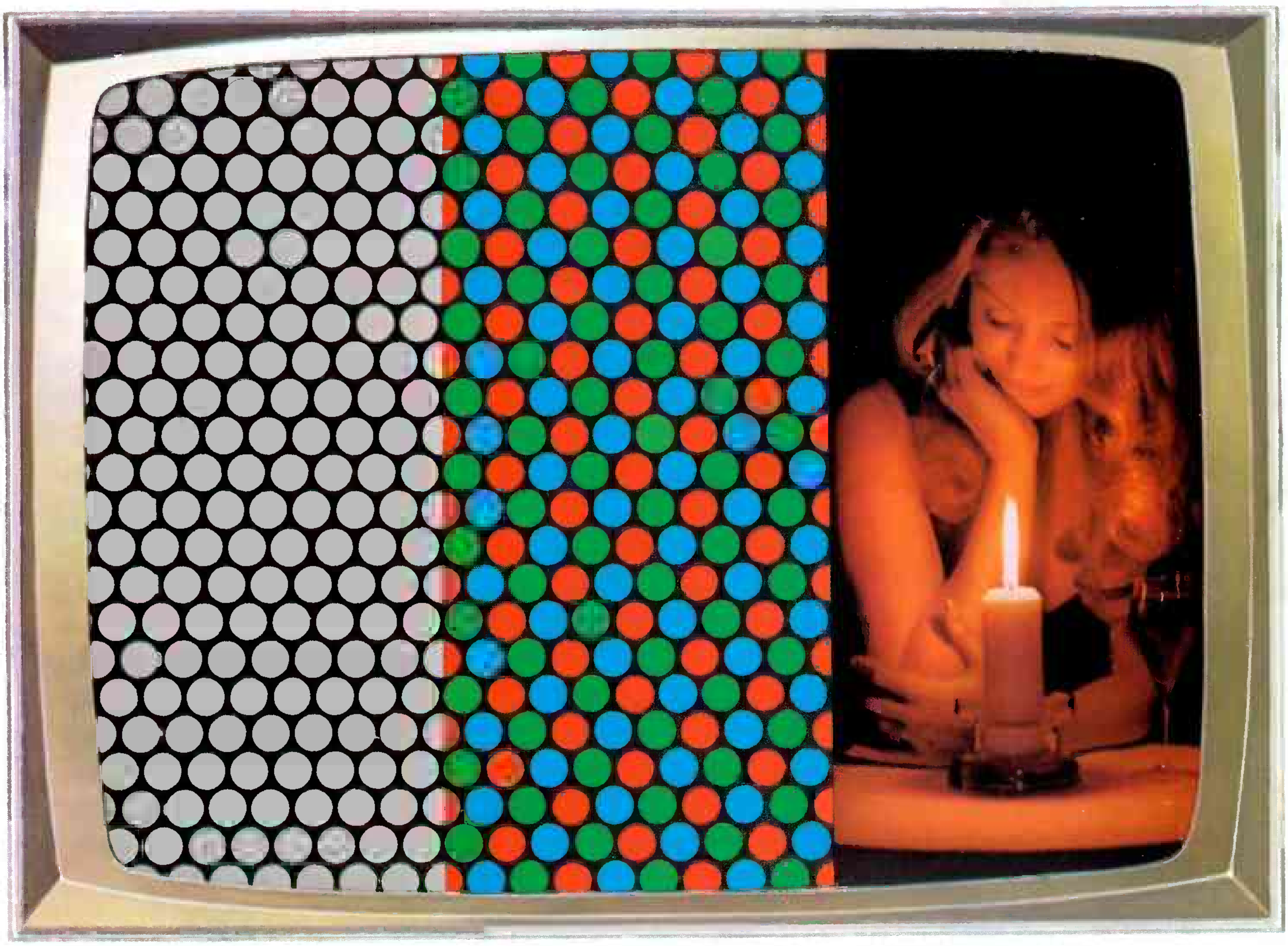

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The RCA MATRIX phosphor-dot process*
First, we developed brilliant new phosphors and a unique screening process incorporating a jet-black matrix. Then we deposited the 1,200,000 red, green, and blue high-intensity phosphor dots precisely within the black matrix. Result: brightness doubled with dramatic improvement in contrast and clarity.

The RCA MATRIX picture**
Spectacular! In operation, a new, unique high-resolution gun "shoots" the phosphors with more energy than any other gun previously available. Result: black matrix + phosphors + high-resolution gun = maximum sharpness over the entire brightness range, truer colors under all viewing conditions.

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*Magnified drawing **Simulated