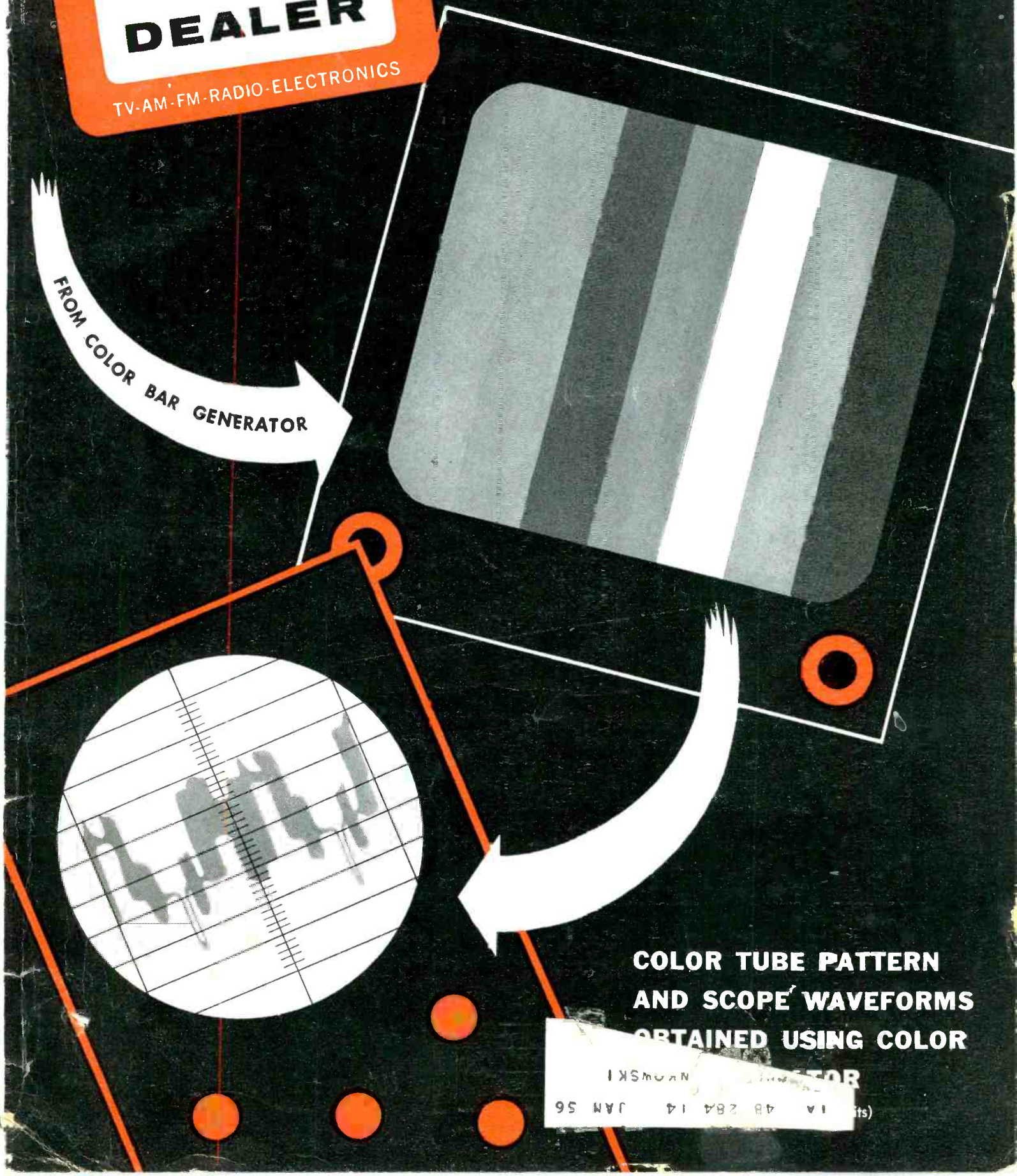
JANUARY 1956
25¢

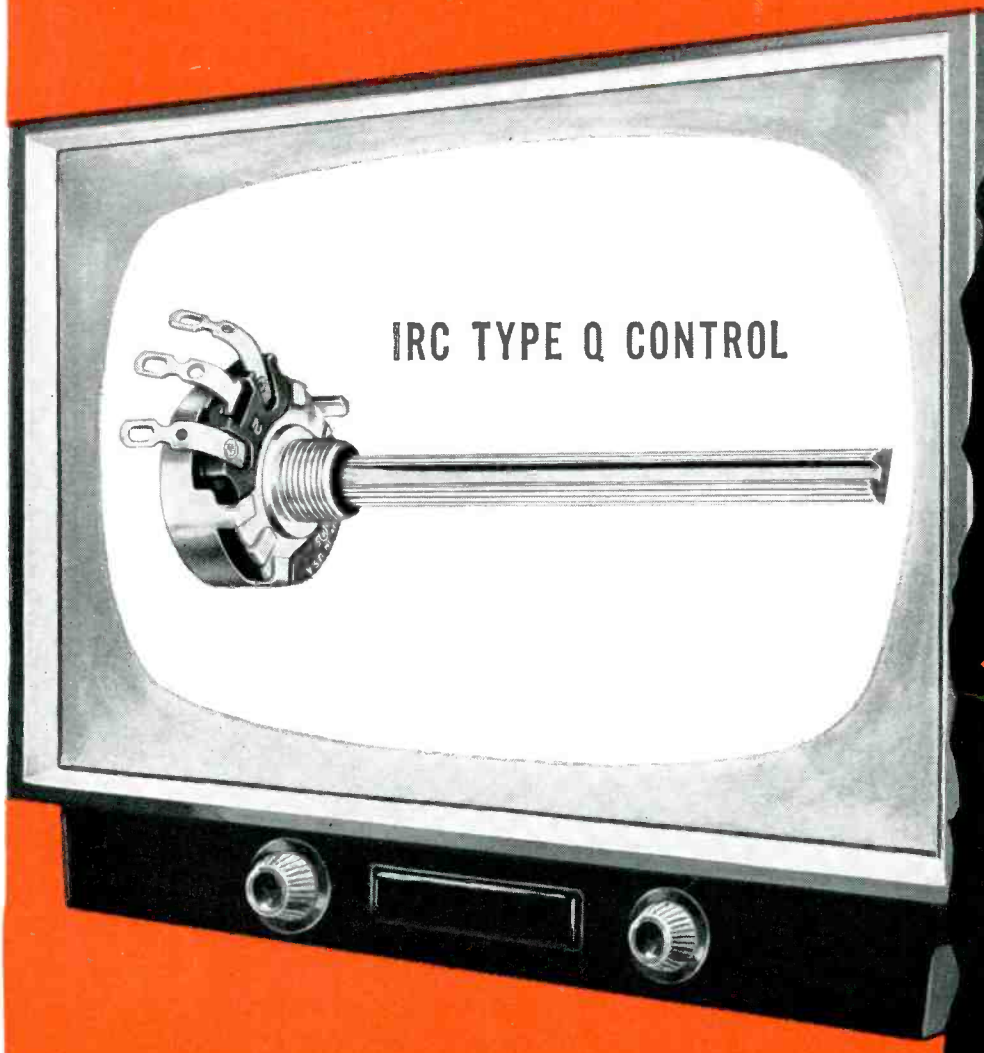
Radio-Television SERVICE DEALER

TV-AM-FM-RADIO-ELECTRONICS



COLOR TUBE PATTERN AND SCOPE WAVEFORMS OBTAINED USING COLOR

Preferred for modern set servicing



KNOBMASTER FIXED SHAFT
Q Control standard shaft is knurled, flatted and slotted —fits most knobs without alteration.

INTERCHANGEABLE FIXED SHAFTS
Exclusive IRC convenience feature—provides fast conversion to "specials", with FIXED shaft security. 15 types available.

1/4" LONG BUSHING
Accommodates all small sets, yet handles large set needs perfectly.

7 STANDARD TAPERS
Full coverage of all taper requirements is provided in the Q Control.

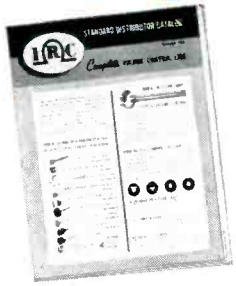
94 RESISTANCE VALUES
For TV, AM and FM coverage, 94 values of plain and tapped controls are furnished.

QUALITY APPEARANCE
The handsome professional appearance of IRC Q Controls lets you point to your work with pride.

CUSHIONED TURN
The smooth, quality of "feel" of a Q Control contributes to customer confidence.

TYPE 76 SWITCHES
Either of two type IRC switches attached as quickly and easily as a control cover—meets all your requirements.

Service technicians get greater coverage with less investment; more practical service features; and easier, faster installation with the IRC Type Q Control. Here's a dependable, basic control that is directly designed for modern set servicing. For appearance, performance and price . . . there's none better. So why settle for less? Tell your Distributor you want Q Controls . . . most servicemen do.



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Wherever the Circuit Says ↓

only

C·D·R Rotors

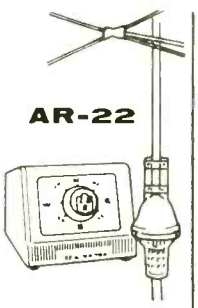
have the 1 2 punch

1. The Most Complete Line

The CDR Rotor line is COMPLETE to every detail, with a model for every application! A distinct selling advantage because YOU can give your customer EXACTLY what is required! The RIGHT CDR Rotor for the RIGHT job.

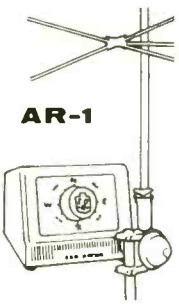
2. Pre-SOLD For You on TV

to millions of viewers through an extensive coverage of audiences in every important TV market. Capture this pre-sold market by featuring these nationally advertised CDR ROTORS.



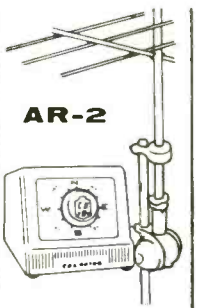
AR-22

Completely AUTOMATIC version of the TR-2 with all the powerful features that made it famous.



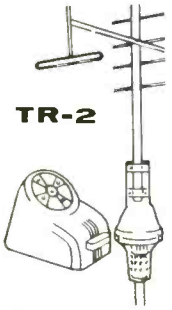
AR-1

Completely AUTOMATIC rotor, powerful and dependable. Modern design cabinet. 4 wire cable.



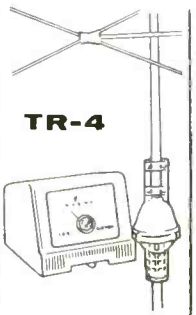
AR-2

Completely AUTOMATIC rotor with thrust bearing. Handsome cabinet, 4 wire cable



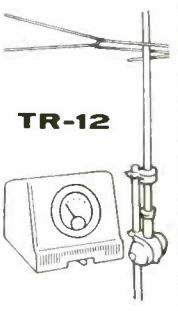
TR-2

Heavy-duty rotor with plastic cabinet, "compass control" illuminated perfect pattern dial, 8 wire cable.



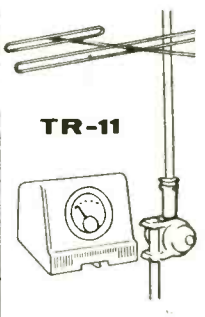
TR-4

Heavy-duty rotor, modern cabinet with METER control dial, 4 wire cable.



TR-12

Combination value complete rotor with thrust bearing. Modern cabinet with meter control dial, uses 4 wire cable.



TR-11

Ideal budget all-purpose rotor, new modern cabinet featuring meter control dial, 4 wire cable.

CORNELL-DUBILIER
SOUTH PLAINFIELD, N. J.

THE **RADIART** CORP.
CLEVELAND 13, OHIO

RAYTHEON "Lumilac" ALUMINIZED PICTURE TUBE REPLACEMENT GUIDE

RAYTHEON "Lumilac" ALUMINIZED PICTURE TUBE	REPLACES STANDARD TYPE	NECESSARY ADJUSTMENTS OR CHANGES
12KP4A	12KP4	None.
	12QP4	Ground conductive coating. Remove ion trap.
	12QP4A	Ground conductive coating. Remove ion trap.
	12RP4	Ground conductive coating. Remove ion trap.
16KP4A	16KP4	None.
	16QP4	Ground conductive coating. Change ion trap.
	16RP4	Check conductive coating contact.
	16TP4	Space may not be sufficient in some cases.
	16XP4	Ground conductive coating. Change ion trap.
17BP4B	17BP4	Ground conductive coating.
	17BP4A	None.
	17BP4C	None.
	17JP4	Do not exceed voltage rating.
17HP4B	17HP4	None.
	17HP4A	None.
	17RP4	None.
17LP4A	17LP4	None.
	17VP4	None.
20DP4C	20DP4A	None.
21ALP4A	21ALP4	None.
	21ALP4B	None.
	21ANP4	Ground conductive coating.
	21ANP4A	Ground conductive coating.
21AUP4A	21AUP4	None.
	21AUP4B	None.
21AVP4A	21AVP4	None.
	21AVP4B	None.
21EP4B	21EP4	Ground conductive coating.
	21EP4A	None.
21FP4C	21FP4	Ground conductive coating.
	21FP4A	None.
21YP4A	21AFP4	Ground conductive coating.
	21YP4	None.
21ZP4B	21ZP4	Ground conductive coating.
	21ZP4A	None.
24CP4A	24CP4	None.
	24QP4	None.
	24TP4	None.
	24XP4	Ground conductive coating.
24DP4A	24DP4	None.
27EP4	27GP4	None.
	27NP4	Add filter condenser.
27RP4	27GP4	Ground conductive coating.
	27NP4	None.

COWAN PUBLISHING CORP., 67 West 44th Street, New York 36, N. Y.
Telephone MUrray Hill 7-2080

VOL. 17, NO. 1 JANUARY, 1956

FEATURE ARTICLES

CIRCUIT AND SERVICE FORUM

DEPARTMENTS

Our front cover this month illustrates a color bar pattern appearing on a CBS-Columbia 205TV Receiver. The signal for this pattern was generated by a Hickock 655XC Color Bar Generator. The scope used was a Hickock Model 770.

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EDITORIAL...

by S. R. COWAN
PUBLISHER

Your Cooperation Will Help

Brand Name Surveys of Chicago is about to conduct a nation-wide survey of brand preferences among radio and TV servicemen. In February questionnaires will be mailed to servicemen throughout the United States. Servicemen will be asked why they prefer certain brands of electronic replacement components. The answers, when collated, will be used by the manufacturers who are participating in the survey as a means of improving their products and making them easier for servicemen to use.

All servicemen should take the few moments necessary to answer the impending Brand Name and other such surveys that come along. Surveys serve a useful purpose, not only for those seeking information, but also for those who reply. For example, our circulation manager periodically surveys all our 73,000 readers asking them pertinent questions about their work. The replies help us maintain accurate circulation records, the facts given are kept in confidence, but in addition they guide our editors in selecting articles that will be of optimum value to our subscribers. Incidentally many subscribers inquire "what does BPA mean?" BPA means Business Publications Audit—an organization that verifies and then audits the circulation records and claims of magazines like SERVICE DEALER.

Dealers Down — Servicers Up

Our records indicated that during the past twelve months upwards of 3100 radio-TV service dealers discontinued selling TV set lines and became service firms exclusively so they could concentrate on the more profitable part of their business, servicing, and get out of the rat-race, competitive selling field. This is particularly true in big cities and their closely adjacent suburbs. Discount houses scrapping price-wise with department stores have cut out of competition many neighborhood retail stores.

In addition, many service dealers report to us that although they have discontinued selling TV set lines they have instead reinvested that money in lines of Hi-Fi equipment—and without a pun intended—it's a sound switch. Hi-Fi is selling nicely. In 1955 Hi-Fi sales passed the $100 million mark.

A small service dealer who carried a $3000 stock of TV sets, before the discount house era, expected to realize a 3 time-a-year turnover with an approximate net profit of $900. Since discount houses and department stores have been price-fighting these same service dealers have operated in the red. Now, by investing the same sum in Hi-Fi, and by going after the vast amount of Public Address sales, service and rental business available, the service dealers are realizing a better turnover and upwards of $1300 net profit per annum.

Stormy Weather Ups Antenna Sales

Careful analysis of TV antenna sales over a period of several years shows that normally most antennas are sold between January and May. There has usually been a fall off from June to September —and then after a big October—another dip until January.

1954 and 1955 were exceptions. Freak hurricanes, torrential floods and heavy snow-falls in various parts of the country upset the former pattern. For example, the rains and floods that hit the east coast in mid-summer of 1954 and again in 1955 destroyed more antennas (requiring the immediate installation of new ones) than normal weather and deterioration would have in 2 years.

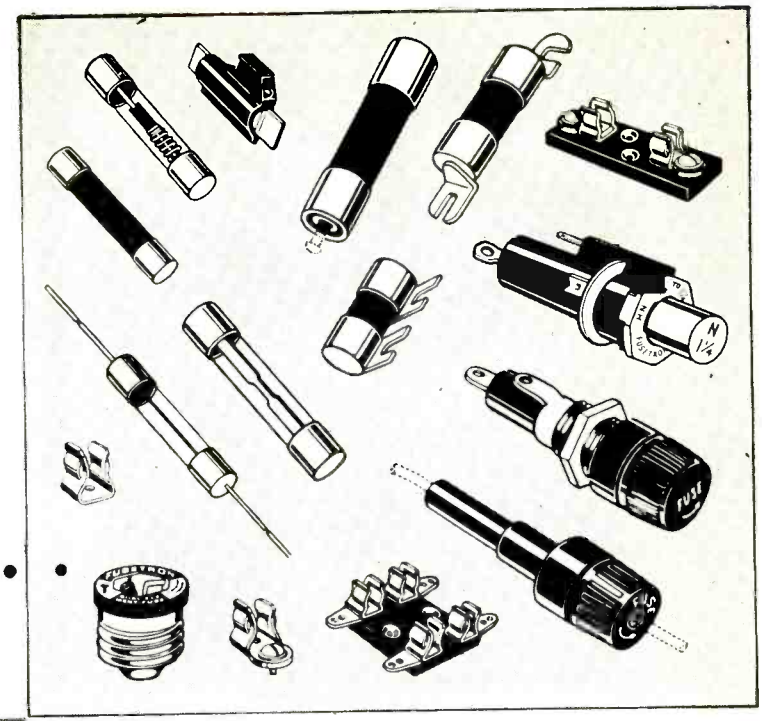
Transistors Won't Replace Tubes For Years

Noting the vast number of transistorized radios being marketed of late, and realizing that all servicemen derive a substantial profit monthly from replacement tube sales—I began to wonder, as did many servicemen, whether or not in the days ahead we might find ourselves transistorized out of tube replacement sales. Putting the question straight-forwardly to the transistor makers — we learned that they believe that transistors won't seriously affect a serviceman's profits from tube sales for at least 20 to 30 years to come.

Today there are less than ¾ million transistor-operated radios and used (with a total of 3 million transistors in use) compared to over 1.6 billion tubes in home and auto radios and TV sets—and not including the other billions of tubes being used daily in the myriad of other electronic applications.

The mathematical progression is such that with every passing month servicemen can logically expect to sell over 1% more replacement electronic tubes than the preceding month—because every year there are 15% more tube sockets in use than there were in the corresponding previous year. In other words—things look good for tube makers—and we who sell 'em as replacements.

The unfailing Dependability of BUSS FUSES . . .



helps you keep customers satisfied!

By operating properly under all service conditions — BUSS fuses can help safeguard the reputation of your product or service against loss of customer good will.

When there is an electrical fault — BUSS fuses open and prevent further damage to equipment, saving users the expense of replacing needlessly burned out parts.

And just as important, BUSS fuses won't give a false alarm by blowing when trouble doesn't exist. Useless shutdowns caused by poor quality fuses blowing needlessly are not only irritating to customers — but customers' confidence in your product or service could be jolted.

Every BUSS fuse is electronically tested to assure "trouble-free" operation.

Every BUSS fuse normally used by the Electronic Industries is electronically tested. A sensitive device automatically rejects any fuse not correctly calibrated, properly constructed and right in all physical dimensions.

With a complete line of fuses, fuseholders and fuse blocks available — it is just good business to standardize on BUSS.

For more information on FUSETRON and BUSS small dimension fuses and fuseholders . . . Write for bulletin SFB.

Makers of a complete line of fuses for home, farm, commercial, electronic, automotive and industrial use.

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

BUSSMANN MFG. CO.
(Division of McGraw Electric Co.)
UNIVERSITY AT JEFFERSON
ST. LOUIS 7, MO.

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BUSS FUSES ARE MADE TO PROTECT — NOT TO BLOW

trade

The outlook for the radio-television and electronics industry is more encouraging now than the 1955 outlook had been at this time last year, James D. Secrest, executive vice president of the Radio-Electronics-Television Manufacturers Association, reported during a Symposium on the Business Outlook for 1956 sponsored by the U. S. Chamber of Commerce in Washington. He expressed the belief of many industry leaders that at least 250,000 color sets will be sold next year but pointed out that the governing factor will be the number and quality of color broadcasts, over which the manufacturers have no direct control. If other new records are not set in 1956 it will not be surprising, Mr. Secrest pointed out, considering that factory sales of all electronics products rose to a new peak of about $5.5 billion this year, nearly 10 percent above 1954; TV receiver production and sales are at the highest point on record; radio production will exceed 14 million sets compared with 10.4 million last year, and military electronic procurement and deliveries increased to about $2.4 billion despite a general cutback in defense spending.

The television industry should sell 300,000 color sets in 1956, H. Leslie Hoffman, president of Hoffman Electronics Corporation, predicted.

Mr. Hoffman attributed the expected growth of color TV to the increased programming which will be offered next year and the added exposure of color to the public. He cited specifically the announced plans for increased color broadcasting facilities on the West Coast, and NBC's commitment that, by next fall they will offer 80 hours of color program a month, as providing a powerful stimulus for color TV sales in the area.

In a recent release entitled, "A Preview of 1956," Dr. W. R. G. Baker, Vice-President, General Electric Company, states, "In looking forward to the coming year, we have every confidence that the electronics industry will more than equal 1955's record activity. Aided by a continuation of the current high national economic level, the rapid rate of advancement peculiar to the electronics business may carry us to new all-time peaks in total industry volume next year.

"Contributing to the general outlook for the electronics field for the next 12 months are the following factors:

"There will be a growth of television broadcasting in smaller market areas. Sixty-five new television stations are expected to go on the air in 1956, bringing the total to 535. More than half of these will be able to transmit color. The swing to color transmission will proceed steadily. New advances will be made in color reception. Industry retail sales of color television receivers should total approximately 150,000 in 1956. Sales of monochrome television sets are expected to total 7,100,000 next year. The steady impact of clock and portable radios will help offset a regressive movement in the table-model market. We expect that the industry will sell 7,000,000 home and portable radios in 1956. The thriving industrial radio market will continue to move upward. Total industry sales of mobile communications equipment in 1956 will show a 15 per cent increase. The new year will see transistors make a major break-through in devices for entertainment and industrial purposes as well as for military use. For the first time, transistors will be available which will reduce the size and complexity of computing machines and make them smaller and more efficient."

flashes

John D. Van der Veer has been appointed general sales manager of Tung-Sol Electric Inc. He succeeds George W. Keown who was elected vice president of the comapny last month and who assumes responsibility for all sales on this date. Mr. Van der Veer joined Tung-Sol in 1945 following service in the Signal Corps as a captain. He held the position of western equipment tube sales manager until 1950 when he assumed equipment tube sales responsibility for all territories. In September, 1954 Mr. Van der Veer was named assistant general sales manager.

The Brach Division of the General Bronze Corporation recently announced that they have developed the Emerson-Brach Radiator-Rotator. The Brach control box is built into Emerson Radio sets. Actually the rotator control unit which is built within the set itself serves two purposes. A radio set and television set can be hooked up simultaneously to the antenna on top of the roof with this new device. The antenna atop the roof is rotated by a hollow torque shaft of high strength aluminum alloy which is attached to the right side of the radio.

Robert C. Sprague, Chairman of the Board of the Sprague Electric Company, North Adams, Massachusetts, receives the "Silver Knight of Management" award of the National Association of Foremen from Harold Brafman, retiring President of the Sprague Management Club, an NAF affiliate. Mr. Sprague received this award for the practice of the NAF code of ethics in his every-day business, for his loyalty to objectives of the NAF, and his efforts for the advancement of the American free enterprise system.

Jontz Mfg. Co. announces that its new colored guy rings are available—red on 16 ga. masts and green guy rings on 18 ga. masts. This has been made available to simplify identification, facilitate inventory and shipping. The colored guy rings improve the appearance from all viewpoints.

Holloway Electronics Corporation of Fort Lauderdale, Florida announces the introduction to the antenna market of their new Expo-I.R.I.S. antennas designed to eliminate interference in television reception. I.R.I.S. or Infinite Rejection Interference System, is combined with the Exponential antennas manufactured by this firm so as to eliminate co-channel, adjacent channel interference and ghosts.

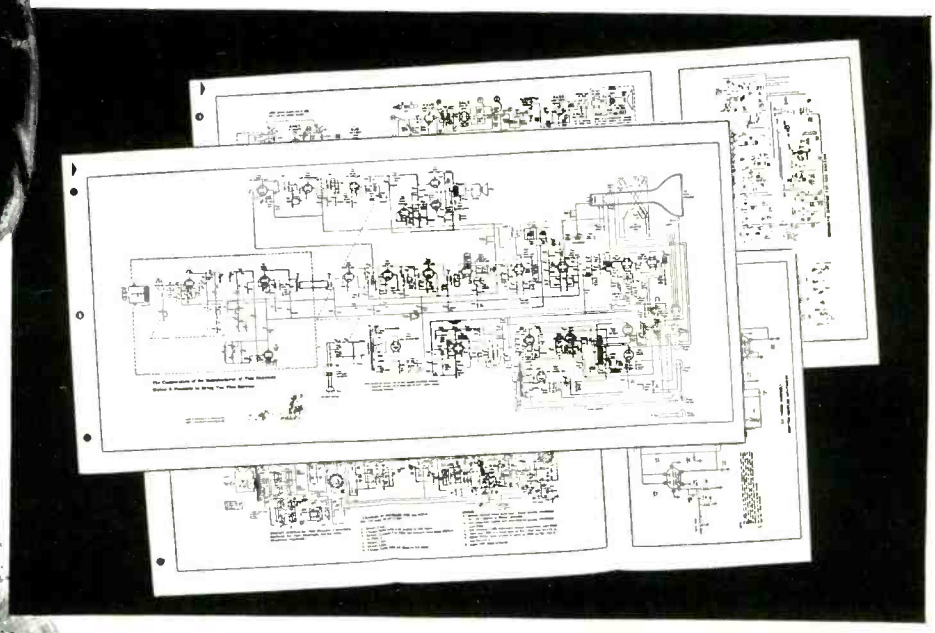
In announcing the introduction of this development, R. O. Holloway, President of the firm, stated that it was a complete and fundamental answer to the interference problem, being based upon the concept that an interfering signal can be completely cancelled by an opposing signal of equal amplitude but of opposite phase. The system consists of two antennas one of which is vertically disposed above the other, cancellation of the interfering signal being accomplished by merely rotating one of the antennas. Common forms of interference such as "venetian blinds," splatter from strong local signals and ghosts are said to be completely eliminated by Expo-I.R.I.S. Both I.R.I.S. and the fundamental wide band Exponential antenna marketed by the firm are the results of years of research and development by John R. Holloway, Director of Engineering of the firm.

Color television sets will be produced in volume by the

[*Continued on page 37*]

NOW! PHOTOFACT BRINGS YOU EXTRA SCHEMATIC COVERAGE

you get immediate coverage on leading receivers just as soon as they hit the market!



IT'S AN "EXTRA" SERVICE—
IN ADDITION TO REGULAR COVERAGE—
AT NO EXTRA COST TO YOU

The January issues of Sams' PHOTOFACT contain the first of a series of schematic diagrams covering the nation's top manufacturers' new model releases. Look for PHOTOFACT Sets 302, 303, and 304 at your Parts Distributor today! See for yourself how PHOTOFACT keeps you current with the present output of new TV and Radio Models. Be sure to enter your "standing order" for each new monthly release of Sams' PHOTOFACT Sets—they'll put you out ahead in service work.

remember—you get the world's finest service data —

you get it fastest in PHOTOFACT

HOWARD W. SAMS & CO., INC., 2209 E. 46th St., Indianapolis 5, Indiana

FIELD REPORT NO. 9

FOR BEST BLACK AND WHITE, AND COLOR RECEPTION...

ELIO PURA
KING CITY-TV
KING CITY, CALIFORNIA

WE HAVE EIGHT POSSIBLE TV CHANNELS IN KING CITY. TWO ARE SNOW-FREE, BUT THE OTHERS ARE FRINGE. THEY ARE LISTED AS FOLLOWS:

CHANNEL 3 SOUTH
SANTA BARBARA, CALIF.
CHANNEL 4 NORTH
SAN FRANCISCO, CALIF.
CHANNEL 5 NORTH
SAN FRANCISCO, CALIF.
CHANNEL 6 SOUTH
SAN LUIS OBISPO, CALIF.
CHANNEL 7 NORTH
SAN FRANCISCO, CALIF.
CHANNEL 8 NORTH
SALINAS, CALIF.
CHANNEL 10 N/E
SACRAMENTO, CALIF.
CHANNEL 11 NORTH
SAN JOSE, CALIF.

STACKING A JFD STAR-HELIX ON ROTOR MAKES POSSIBLE VIEWING ON ALL EIGHT CHANNELS.

ANY PERSON WISHING A GOOD ANTENNA INSTALLATION, "WE RECOMMEND A JFD STAR-HELIX ANTENNA."

CHARLES M. BOLINGER
BOLINGER RADIO & TV SHOP
CARROLLTON, MISSOURI

FOR AN AVERAGE INSTALLATION WE SIMPLY USE A SINGLE STAR-HELIX. IN A VERY DIFFICULT SPOT WE STACK TWO OF THEM. IN EITHER CASE IT DOES AN EXCELLENT JOB FOR US ON BOTH MONOCHROME AND COLOR AS WELL AS CUT ABOUT ONE-THIRD OFF THE INSTALLATION TIME.

WE NOW USE THE STAR-HELIX IN MOST LOCATIONS WHERE PREVIOUSLY IT WAS NECESSARY TO USE A STACKED ARRAY OF SOME TYPE IN ORDER TO GET SATISFACTORY RECEPTION.

VIOLET M. HOYT
KINI POPO RADIO-TV SERVICE
KEALAKEKUA, KONA, HAWAII

"IT IS SO SIMPLE TO ASSEMBLE THAT EVEN I HAVE GONE OUT ON ANTENNA JOBS WHEN MY HUSBAND WAS BUSY IN THE SHOP, AND WITH A COUPLE OF UNTRAINED HELPERS, HAVE MADE PERFECT INSTALLATIONS. WE ARE LOCATED 100 MILES FROM THE NEAREST TV TRANSMITTER, AND THE STAR-HELIX ANTENNA PULLS IN A BEAUTIFUL PICTURE, WITH NO GHOSTS.

JAMES S. JEWELL
JEWELL TV-APPLIANCE CO.
DECATUR, MICHIGAN

I RECENTLY TRIED THE JFD STAR-HELIX ANTENNA WHEN INSTALLING MY FIRST COLOR SET AND WAS MORE THAN PLEASED WITH THE RESULTS. I HAD TRIED OTHER FRINGE ANTENNAS, BUT NOTHING WAS GIVING A CONSISTENT, SNOW-FREE SIGNAL, EVEN ON BLACK AND WHITE, FROM GRAND RAPIDS-CHANNEL 8, WHICH IS ABOUT 80 MILES AWAY.

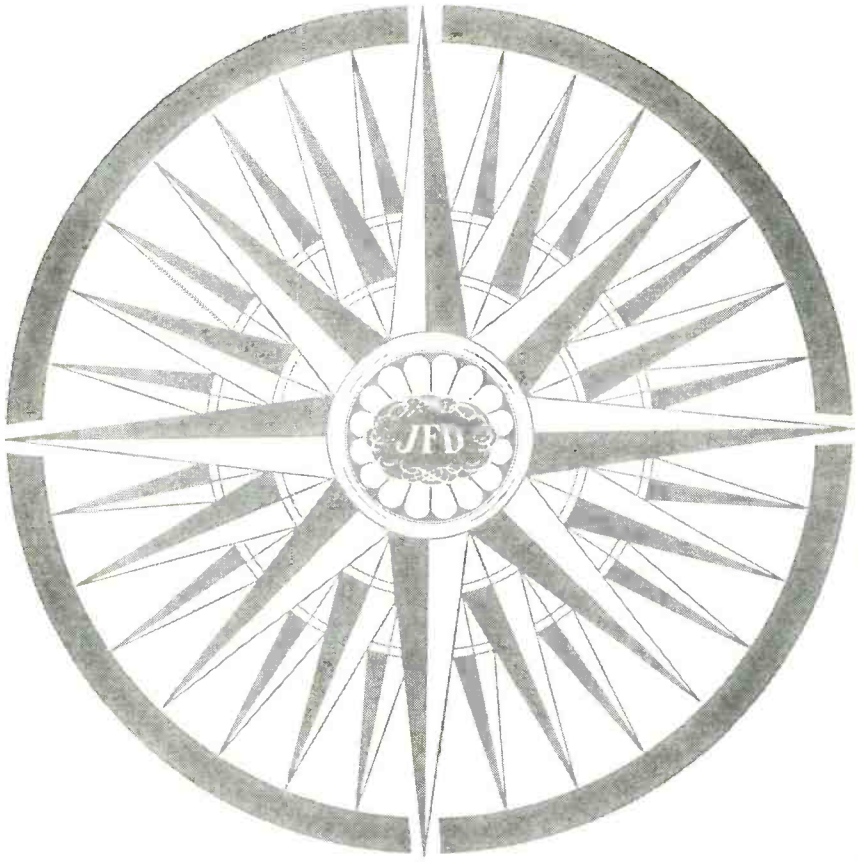
NOW WITH THE JFD STAR-HELIX, EVEN COLOR SIGNALS ARE STEADY AND FREE FROM SNOW. WE ARE ALSO RECEIVING GOOD SIGNALS FROM FAR AWAY AS 125 MILES FROM CHICAGO ON CHANNELS TWO, FIVE, SEVEN AND NINE.

JOHN A. ETCHINSON
E. O. BROOKS APPLIANCES
FLORA, ILLINOIS

WE ARE USING THE NEW STAR-HELIX ANTENNA AND FIND THAT IT OUT PERFORMS ANY OTHER ANTENNA WE HAVE EVER USED. FLORA IS LOCATED APPROXIMATELY ONE HUNDRED MILES FROM STATIONS EAST, WEST, NORTH AND SOUTH AND WE REQUIRE AN ANTENNA THAT WILL SEPARATE THESE STATIONS AS WELL AS BRING IN RECEPTION. THE NEW STAR-HELIX WILL DO AN EXCELLENT JOB IN SEPARATING THESE STATIONS, THUS ELIMINATING CO-CHANNEL INTERFERENCE.

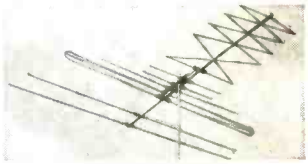
EARL FRAZIER
FRAZIER FURNITURE CO.
BLACKWELL, OKLAHOMA

"AFTER TRYING NUMEROUS ANTENNAS HERE IN A FRINGE AREA, WE HAVE SETTLED ON STAR-HELIX BECAUSE OF ITS FRONT TO BACK RATIO. WE FIND IT IS THE FINEST ANTENNA WE HAVE USED FOR NO BACK GAIN."



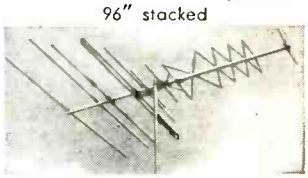
SERVICEMEN *EVERYWHERE* AGREE ON JFD ANTENNAS

EXPERIENCE IS THE BEST TEACHER. THAT'S WHY MORE AND MORE SERVICE-DEALERS, AT HOME AND ABROAD, ARE STANDARDIZING ON JFD TV ANTENNAS. THEY'VE LEARNED THAT A JFD ANTENNA ASSURES THEIR CUSTOMERS THE FINEST POSSIBLE RECEPTION IN BLACK AND WHITE TODAY, AND COLOR TOMORROW. THEY'VE SEEN HOW JFD INSTALLATIONS BUILD CUSTOMER CONFIDENCE—THE BEST INSURANCE FOR FUTURE BUSINESS. SO WHY COMPROMISE YOUR REPUTATION WHEN IT COMES TO QUALITY RECEPTION? ASK YOUR DISTRIBUTOR TO SHOW YOU THE JFD ANTENNA THAT SOLVES YOUR PROBLEM...FITS YOUR PURSE.



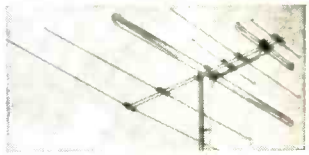
STAR-HELIX

SX711	single	**$25.50**
SX711S	stacked	**$52.50**
SX711-96*	96" stacked	**$55.00**



SUPER-STAR HELIX

SX13	single	**$35.00**
SX13S	stacked	**$72.50**



FIREBALL

FB500	single	**$17.35**
FB500S	stacked	**$36.65**
FB500S-68†	68" wide stacked	**$36.65**
FB500S-96*	96" wide stacked	**$38.60**

***for added ch. 2-6 gain**

†for areas with co-channel and cross-channel interference

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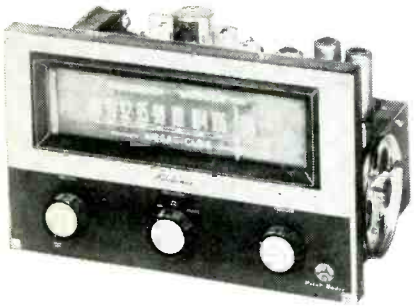
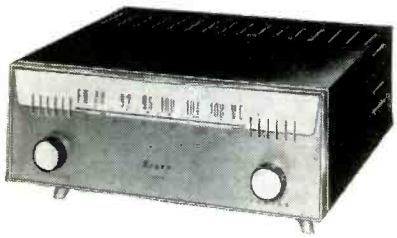
GO FORWARD WITH JFD ENGINEERING!

NEW FM

This article discusses FM tuner terminology and defines in simple manner the various terms used. Circuit analyses of FM tuners and a similar discussion and treatment of AM-FM tuners will follow in succeeding issues of RTSD.





THE sole reason for high fidelity equipment is to provide entertainment that sounds right, and which gives the illusion of "presence." Otherwise, it isn't high fidelity. Frequency modulation radio reception is ideal for use with high fidelity equipment because the frequency of the sound signal is not limited as in AM, and because this type of transmission is relatively undisturbed by atmospheric noises, electrical equipment and interferences of other annoying types.

Special units are manufactured for use as components in a high fidelity sound system as illustrated in *Fig. 1*. One of these units, called an FM tuner, is of particular concern in this article.

The FM tuner is a portion of a receiver in which the *rf* signal is built up to a desired value and demodulated before injection into an audio amplifier. The tuner is connected with the other components of the high fidelity system, usually an audio amplifier and loudspeaker as shown in *Fig. 1*. This same loudspeaker and amplifier unit may also be used for phono operation, AM broadcast tuners, tape recorders, etc. This audio amplifier system should be of a high quality type and capable of reproducing to a high degree of faithfulness the signals applied to it.

FM radio broadcasting is the ultimate in audio transmission but it must also be understood that the fidelity of sound obtained is only as good as the material transmitted, and the capabilities of the FM tuner and audio system employed to reproduce it. The job of the FM tuner is to provide a means of selecting the desired FM stations in the band from 88 to 108 *mc*. As can be appreciated it must select only the desired station and effectively attenuate all other stations. This is a measure of its selectivity.

Naturally, one of the most important attributes of an FM tuner is its ability to amplify the received signal to a level where it will be sufficient to drive an audio amplifier system and be heard. Also, with relatively weak signal inputs, the signal-to-noise ratio of the audio output must be sufficiently high to result in good quality reproduction. Both of these factors are a measure of tuner sensitivity.

Since this tuner is to operate into a high fidelity system it must not introduce distortion in its handling of the signals, whether they be weak or very strong. Along these lines it must be able to block out interference to a high degree. The ability of an FM tuner to block out interference depends on (1) *rf* selectivity, (2) "Capture Ratio". Capture ratio measures the ability of the tuner to suppress interfering signals in the same pass-band as the desired signal.

Pointing out a few of the characteristics of FM, a well-designed receiver is less disturbed by noise and interference than an AM receiver. Also, in FM the input signal to the receiver does not remain substantially constant and may vary considerably even over a short period of time. However, with well designed limiters the audio output will remain constant with a constant percentage modulation even though the incoming signal varies over a wide range. Finally, in FM the system is inherently capable of reproducing the whole range of audio frequencies which the human ear is sensitive to. An FM receiver must be designed with greater care because the *rf* and *if* frequencies are much higher than in an AM receiver and because of the greater potential audio response range available.

Station tuning may be one of the difficulties that can be experienced with an FM tuner of inadequate mechanical design. Another possible problem is oscillator drift, but here again this is overcome by the use of high quality components such as negative temperature coefficient condensers, and auxiliary control circuits such as *afc* (automatic frequency control). Oscillator drift which can occur with temperature increases during warmup time and changes in line voltage are compensated for by these methods.

TUNERS

Part 1

by

STEVE TRAVIS

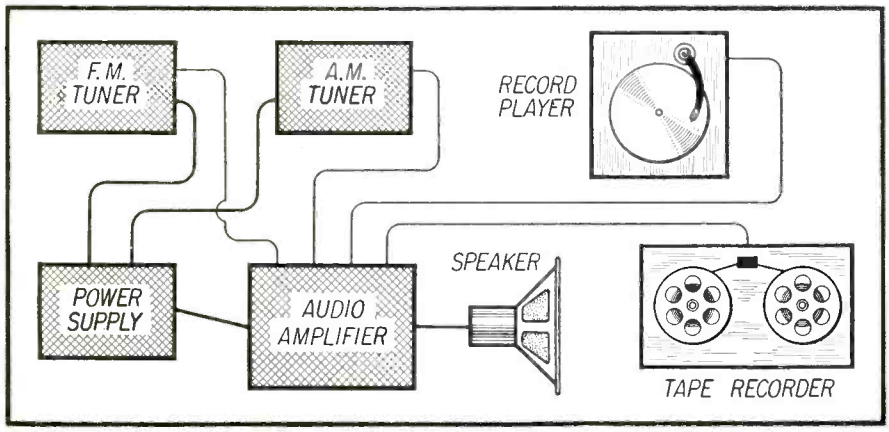
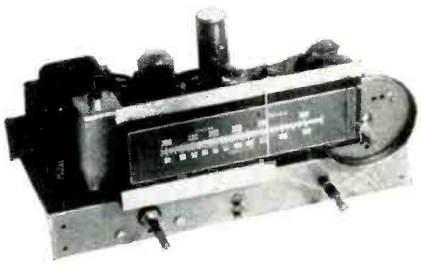
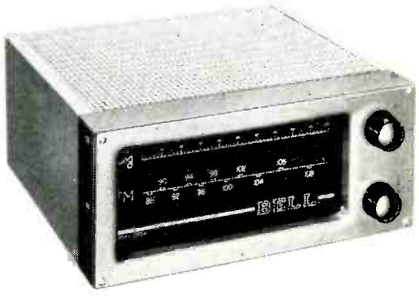


Fig. 1—Block diagram of a complete high fidelity system showing the manner in which the various units are connected to one another.





Selecting an FM Tuner

With the great public interest in quality audio and high fidelity systems, a prominent question that arises in putting together such a system is what FM tuner is best suited for the job. FM tuners are merchandised in a great many forms, from kits to complete units with sensitivity meters and logging scales (which are auxiliary scales for rapid station selection). They are obtainable as units which contain only a tuning knob and an on-off switch, as well as units which contain bass, treble, volume, squelching, and level or gain controls; plus multiple function switches for such purposes as *afc, agc,* etc.

One point to bear in mind in the selection of a tuner is the possibility of the duplication of controls on the tuner and amplifier. Wherever possible this should be avoided since it only leads to confusion and to unnecessarily higher cost.

An important consideration concerning FM tuners is the location of the receiver with respect to the broadcast stations. It is evident that if local reception is adequate a super-sensitive tuner is not required. A quality tuner should have other features besides sensitivity and is often judged by *what it doesn't pick up* as well as how well it pulls in weak signals. In metropolitan areas numerous spurious signals can be received such as adjacent channel interference and image frequencies if provisions have not been designed into the tuner to prevent these disturbances from disrupting reception. Other sources of interference are television receivers, diathermy units, and ignition systems.

In the selection, then, of an FM tuner it is necessary for the technician to qualify as an expert in order to determine which tuner meets the specific needs and requirements. The variety of tuners available is so broad as far as design and performance variations are concerned that only a discussion of them can bring to light the many facets of a good tuner besides a brightly polished front panel.

Sensitivity and Quieting Ratings

FM tuners are designed so that the limiter or ratio detector action provides noise reduction with increased signal strength. Noise reduction or quieting is expressed as a *db* ratio. A typical curve showing how noise varies with signal input is shown in *Fig.* 2. The noise referred to is the inherent noise generated in the tuner itself. It must be understood that provisions for better reception in the form of efficient antennas and location will result in greater signal strengths appearing at the antenna and

consequent greater signal to noise or quieting ratio.

The noise at the output of a tuner is a maximum in the absence of an *rf* signal at the input, and decreases as the *rf* signal input is increased. One way of defining the quieting sensitivity of a tuner is by specifying the amount of CW signal needed at the input to effect a specified reduction in output noise, like "10 microvolts for 20 *db* of quieting." The *db* ratio of the original noise output over the reduced noise output is what we see in *Fig.* 2 expressed as Noise Reduction in decibels.

Acceptable listening may be obtained when the noise reduction in a tuner is in the order of 20 *db* or greater. Actually, this concept classifies tuners according to the amount of noise originating in the circuits and presented at the output. This measurement is made at a time when there is no modulation of the carrier being transmitted which could mask the measured noise.

A typical expression of sensitivity might be 5 microvolts at 30 *db* of quieting. Less microvolts of signal strength for the same quieting or more *db* of quieting for the same signal strength indicates a better tuner. It is for this reason that *rf* stages in FM tuners are at present of a cascode design. Using dual triode tubes for high frequency amplification and mixing operations causes the generation of less noise in these stages than does the employment of pentode tubes for the same purpose.

Capture Ratio

The voltage ratio in *db* between the maximum interference signal on the same passband that can be rejected and the desired signal is termed the "capture ratio."

As an example, suppose a 100 microvolt signal is being received in a tuner and the maximum value of an interfering signal at the same center frequency as the desired signal at which rejection takes place is 50 microvolts. Then, the voltage ratio between the two signals is 2 to 1 and the capture ratio is 6 *db*. Now, suppose another tuner also receiving the 100 microvolt signal does not reject an interfering signal unless it is below 10 microvolts. In this case the voltage ratio is 10 to 1 and the capture ratio is 20 *db*. It is evident that the tuner with the smaller capture ratio is more effective in rejecting interfering signals than the tuner with the high capture ratio.

A tuner having a capture ratio of 2.5 *db* is considered quite good. Tuners with comparatively low capture ratios are less susceptible to interference than tuners with high capture ratios. Interference can mean outside noise such as ignition as well as other signals. Interference rejection is one of the most desirable features in an FM tuner.

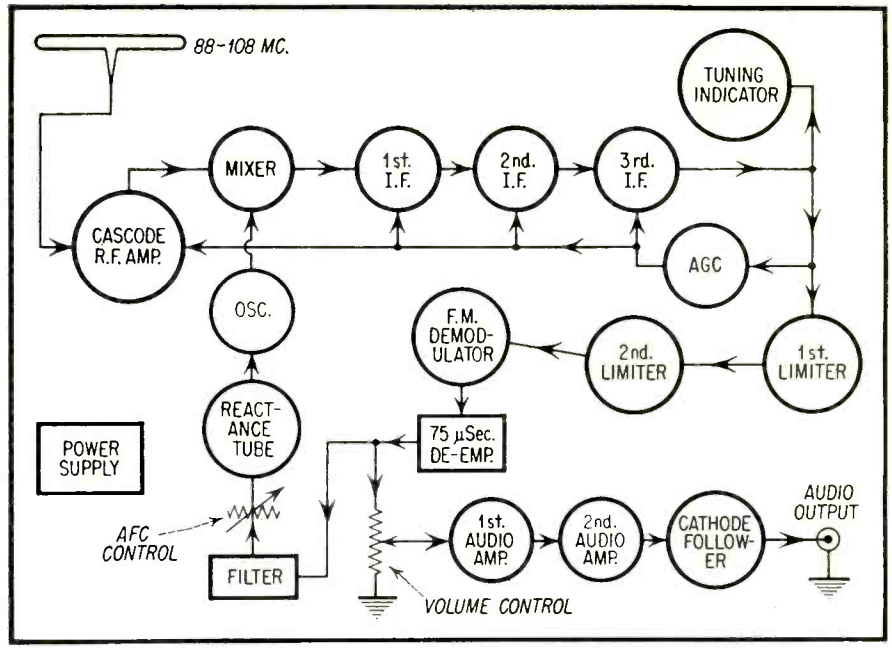


Fig. 3—Block diagram of a typical FM tuner indicating the various signal paths taken by the many signals developed in the tuner.

A composite block diagram incorporating a number of features found in FM tuners is shown in *Fig.* 3. As can noted in *Fig.* 3 a cascode stage may be employed as the *rf* amplifier. From the tuned *rf* stage the signal is applied to the mixer stage along with the proper oscillator signal.

The resultant difference frequency at the mixer circuit output is coupled to the *if* stages where additional amplification is performed. At the output of the third *if* stage a diode rectifier circuit may be employed to provide a negative voltage with which to govern the gain of the *rf* and *if* stages. This is the desired point also for a visual indication of tuning such as a sensitivity meter because limiting has not been performed as yet on the signal. Limiting would prevent a tuning indicator or *age* circuit from being fully responsive as these circuits and devices generally operate as a function of amplitude.

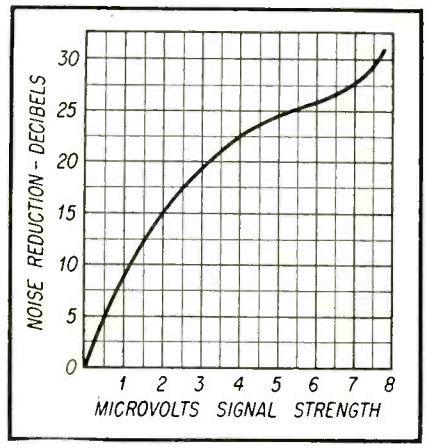


Fig. 2—Graph illustrating noise reduction in db versus signal strength in microvolts (uv).

The third *if* stage feeds the first limiter circuit followed by another stage of amplitude limiting. The signal is applied from the output of the 2nd limiter to an FM demodulator stage where the audio signal is recovered.

From the demodulator circuit a *dc* potential is obtained for *afc* purposes. This voltage, negative or positive dependent upon an error in *if* frequency at the FM demodulator circuit, is supplied to a reactance stage. The reactance stage changes the oscillator tuning in response to the positive or negative voltage correcting the oscillator frequency so that the *if* signal applied to the demodulator circuit is held at the correct frequency.

The transmitted signal has been altered at the broadcast station to accentuate the high audio frequencies above their normal level with respect to the frequencies below 1000 *cps*. This is called pre-emphasis and is used for achieving a better signal to noise ratio in the output audio signal. At the receiver, the increase in amplitude of the frequencies above 1000 *cps* must be brought back to its normal level. This is achieved through the use of a de-emphasis network.

From this point the audio signal is developed across a volume control which permits adjusting the level of audio voltage applied to the first audio amplifier. The second amplifier increases the audio level further and the signal is coupled to a cathode follower

[*Continued on page* 47]

JOHN F.

RIDER SPEAKS

MOST hi-fi fans cannot repair their own equipment. For that matter, most of them do not understand the functioning of the component parts. But this does not in the slightest dim their pride in their possession—or deter them from bragging a little about how and why their setup is better than some other. Each owner has developed a fairly deep mental impression of what his equipment can do—of how every record he plays "sounds." It's like a stamp collector who somehow or other has a mental image of *every* stamp in his collection.

When something goes wrong and someone must be called in to make the repair, the hi-fi fan begins to worry. Whom should he call? What assurance does he have that the technician will do a good job? Do TV technicians know anything about hi-fi? The feeling of anxiety grows stronger and stronger. Maybe it would be best to send the equipment back to the factory—they must know everything about it. But the packing is such a task—and how long would they keep it? Would it arrive undamaged? No, maybe it's best to try to find a good repair man in town. Where to look—whom to ask—to find this individual. These are troublesome thoughts.

Finally, someone is selected. The job is done and the equipment is again in operation. Critical listening begins and with it a new period of concern. It just doesn't seem to sound right. Did the repair man use the right parts? Did he know what he was doing?

As the feeling of suspicion grows, many more things seem to be wrong.

How can the servicing industry avoid such a situation? The first step is to know the *correct* performance of the equipment as produced by the manufacturer, not by guessing but by having and using the correct information. The manufacturer should furnish the hi-fi equipment purchaser with a full set of specifications covering the performance. This is done by many in the form of frequency response curves, gain figures, impedance values, and the like. Unfortunately, it is not done by all manufacturers.

The service information covering the devices should be complete in detail, especially as it relates to those components which are critical in their effect on the overall performance of the device. Withholding such information from a service manual in an effort to

promote factory repair (or the purchase of components from the factory) is creating obstacles to increased hi-fi equipment sales. Admittedly, many hi-fi enthusiasts send defective equipment back to the factory for repair, but to make this a necessity is to deter the growth of hi-fi.

Local service facilities are as necessary for hi-fi equipment as for automobiles, deep freezers, washing machines, and radio and television receivers. The fact that the choice of components and their integration in a system is more critical in a hi-fi installation than in other home electronic devices is not license to deny local service. Unavailability of local service can be a hindrance to sales, whereas the presence of such service can be a stimulant. It should not be surprising to see those devices that are readily serviceable outdistancing in sales those that are not.

A person who spends hundreds or even thousands of dollars for an electronic installation in the home is entitled to rapid and efficient service on the spot—at least somewhere in the community where he lives. It is unfortunate that even under most favorable conditions, all the components used in the many brands of hi-fi systems sold throughout the nation cannot be stocked by the electronic parts distributors for purchase by local service technicians. The situation should be relieved as much as possible by the dissemination of the maximum amount of service information.

The servicing industry also has responsibilities. It can't compromise with quality in a hi-fi system repair. Such a compromise is too easily recognized. The service technician must make use of the performance specifications that are part of the hi-fi manufacturers' service literature to determine whether the repair was correctly made. The equipment performance after repair must meet the specifications. If the service facility does not have its own file, it should use for comparison the material given to the purchaser by the manufacturer of the equipment.

It is not difficult to repair a defect in a hi-fi system, but a background in the subject is necessary. It must be done carefully. A reduction or a change in frequency bandpass in a radio receiver or, for that matter, even in a television receiver, often passes unnoticed. Not so with the critical ear of the hi-fi fan. A misplaced lead can adversely affect the normally controlled feedback, prevent complete control of a signal; in general, impair the performance.

The avergae service technician looks upon a sound reproducing system as something uncomplicated. This is true as far as the schematic is concerned, but when a number of different devices (a tuner, a record player, a tape recorder, a pre-amplifier, an amplifier, a mixer and/or one or more loudspeakers), must be tied together into an integrated system, it is not a casual job.

Each part contributes to the whole; each part must be "matched" to the other. Each part must function correctly with the other—it must be an integrated system.

Many service technicians are of the impression that only television service offers financial rewards. This is not true. The individual who has hi-fi as a hobby usually spends a substantial amount of money for his equipment, and is prepared to pay adequately for *good* service. Remember, he takes pride in what he owns! Remember that his hi-fi equipment is satisfying the inner man. No such thing exists with radio or television equipment. A hi-fi system is always a prideful possession; in comparison, a radio receiver or a television receiver is an ordinary appliance.

Unlike the owner of a television receiver the hi-fi fan makes it his business to learn something about his equipment. Even if he does not know the underlying theory, he knows what each part of the equipment contributes to the end product. The service technician who desires to build confidence in the mind of the hi-fi fan must be prepared to *talk the language of the hobby*. He must display a familiarity with varieties of the equipment as well as with the techniques of repair.

Hi-fi servicing is good business and, if the past is any barometer of the future, the sales and service of high-fidelity equipment are destined to boom to substantial heights.

JOHN F. RIDER

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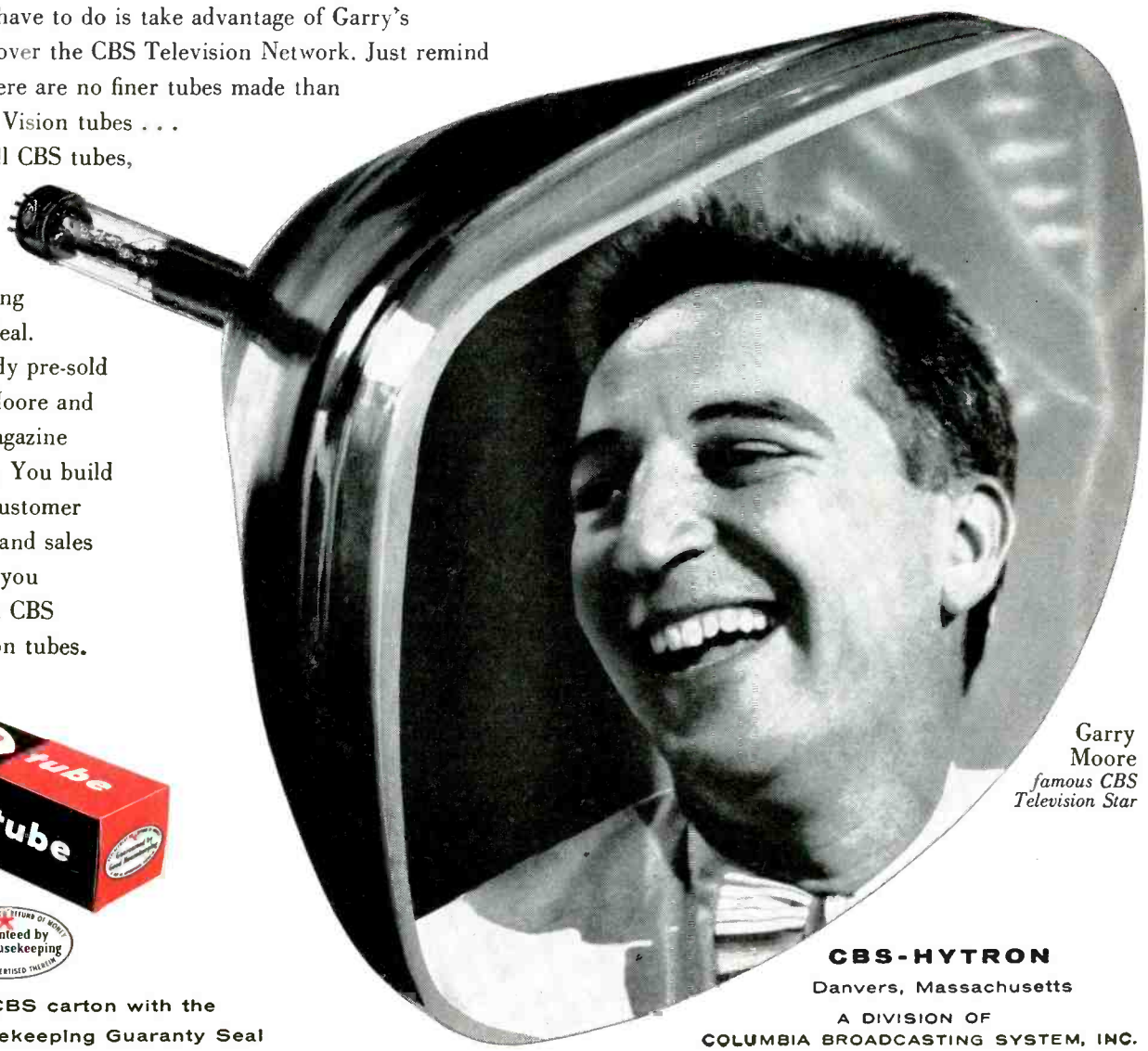
Sure, *you* are already sold on the advantages of aluminized tubes. You know that the CBS Silver Vision aluminized screen with its silver-activated phosphors and the CBS small-spot gun mean clearer, sharper, brighter pictures.

But your woman customer (76.9% of TV service customers are women) doesn't understand electronics or CBS advanced-engineering as you do.

She does know and respect the name CBS . . . she has confidence in Garry Moore and in the Good Housekeeping Guaranty Seal. So all you have to do is take advantage of Garry's pre-selling over the CBS Television Network. Just remind her that there are no finer tubes made than CBS Silver Vision tubes . . . And, like all CBS tubes, they have the Good Housekeeping Guaranty Seal. She's already pre-sold by Garry Moore and national magazine advertising. You build profitable customer confidence and sales every time you recommend CBS Silver Vision tubes.



Garry Moore
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Danvers, Massachusetts
A DIVISION OF
COLUMBIA BROADCASTING SYSTEM, INC.

ASSOCIATION NEWS

by Samuel L. Marshall

National Alliance of TV and Electronic Service Associations

The following release from NATESA is reproduced in its entirety in order to present NATESA's side of the present controversy centered around the recent unity meeting at Indianapolis.

"Numerous press releases have been issued by a few delegates to the service unity meeting at Indianapolis who participated in the unanimous vote to accept NATESA as *the* national association, but who now are going back on their word. The phraseology of these releases bears remarkable similarity to those of a publisher of a so-called service management magazine who has long had ambitions to control the service industry through a captive association and the use of his magazine as the voice of the group.

"To recognize the insincerity of the charges being made it should be recognized that NATESA had less than 1/3 of the total vote at the meeting. The president of NATESA is being falsely charged with dictatorship simply because he has been doing, and we are quoting one of their releases, 'three jobs' without compensation and 'there are too few persons with the initiative, time and ability to carry out the duties of *one* of these jobs, much less all three,' and for that reason was reelected in open elections five times. Would a dictator publicly offer to resign and disavow any office as did the NATESA president at Indianapolis, and in print?

"The second false charge is that made against the organizational set-up of NATESA which has been in effect since the first days of NATESA. Originally, three divisions were created. These have been expanded as NATESA grew. Full recognition is given state groups. The opponents of NATESA give credit for origination of this set-up to a Texas group which has such plans for the future. The "State Supremacy" group would deprive ¾ of all local groups of a voice since very few state groups exist. Is this an example of their lack of knowledge of the independent service industry, or are their plans insidious?

"NATESA has offered to waive its right to challenge applications of qualified groups if they are submitted by a specified date; the NATESA president has offered to resign; NATESA, at its cost, distributed copies of the Indianapolis meeting minutes, its Constitution, organizational system and other materials, to the non-affiliates who attended the meeting; NATESA has for five years mailed large numbers of informational bulletins and for three years each copy of the SCOPE free to over 200 non-affiliated local groups; it has, at no cost, mailed copies of its 'Here's How' brochure to help new groups organize; NATESA personnel has made personal visits to many cities at their own expense, to help many new associations. Can any of the NATESA opponents make these statements truthfully? Why have these groups repeatedly refused to cooperate and reciprocate?"

Association of TV Service Companies, Cincinnati, Ohio

ATSCO is ready to launch a License Agreement program aimed to further the goal of higher standards in the service industry. This agreement is intended to license and regulate persons, partnerships, firms or corporations, who are members of ATSCO, engaged in the business of repairing and servicing TV sets, radios or other electronic devices in the metropolitan area of Greater Cincinnati, deemed necessary for the preservation of the public peace, health and safety.

Radio TV Assoc. of Santa Clara Valley, Calif.

RTASCV's campaign to bring KSBW-TV's advertising program into line consistent with its reception has turned to U. S. Government sources for support. Association Executive Secretary Wes Strouse appealed to the Federal Communications Commission last month for aid in the Association's campaign which began last Summer with written protest to the Salinas station. Strouse opened his campaign after RTASCV men condemned Channel 8's "Look at 8 It's Great" ad series in media that covered Valley and Peninsula areas where Eight's signal generally was weak. Set owners in San Jose and northward

[*Continued on page 46*]

Superior's New Model TV-12

TRANS-CONDUCTANCE TUBE TESTER

ALSO TESTS TRANSISTORS!

TESTING TUBES

★ **Employs improved TRANS-CONDUCTANCE circuit.** An in-phase signal is impressed on the input section of a tube and the resultant plate current change is measured. This provides the most suitable method of simulating the manner in which tubes acutally operate in Radio & TV receivers, amplifiers and other circuits. Amplification factor, plate resistance and cathode emission are all correlated in one meter reading.

★ **NEW LINE VOLTAGE ADJUSTING SYSTEM.** A tapped transformer makes it possible to compensate for line voltage variations to a tolerance of better than 2%.

★ **SAFETY BUTTON**—protects both the tube under test and the instrument meter against damage due to overload or other form of improper switching.

★ **NEWLY DESIGNED FIVE POSITION LEVER SWITCH ASSEMBLY.** Permits application of separate voltages as required for both plate and grid of tube under test, resulting in improved Trans-Conductance circuit.

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Model TV-12 housed in handsome rugged portable cabinet sells for only

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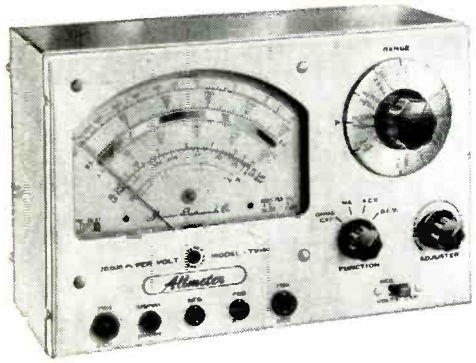


Superior's New Model TV-60

20,000 OHMS PER VOLT

ALLMETER

Includes services never before provided by an instrument of this type. Read and compare features and specifications below!

FEATURES

• Giant RECESSED 6½ inch 40 Microampere meter with MIRRORED scale. • Built-in Isolation Transformer. • Use of the latest type PRINTED CIRCUIT and 1% multipliers assure unchanging accurate readings.

SPECIFICATIONS

8 **D.C. VOLTAGE RANGES:** (At a sensitivity of 20,000 Ohms per Volt) 0 to 15/75/150/300/750/1500/7500/30,000 Volts.
7 **A.C. VOLTAGE RANGES:** (At a sensitivity of 5,000 Ohms per Volt) 0 to 15/75/150/300/750/1500/7500 Volts.
3 **RESISTANCE RANGES:** 0 to 2,000/200,000 Ohms, 0-20 Megohms.
2 **CAPACITY RANGES:** .00025 Mfd. to 30 Mfd.
5 **D.C. CURRENT RANGES:** 0-75 Microamperes, 0 to 7.5/75/750 Milliamperes, 0 to 15 Amperes.
3 **DECIBEL RANGES:** —6 db to +58 db.

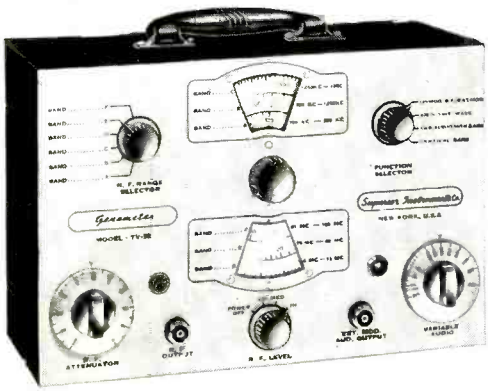
R.F. SIGNAL TRACER SERVICE: Enables following the R.F. signal from the antenna to speaker of any radio or TV receiver and using that signal as a basis of measurement to first isolate the faulty stage and finally the component or circuit condition causing the trouble.

AUDIO SIGNAL TRACER SERVICE: Functions in the same manner as the R.F. Signal Tracing service specified at left except that it is used for the location of cause of trouble in all audio and amplifier systems.

Model TV-60 comes complete with book of instructions; pair of standard test leads; high-voltage probe; detachable line cord; R.F. Signal Tracer Probe and Audio Signal Tracer Probe. Pliofilm bag for all above accessories is also included. Price complete. Nothing else to buy. ONLY

$52.50 NET

Superior's New Model TV-50



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A versatile all-inclusive GENERATOR which provides ALL the outputs for servicing:
A.M. Radio • F.M. Radio • Amplifiers • Black and White TV • Color TV

R. F. SIGNAL GENERATOR: The Model TV-50 Genometer provides complete coverage for A.M. and F.M. alignment. Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

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7 Signal Generators in One!

- R.F. Signal Generator for A.M.
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- Audio Frequency Generator
- Bar Generator
- Cross Hatch Generator
- Color Dot Pattern Generator
- Marker Generator

CROSS HATCH GENERATOR: The Model TV-50 Genometer will project a cross-hatch pattern on any TV picture tube. The pattern will consist of non-shifting horizontal and vertical lines interlaced to provide a stable cross-hatch effect.

DOT PATTERN GENERATOR (FOR COLOR TV) Although you will be able to use most of your regular standard equipment for servicing Color TV, the one addition which is a "must" is a Dot Pattern Generator. The Dot Pattern projected on any color TV Receiver tube by the Model TV-50 will enable you to adjust for proper color convergence.

MARKER GENERATOR: The Model TV-50 includes all the most frequently needed marker points. The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency.)

THE MODEL TV-50 comes absolutely complete with shielded leads and operating instructions.

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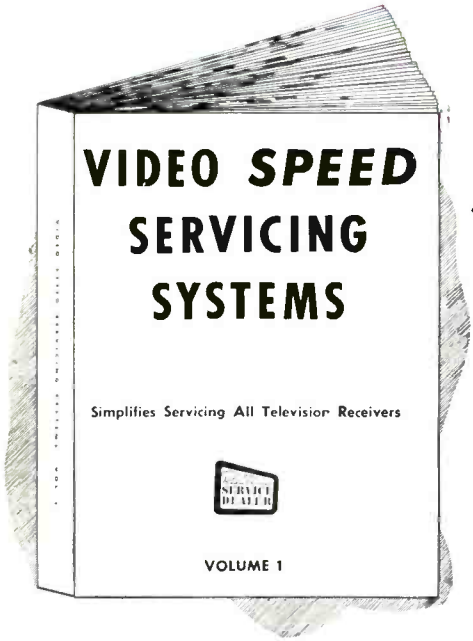

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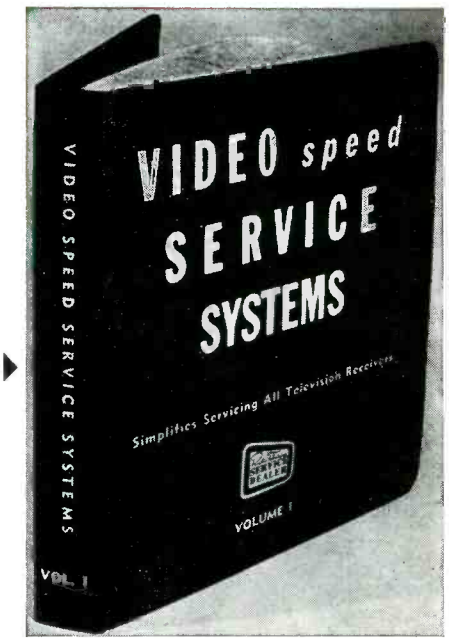

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The ANSWERMAN

Inquiries Sent To The Answerman Will Be Acknowledged Only If Accompanied By Radio-TV Service Firm Letterheads Or Similar Identification.

by **RTSD Technical Staff**

Dear Sir:

I had a Philco TV-390 chassis that exhibited a no sound, no picture condition. I changed the tubes in the *if* circuit and tuner but this did not restore the receiver to operation. So, it was necessary to remove the chassis from the cabinet. Physical examination revealed that a resistor was burned and my voltmeter showed that there was no voltage to the *if* strip. The burned 220 ohm resistor, *R*25 was replaced. But still no picture.

I adhered to my strict policy of making sure the tubes are not the cause of any difficulties and found that the 6AM8 tube was defective. Upon replacing this tube everything returned to normal.

I have been wondering whether I just ran into a receiver that contained two troubles or did the 6AM8 tube cause the 220 ohm resistor to become defective.

T. F.
Harrisburg, Pa.

As can be noted in *Fig 1*, the Philco TV-390 chassis employs the audio output tube to devolop the voltage drop that provides the lower B plus voltage of 145 volts for low potential operations.

From appearances the 6AM8 tube evidently shorted internally between suppressor and plate, in this case, causing the resistor *R*25 to pass too much current and burn open. The 6AM8 tube has failed a few times in this fashion. Frequently the short has occurred between the suppressor and screen elements.

It is suggested that a two watt unit be used in replacement of the 220 ohm resistor, *R*25.

Dear Mr. Answerman:

In a Magnavox model CTA404B TV receiver I have an unusual condition. I can't get picture or sound through the chassis and to the best of my knowledge nothing is wrong with the tuner or *if* strip. The only voltage that is different that I have found is the plate voltage on the video amplifier tube, 6CB6. This potential is low.

One point that might be of help is that when any of the horizontal tubes such as the horizontal oscillator, output or damper tube is removed from the chassis sound comes in but I don't understand what this indicates.

H. P.
Los Angeles, Cal.

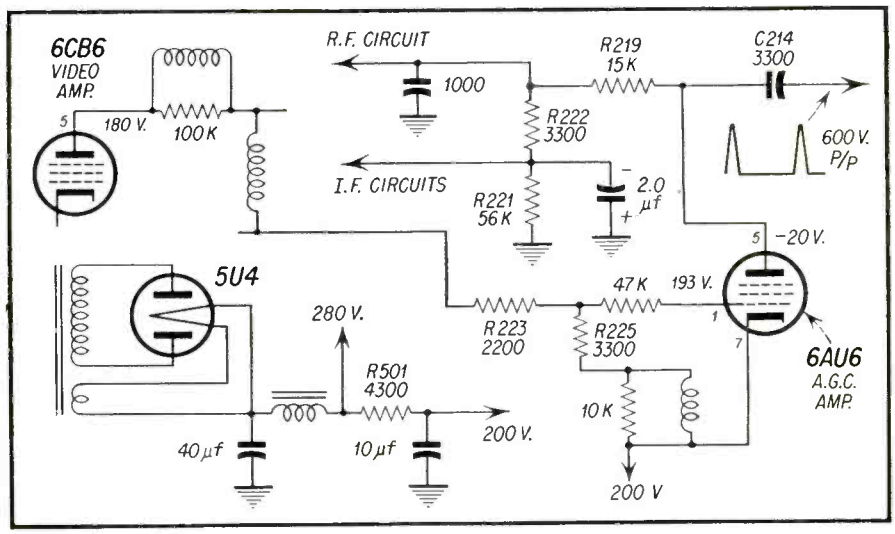

Fig. 2—Partial schematic of Magnavox Model CTA 404-B.

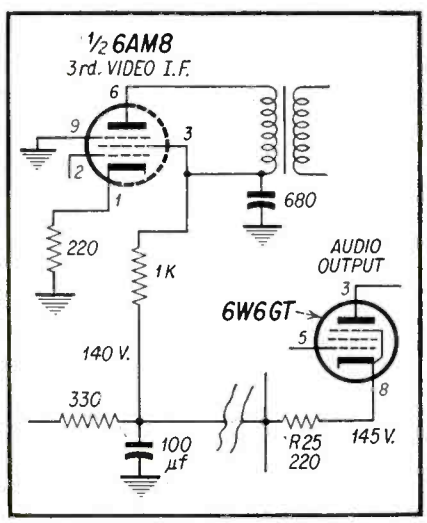

Fig. 1—Partial schematic of Philco TV 390 circuitry.

In examining *Fig.* 2 it can be noted that the B plus voltage of 200 volts is fed to the 6AU6 *age* amplifier tube. This voltage is reduced by resistors *R*223 and *R*225 and then supplied to the plate circuit of the video amplifier tube, 6CB6. Take particular note that the 200 volts B plus is applied to the cathode of the gate tube. This voltage acts as a bias voltage on the tube. The pulse from the winding on the horizontal output transfromer, being a positive going voltage, must be larger than 200 volts before it can cause conduction to occur through the tube and the charging of condenser *C*214, 3300 *μμf*. This charge taken by the condenser due to conduction in the tube then flows through the associated resistors, *R*219, *R*222 and *R*221 developing a negative voltage for the biasing action of the *age* system to govern the *rf* and *if* stages.

Of course, this presupposes that a positive going video signal is being applied to the grid of the *age* amplifier tube in phase with the horizontal pulse. The conduction in the tube is in proportion to the amplitude of the signal applied to the grid since the pulse from the horizontal circuit is constant in amplitude. A point has been made to include this pulse in *Fig.* 2 to show how it affects the circuit action.

[*Continued on page* 39]

ZENITH Remote

Simplified Explanation Of

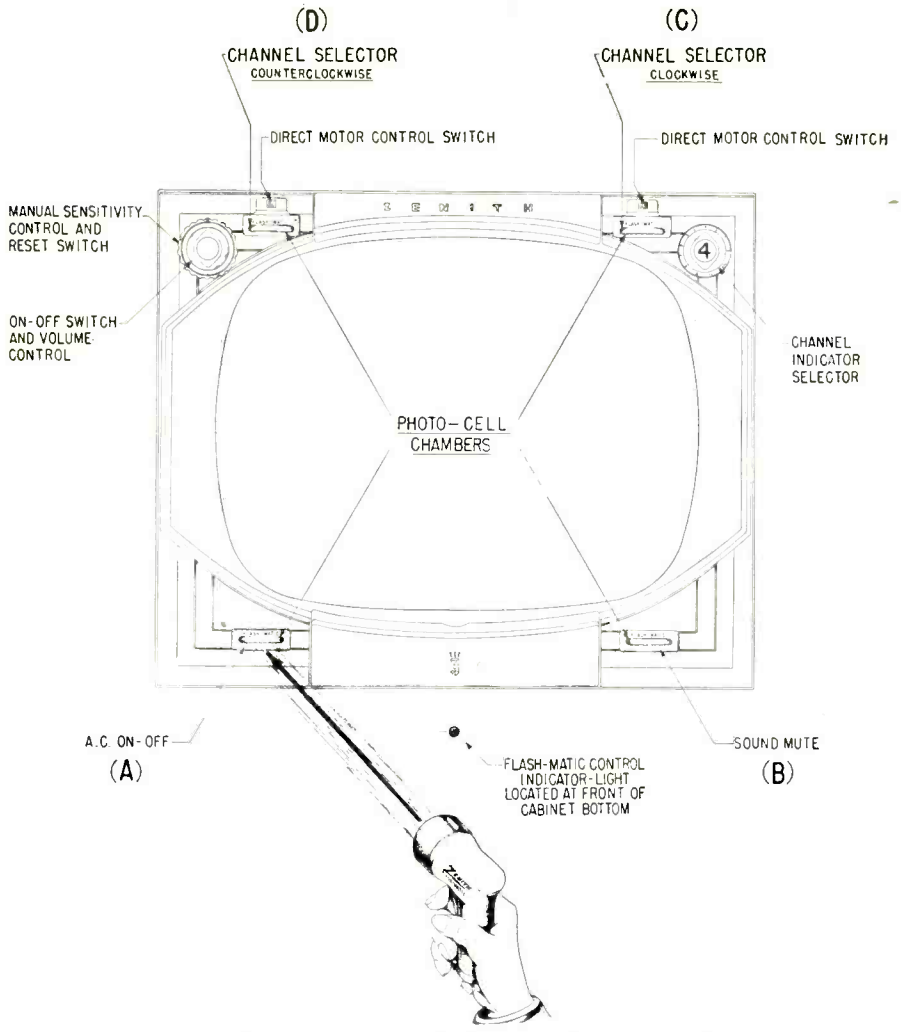

Fig. 1—Functional view of Flash-Matic in operation.

by **Oscar Fisch**

THE schematic diagrams included in the back pages of this issue cover the complete line of Zenith TV receivers for 1956. The outstanding innovation introduced by Zenith in this line is the inclusion of a unique type of remote control in some of these models. The letter "Q" following any model or chassis number indicates that the receiver is equipped with this new "Flash-Matic" remote control. In line with our established policy of keeping the service industry up to date on new circuitry, the following description and analysis of this control unit is presented.

The "Flash-Matic" remote control system differs from most others in that no connecting wires are needed between the control point and the receiver. This is accomplished by using a beam of light from a flashlight to actuate any one of four different control circuits. The following remote operations are possible:

1. The receiver may be turned on or off.
2. The sound may be muted (during commercials for example).
3. The desired channel may be selected. This operation may be accomplished in either of two ways:
   a) By clockwise rotation of the tuner
   b) By counter clockwise rotation of the tuner.

Each of these operations requires its own control circuit and its own photoelectric cell. *Fig. 1* indicates the location of the photocell chambers for each function.

The diagram of the complete control unit may be seen by referring to the schematic in the Zenith schematic insert included in the back section of this issue. To clarify our discussion, we shall use separate partial schematics for each of the control functions discussed. It is suggested that a copy of these partial schematics be placed in your files, since they will simplify the problem of circuit tracing when trouble develops.

"ON-OFF" CONTROL CIRCUIT

Basic Principle of Operation

Figure 2 is a partial schematic which includes only those portions of the circuit involved in the "ON-OFF" control function. It is drawn to facilitate following the circuits through the various plugs and sockets which connect the control unit to the receiver. For example, the lower end of the "Manual Sensitivity Control" is shown connected to ground by going through pin #4 of Plug (P) #4, pin #4 of Socket (S) #4, pin #6 of Plug #2, and pin #6 of Socket #2.

The basic operation of the circuit is as follows. V1, the 2D21 is a thyratron. *R3*, the manual sensitivity control, and *R4*, the "on-off" sensitivity control are adjusted so that the grid of V1 is biased beyond cut off under normal room lighting conditions. (*R3* is adjusted to compensate for different room lighting conditions.) When light strikes the photo cell, it causes the grid to be raised above cut-off (explanation below) and triggers the 2D21 into conduction. The plate current of the 2D21 actuates the solenoid in the plate circuit which in turn actuates the switch SW1. One set of contacts on this switch is in series with one side of the *ac* line supplying the power transformer for the TV receiver, thus giving "on-off" control.

Photocell Circuit

Referring to *Fig. 2*, it will be seen that the control grid of V1 is biased by the voltage it receives from the arm of the potentiometer *R4*. One end of this control is connected to −16 V *dc* derived from the selenium rectifier, SE1. The other end is connected through the photocell, a 27K resistor, and the arm of *R3*, to a positive voltage derived from the selenium rectifier SE-2.

The photocell is of the resistive type. This simply means that when light strikes the cell, it causes a change in resistance between its terminals. Thus, in total darkness, the cell may exhibit a resistance as high as 100 megohms, whereas if the cell is illuminated by intense light, its resistance may drop to as low as 25,000 ohms.

The voltage applied to the grid of V1 is the voltage between the arm of *R4* and ground. This consists of the drop across the 47K resistor plus the drop across the portion of *R4* between the arm and this 47K resistor. Now consider the condition when little or no light falls on the photocell. Since the selenium rectifier SE-1 is connected to

Flash-Matic Control

Its Operation And Service

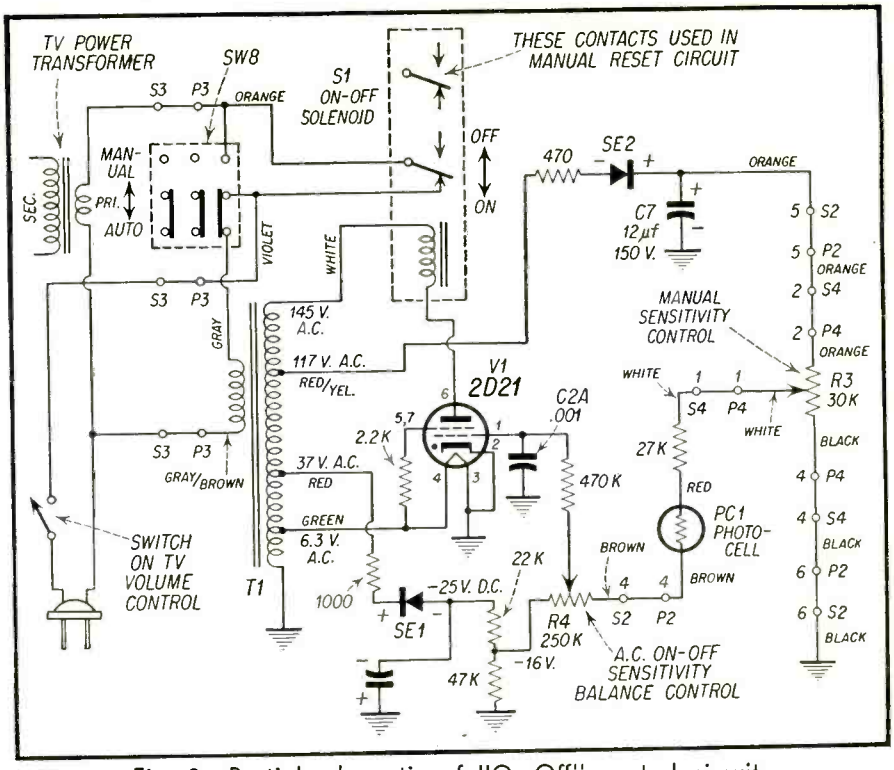

Fig. 2—Partial schematic of "On-Off" control circuit.

produce a negative voltage, there would be an electron flow from SE-1 through the 22K and the 47K resistors to ground. This makes grid end of the 47K resistor about 16 volts negative. At the same time the positive voltage from SE-2 tends to cause an opposing current through the 47K resistor. The strength of this opposing current depends on the total resistance in the path from the arm of *R3* to ground. The voltage drop across this 47K resistor depends on the *net* current through it. Thus, if downward flow produced by SE-1 were the only current present, the voltage across the 47K resistor would be 16V negative at the grid end. Any contribution of current by SE-2, through the series path of the 47K resistor, *R4*, and the 27K resistor will make the grid more positive by:

a) Making the grid end of the 47K resistor less negative

b) By adding whatever positive voltage is developed across the portion of *R4* between the arm and the 47K resistor.

In the case we have chosen, namely, little or no light striking the photocell, the photocell presents a very high resistance. The upward current through the 47K resistor is thereupon very small and the grid is essentially 16 volts negative, or beyond cut-off. When light now strikes the photocell, its resistance is greatly decreased, the current in its

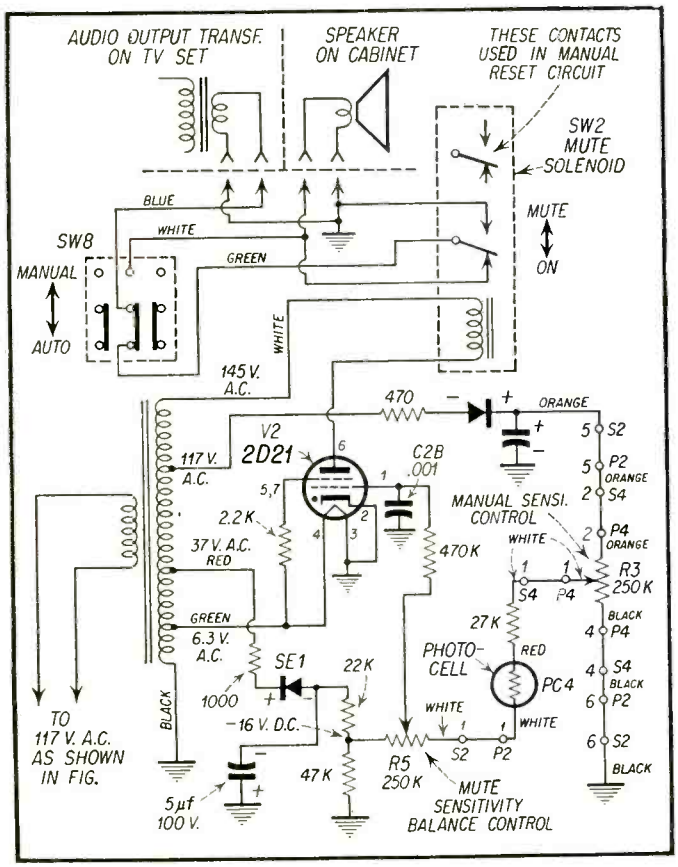

Fig. 3—Partial schematic of CCW motor control.

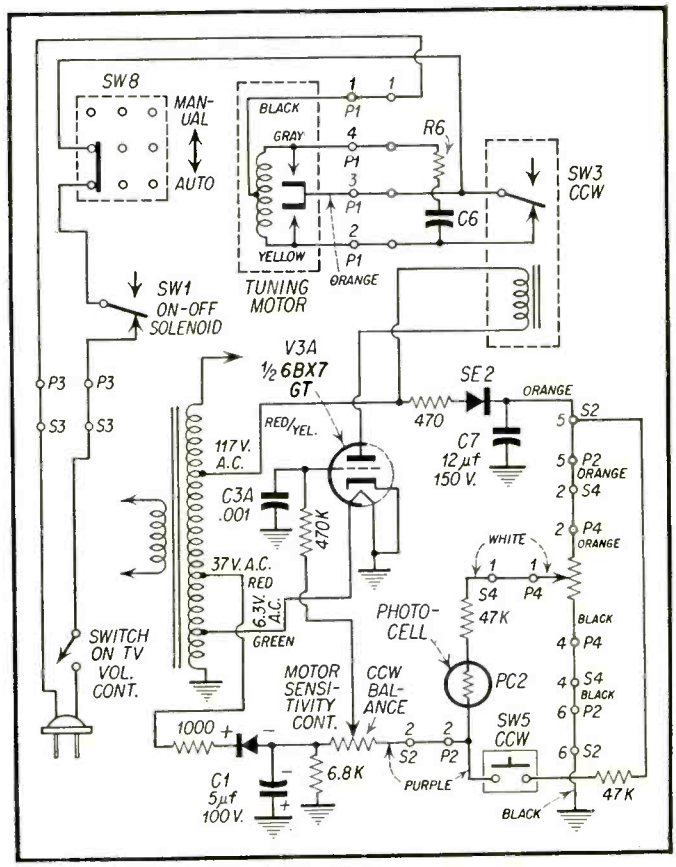

Fig. 4—Partial schematic of Mute control circuit.

circuit increases and grid voltage is raised above cut-off as described above. V1 then conducts and activates the solenoid in the plate circuit.

Switching Circuit

Figure 2 shows the switch in the "ON" position. Following the circuit through shows that in this position the circuit from the primary of TV receiver power transformer to the *ac* line is closed. The next time the solenoid is actuated by light falling on PC 1, the contacts of SW1 open, thus opening the *ac* line to the power transformer.

The extra set of contacts shown on the diagram are involved with the manual re-set circuit which is not shown here. This circuit enables the user to reset the position of the contacts on SW-1 by means of a switch on the front panel, without having to resort to a light beam.

MUTE CONTROL CIRCUIT

Figure 3 is a partial schematic of the "Mute" control circuit. This circuit enables the viewer to silence the sound at his convenience. A comparison of *Fig.* 3 with *Fig.* 2 will show an exact similarity of circuitry except for the circuits tied to the solenoid switches. From this it follows that the circuit explanation given for the "ON-OFF" control circuit applies in this case as well. As can be seen by the pin, plug, and socket numbers, the manual sensitivity control circuit is common to both the "ON-OFF" and the "MUTE" control circuits. Actually, as will be seen later, it is common to all the control circuits.

The switching circuit is a fairly simple arrangement. In the "on" position shown in *Fig.* 3, the secondary of the audio output transformer is connected through the switch contacts to the speaker voice coil. In the "mute" position, the output transformer secondary is shorted. The second set of contact points, as with the "ON-OFF" circuit, are concerned with manual re-set of the mute contacts.

MOTOR CONTROL CIRCUIT

Figure 4 is the partial schematic showing the motor control circuit for counter clockwise rotation of the tuner. Let us first examine the motor unit itself. This is an induction type motor with two windings. As seen in the figure one of these windings is between terminals 1 and 4 of the motor plug and the other between terminals 1 and 2. One side of the *ac* line is permanently connected to the common terminal, No. 1. If the other side of the line is connected to terminal 2, the motor rotates in a counter clockwise direction, while clockwise rotation is produced if the connection is made to terminal 4.

SW-3 is an ordinary plate circuit relay, actuated by the plate current of V3A. The control circuit itself is very similar to the "on-off" control circuit. The same explanation given previously for the action of the photocell in controlling the tube bias holds in this case also. An important difference is that plate relay switch makes only momentary contact. It releases as soon as the light beam is removed from the photocell. The current requirements for this operation are much less than that required for the solenoids. For this reason an ordinary low current triode may be used for control rather than the thyratron.

Homing Action

When the relay is actuated, the contacts of SW-3 close, and the motor begins to turn in a counter clockwise direction. The motor is geared to turret tuner. *Fig.* 5 is a photograph of the drive motor assembly and will help in understanding the action which takes place. The index cam actuates the switch trip latch which closes a set of contacts (Switch assembly S-23294). These contacts are wired in parallel

[*Continued on page 42*]

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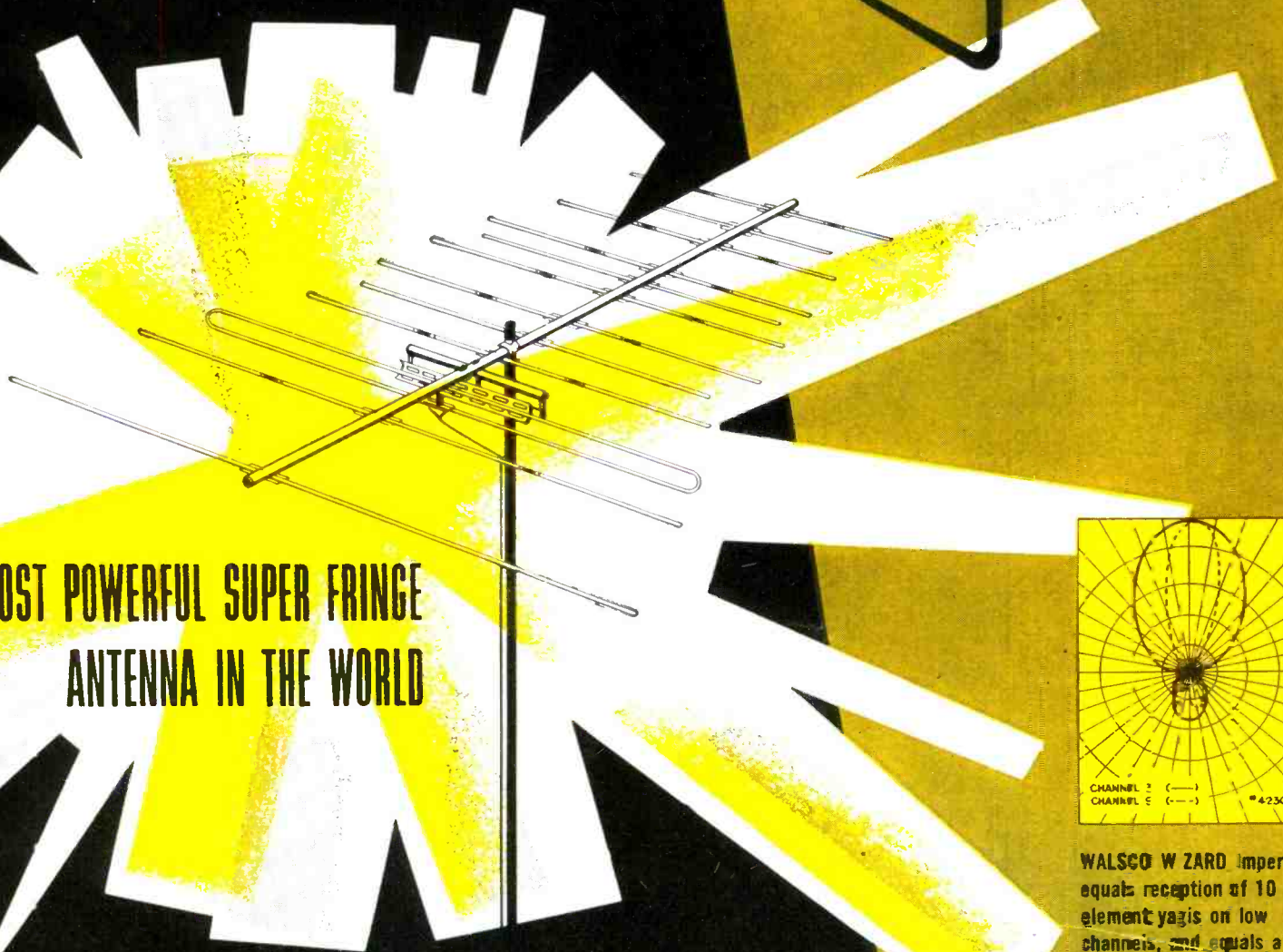

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Antenna "B" — Yagi Type with Phasing Loops	5.1	5.5	6.8	7.5	9.6	8.8	11.2
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COLOR SYNC ANALYSIS

Discussion Of Burst Gate Operation In Color TV Receivers

by

PART 2

Bob Dargan and Sam Marshall

from a forthcoming book entitled "Fundamentals of Color Television"

IN the previous installment we established the functions of the various sections that make up the Color Sync system. These sections consist of the Burst Gate, Phase Detector, Reactance Tube, Local 3.58 MC Oscillator, and Quadrature Amplifier Circuits. We may now proceed to a discussion of the basic circuits employed in each of these sections.

Burst Gate

As outlined in previous discussions, the purpose of the Burst Gate circuit is to make available a pure color burst signal, devoid of other signals, to the input terminals of the Phase Detector. A basic block diagram illustrating this action is shown in *Fig. 1*. Here, in one type of receiver, we observe that the composite signal enters the Burst Gate circuit from one end via a 3.58 *mc* resonant circuit. The phase of this signal with reference to the sampled subcarrier (color burst) is advanced 33° if the receiver is an I/Q type. In an R-Y/B-Y receiver no change in phase is given the signal because its phase is initially correct for demodulation of the chroma signal.

Entering the Burst Gate circuit from the other end is a flyback pulse signal from the horizontal output transformer which drives the Burst Gate tube into conduction. In some receivers this signal is a trifle delayed (as shown by the waveforms at the left side of the figure) so that it reaches the Burst Gate immediately following the horizontal sync pulse. The timing of the delayed flyback pulse now coincides with the color burst signal. Thus, it is seen that the purpose of the Flyback Pulse Delay Network is to synchronize the timing of the flyback pulse with the color burst at the Burst Gate. Where the gating pulse is broad enough to accommodate the horizontal sync pulse and burst gate signal a delay network is not used.

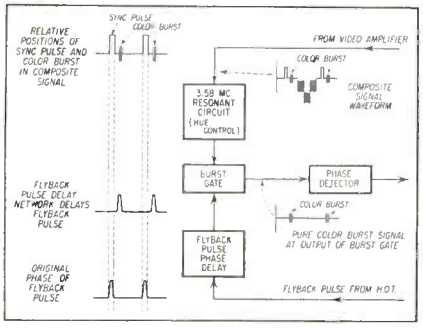

Fig. 1—Functional block diagram of burst gate action in providing pure color burst signal at output of burst gate tube. Where flyback pulse is broad enough to include horizontal sync and burst signals no phase delay network is needed.

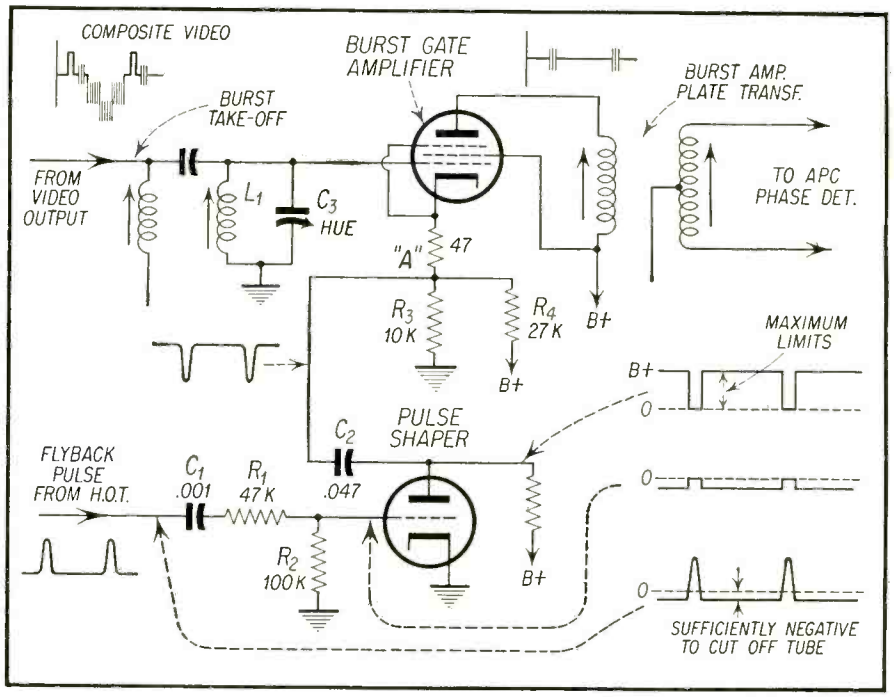

Fig. 2—Simplified schematic of burst gate circuit in CBS I/Q color receiver chassis.

Burst Gate Circuits—CBS

A simplified version of a commercial I/Q Burst Gate circuit is shown in *Fig. 2*. Here a composite video signal is fed into a burst takeoff coil and into the 3.58 *mc* parallel resonant circuit comprising *L1* and *C3*. Hue Control *C3* is adjusted to provide the necessary 33° phase advance to the color burst signal which is fed into the Burst Amplifier. As indicated in previous discussions, correct adjustment of this control is made by the operator when he adjusts it for correct color balance against reference colors such as flesh tones, etc. Although in an R-Y/B-Y receiver this phase shift is not required, a hue control is nevertheless employed to correct for chroma signal phase shift in previous chroma circuits, this control being located in the input to the Burst Gate amplifier or in the Phase Detector circuit.

The manner in which a signal may

be made to undergo a phase shift is shown in *Fig.* 3. In *Fig.* 3*A* we observe a signal of a given frequency entering a a tuned parallel resonant circuit. In *Fig.* 3*B* is shown the manner in which the phase of the output signal is affected as the circuit is tuned in either direction away from resonance.

At resonance, the phase shift is zero. Below resonance the outgoing signal phase may be made to *lead* the incoming signal by as much as 90°. Above resonance the outgoing signal may be made to *lag* the incoming signal by the same amount. In effecting this phase shift, the circuit impedance, and hence the signal amplitude is gradually reduced. However, this phase shift may be as high as 45° in either direction without seriously affecting the signal amplitude.

Returning again to an analysis of *Fig.* 2, the Burst Gate tube is initially biased to cutoff by the negative grid-to-cathode voltage developed across the voltage divider *R3* and *R4*. This circuit contains a tube called a Pulse Shaper which provides a flyback pulse of proper shape and polarity to the cathode of the Burst Gate Amplifier. It is only when a high amplitude negative-going flyback pulse from the Pulse Shaper is present to cancel the positive voltage across *R3* that the Burst Gate tube conducts.

The pulse shaping network consists of *C1*, *R1* and *R2*. This network clips the flyback at the base as shown at the right. In this receiver the flyback pulse is broad enough to accommodate the sync and burst signals so that the color

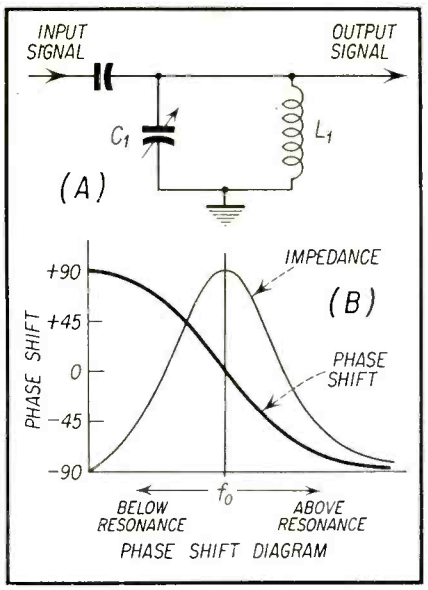

Fig. 3—In (A) we see the signal entering and leaving a parallel resonant circuit. In (B) we observe the phase shift that occurs in a parallel resonant circuit as the circuit is detuned above and below resonance. Above resonance the phase shift is negative. Below resonance the phase shift is positive.

burst appears in the plate circuit of the Burst Amplifier. Connected in this plate circuit is a transformer which feeds the reference burst phase signal to the phase detector.

To summarize the action taking place in this circuit:

1. A delayed positive flyback pulse is applied to the grid of the Pulse Shaper.

2. A negative flyback pulse appearing in the plate circuit of the Pulse Shaper is applied to the cathode of the Burst Amplifier.

3. The Burst Amplifier is triggered into conduction at the same instant that the color burst signal appears in the composite video signal.

4. The plate circuit of the Burst Amplifier contains only the color burst signal advanced 33° in phase, the latter being fed into the phase detector transformer.

Burst Gate Circuit—Motorola

A Burst Gate circuit used in an R-Y/B-Y receiver is shown in *Fig.* 4. Here we observe that the flyback pulse is delayed through the network comprising *R1*, *R2* and *C1*, and is fed a positive pulse into the screen grid of the Burst Amplifier. As a result of this pulse the Burst Amplifier is driven into conduction simultaneously with the appearance of the color burst in the composite signal.

The color burst signal is taken off the bandpass amplifier transformer and is fed into the Burst Gate Amplifier grid via the Burst Takeoff coil. Across this coil we find *C2* the Hue Control which in combination with *L1* is resonant at 3.58 *mc*. In this case being employed in an R-Y/B-Y receiver the Hue Control merely corrects for any phase shift of the color burst signal in previous *chroma* circuits, and thereby provides an exact subcarrier reference

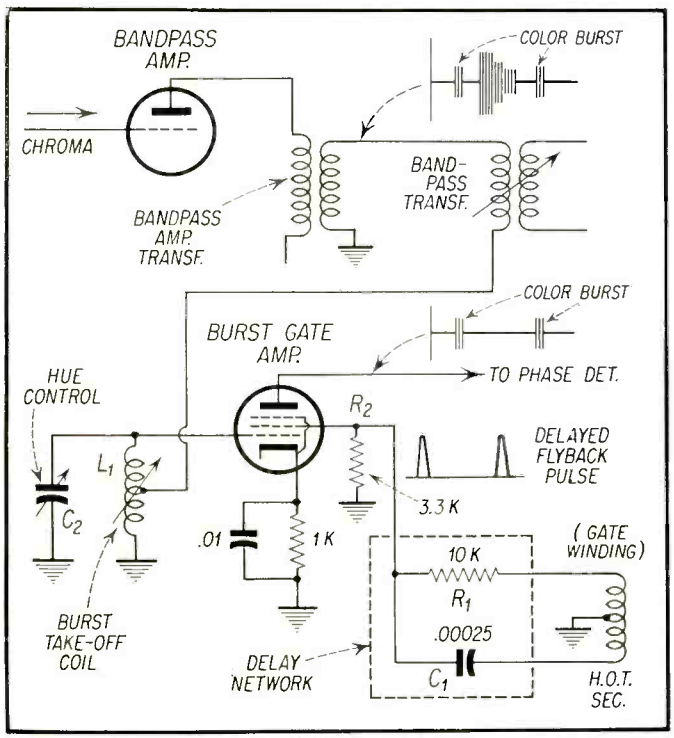

Fig. 4—Simplified schematic of burst gate circuit used in Motorola R-Y/B-Y color receiver.

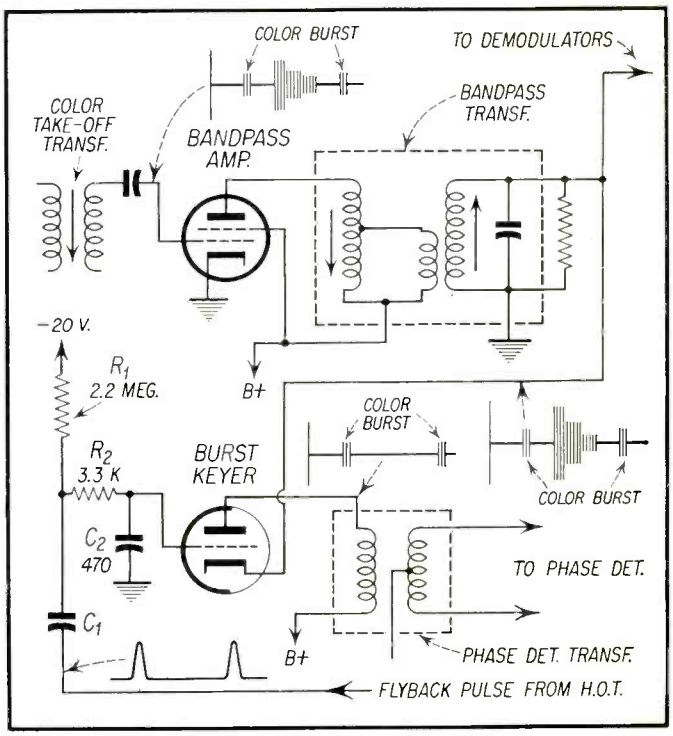

Fig. 5—Simplified burst keyer (burst gate) circuit used in RCA 21CT662U color receiver.

phase color burst signal to the phase detector.

Burst Gate Circuit—RCA

In *Fig.* 5 we illustrate a third type of Burst Gate circuit. Here the Burst Keyer tube is biased –20 volts to cutoff, being returned to the –20 volt buss via *R1*. The positive flyback voltage pulse from the horizontal output transformer via *C1* is sufficient to overcome this bias and drive the Burst Keyer tube into conduction. As in previous circuits a time delay network *R2-C2* provides tube conduction only during the time of the color burst. The latter is fed into the cathode of the Burst Keyer from the Band Pass Transformer. Thus, the signal appearing in the plate circuit of the Keyer tube consists of the color burst signal exclusively, and as such is fed into the Phase Detector Transformer.

Color Burst Circuit—Emerson

A fourth circuit, employing a diode burst gate tube is shown in *Fig.* 6. Here the chroma signal is fed into the Burst Takeoff coil via the primary return of the Demodulator Transformer. This being an R-Y/B-Y receiver no phase shift is given the color burst signal. However, phase shift of the signal which takes place in the components of the previous chroma circuits must be corrected for. This is done by means of the Hue Control which in conjunction with the Burst Takeoff coil forms a 3.58 *mc* parallel resonant circuit.

To understand the operation of the circuit shown in *Fig.* 6 we must first understand how the flyback pulse is developed and fed back to the cathode of the burst gate diode via the 220 ohm resistor. Notice that this flyback pulse is the sum of the voltages across two oppositely phased windings (A) and (B) on the horizontal output transformer. Winding (A) develops a 260 volt peak to peak pulse, and winding (B) develops a 115 volt peak to peak pulse 180° out of phase with winding (A). The peak to peak voltage of the pulse takeoff point Y with respect to ground is thus 260 – 115 = 145 volts.

The voltage waveform across windings (A) and (B) follows the pattern of the conventional waveforms found in a horizontal output transformer secondary but on a somewhat reduced scale. During the trace period represented by (b) in waveform at Y the induced voltage at the terminal Y of the transformer is negative by about 15 volts with respect to terminal X. During retrace however this voltage goes sharply positive by 145 V. Thus, during sweep, the cathode is –15 volts with respect to ground, and during retrace it is +130 volts with respect to ground.

Notice that the plate of the diode is effectively grounded through the burst takeoff coil. Thus, during sweep, when the cathode is negative with respect to plate the tube conducts. During retrace however the cathode is positive with respect to plate and the tube is cut off.

We may now consider the diode as an electronic switch. During retrace it does not conduct and represents the switch open. During sweep the diode conducts and represents the switch closed.

Referring again to *Fig.* 6 we observe that this switch is effectively connected across the Burst Takeoff coil via *C1*. During retrace, the switch is open and the chroma signal is developed across the Burst Takeoff coil from whence the burst signal continues on to the Phase Detector. During sweep, however, the switch is closed and the chroma signal is shorted to ground.

During the latter period it becomes necessary to provide a substantial load to the horizontal output transformer windings. This is taken care of by the 220 ohm resistor in the cathode leg of the diode.

It will be recalled that one of the functions common to the burst gate circuits under consideration is the delay given the flyback pulse so that the Burst Gate tube conducts in time coincidence with the color burst signal. This circuit differs from the previous circuit discussed in that the time delay is effected in another section of the receiver. The following block diagram analysis show how this is done.

Referring to *Fig.* 7 we observe that the composite *if* signal is fed into two detectors, one detector being in the luminance channel and the other in the chrominance channel. The output of the luminance amplifier (A) contains the sync and luminance signals. These are fed into the sync separator the output of which (B) contains only the

[*Continued on page 46*]

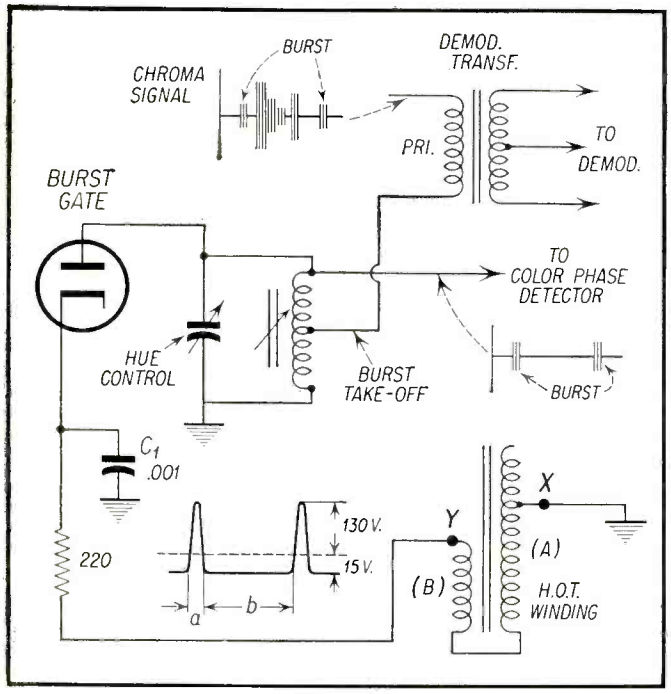

Fig. 6—Simplified schematic of burst gate circuit employed in Emerson R-Y/B-Y receiver.

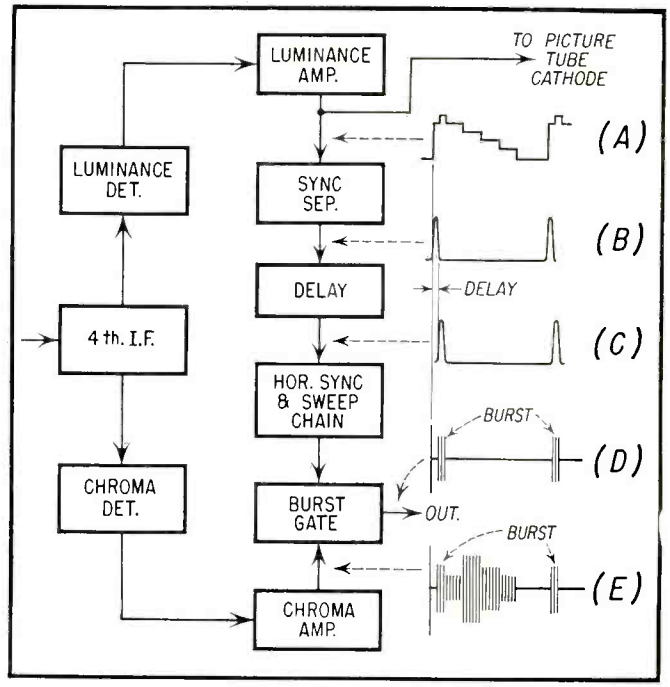

Fig. 7—Sync signal delay in horizontal sync and sweep chain produces burst signal in output.

THE WORK BENCH

Unusual Service Problems And Their Solutions

by Paul Goldberg

This Month's Problems:

Unusual tube trouble
Sound bars in pix
Insufficient vertical sweep

Admiral 22A2

The receiver was turned on and an accompanying whistle was heard from the speaker with the normal audio, but no interference was observed in the picture. This was not the usual tuner howl but of a higher frequency. All the audio tubes were replaced individually but had no effect. The 6V6 and the 6BQ7, tuner oscillator and RF tubes were replaced individually but had no effect. The diagram was then studied. Because there was no interference in the picture it was thought that the oscillation might be caused by the proximity of some wires in the audio circuitry. All the audio wires and components were then pushed and probed and tapped but to no avail. See *Fig. 1.*

While tapping the audio output tube 6V6, the high voltage anode cap was accidentally pushed out of its hole in the C.R.T. (the anode cap is physically directly above the 6V6). When this was done amazingly enough, although there was no raster, there was also no whistle heard from the speaker. Many high frequency whistles are caused by loose connections in the high voltage transformer but usually these whistles are not heard from the speaker but are heard directly from the H.V. transformer.

As a positive check the 6SN7 horizontal oscillator was removed from its socket and the receiver was turned on. No whistle was heard from the speaker. The whistle was thus definitely caused by something in the high voltage supply. The 6SN7 horizontal oscillator, 6CD6 and 6W4 were replaced individually but had no effect. The old trick of tightening up the screws holding the high voltage transformer together was attempted but to no avail. Hopelessly, the 1B3, high voltage rectifier was replaced and to our surprise the whistle stopped. Checking the old 1B3 visually, we assumed that somehow this tube was oscillating internally, either because of a microscopic air hole or a loose element. Whatever it was, the receiver now functioned normally. (The anode lead and H. V. cap, being physically close to the 6V6, acted as the radiating element.)

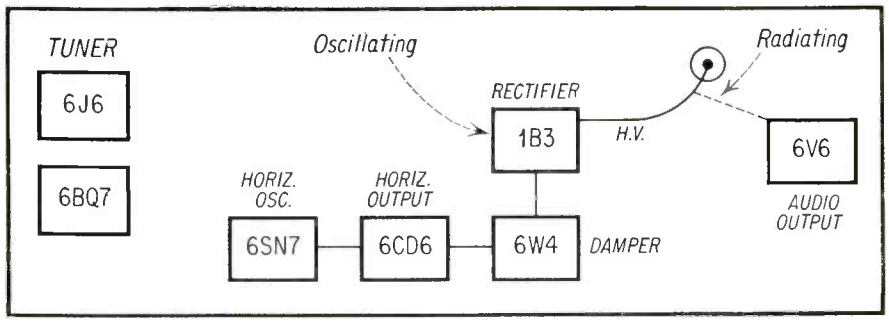

Fig. 1—Partial schematic of Admiral 22A2

General Electric—21T7

The receiver was turned on and it was observed that sound bars were in the picture. The volume control was turned from minimum to maximum to check whether increased volume caused greater sound bar intensity. However, adjusting the volume control seemed to have very little effect. As a positive check, the speaker was disconnected and a 5 ohm resistor was substituted in its place. Nevertheless, sound bars appeared in the picture again. *We had now eliminated the microphonic effect as the cause of the trouble. Also, because an increase in volume did not cause greater sound bar intensity the filters seemed improbable as a cause of the trouble.*

Knowing these facts the picture quality was carefully examined. It was noticed now that a slight herring bone pattern appeared in the picture. This indicates in many cases a misalignment of one of the sound traps (which could cause the sound bar trouble). *L151*, part of the 41.25 megacycle *if* sound carrier trap, was aligned for minimum herring bone in the picture. This solved our problem as the sound bars were

[*Continued on page 43*]

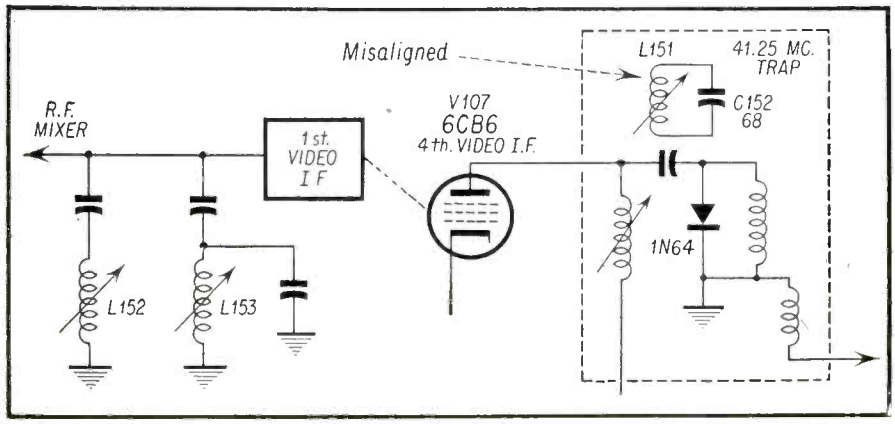

Fig. 2—Partial schematic of General Electric 21T7

The Dyna-Quik Tube

A New Tube Tester Designed For Rapid And

by **Engineering Dept.**
B & K Mfg. Co.

THE DYNA-QUIK Model 500 Tube Tester checks more than 300 of the tubes most widely used in television and radio receivers. It checks these tubes in a very short time because it has relatively few controls. This tester also checks tubes for their Dynamic Mutual Conductance (G_m) in a true transconductance bridge. Diodes are checked for emission only, since they possess no mutual conductance. Each tube is automatically checked for short circuits and leakage up to 1 megohm. These tests are made between heater and cathode, grid and cathode, grid and plate, and screen grid and plate. This test is made before the G_m measurement. Gas, grid contamination, or even obscure grid-to-cathode leakage are all disclosed by an exceptionally sensitive grid current check. This test will reveal as little as 2 microamperes of current in the grid circuit.

Testing Tubes For Dynamic Mutual Conductance

In radio and television circuits practically all tubes (except for rectifiers and diodes) are used as some type of amplifier. Even oscillator circuits (i.e.—R.F. or horizontal oscillators) are just basically amplifiers with regenerative feedback. Therefore, the most important characteristic to be checked to determine how effectively any radio and TV tube will function in its circuit, is its amplification.

The Mutual Conductance is the ratio of the change in plate current that results from a small change in grid voltage.

$$G_m = \frac{\Delta I_p}{\Delta E_g}$$

where:

ΔI_p = a small change in plate signal current.

ΔE_g = a small change in grid signal voltage.

The amplification of a circuit is = $G_m R_L$, where R_L is the equivalent load resistance of the stage. Since R_L is constant in any circuit, we see that the amplification depends directly on the G_m of the tube. The G_m for a given tube can be measured accurately if a small given *ac* signal voltage is applied to the grid and the resultant *ac* plate current measured. This is done by means of a sensitive bridge circuit. Measuring the mutual conductance of a tube provides the most accurate and all inclusive test that can be made on any tube.

Testing Double Triodes And Other Multiple Tubes

In order to quickly test double triodes and other dual tubes, the Mutual Conductance of the two halves of the tube

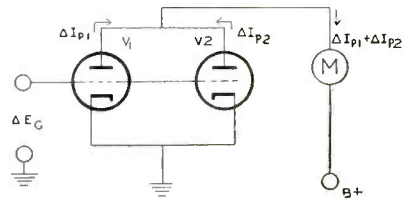

Fig. 1—Measuring G_m of dual triode tubes.

in parallel is measured. In *Fig. 1*, we see that if the same signal voltage $\triangle$Eg is applied to the grid of V_1 and V_2 in parallel, the resultant plate current change measured by the meter will be the sum of the $\triangle$I*p* of each tube.

$$G_m\left(V_1 + V_2\right) = \frac{\Delta I_{p1}}{\Delta E_{g1}} + \frac{\Delta I_{p2}}{\Delta E_{g2}}$$

Since $\Delta E_{g1} = \Delta E_{g2}$

Therefore: $G_m\left(V_1 + V_2\right) =$

$$\frac{\Delta I_{p1} + \Delta I_{p2}}{\Delta E_{g1}}$$

then the G_m reading for the tubes in parallel is the sum of the G_m for each tube.

If either tube is down in G_m then the sum will be low, and the tube

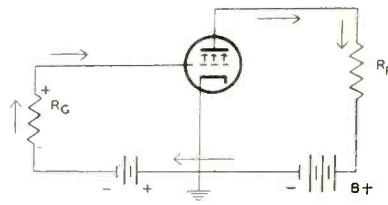

Fig. 2—How negative grid current is developed in a tube.

should be rejected. This way multiple tubes are automatically set up and tested in the DYNA-QUIK with one fast and accurate check.

Life Test

Many manufacturers have found that testing tubes under reduced heater voltage conditions will give a strong indication of its probably useful life. A tube may show adequate G_m under normal test conditions; however, a reduction of 10% to 15% of heater voltage may be marked by a sharp slump in G_m reading. This slump or decay indicates that the space charge of the tube has been depleted to the point where the tube will have a short remaining useful life. While the amount of life remaining cannot be too closely estimated, you can be reasonably sure that a tube showing a sharp slump is not a good risk for continued trouble-free service.

Testing Tubes For Grid Emission Or Gas

The Grid Emission or Gas Test is an invaluable aid in TV servicing because it quickly picks out those tubes which can cause trouble in *agc* sync, *if* amplifier, and *rf* tuner circuits. In order to understand how a tube can have "grid

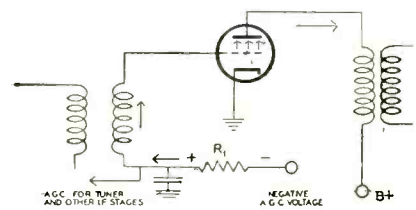

Fig. 3—Effect of negative grid current in a typical IF stage.

Tester

Effective Tube Checking

Fig. 4—Waveform of normal video and sync signal.

emission" and "negative grid current" we must look into the theory of electron tubes.

There is normally some little evaporation of the cathode coating remaining in a tube. Some of this vapor tends to deposit on the grid and causes what is known as "grid emission." Where the grid itself emits electrons the plate draws current commonly known as "negative grid current."

The flow of this "negative grid current" can be followed in *Fig.* 2. The electrons flow from the grid to the plate then back through the power supply to the grid leak resistor *Rg* and up to the grid again. Notice that the voltage drop across the grid leak resistor *Rg* is such that it causes the grid to go more positive than it normally would with no grid emission.

If a slight amount of "gas" is present in a tube some of the electrons from the cathode will collide with molecules of the gas and may knock off one or more electrons leaving positive ions (ionization). Some of these positive ions may then strike the grid, taking an electron from the grid to form a gas molecule again. When this molecule is ionized again, the electron taken from the grid is released and goes to the plate. The electron flow of this "gas current" is exactly the same as it is for the "grid emission current" and can be traced on *Fig.* 2. Notice again that the grid is made more positive by this "gas current."

Now let us see what happens if an *if* amplifier tube in a TV set has grid

Fig. 5—Overloaded or clipped video and sync signal.

Panel view of Dyna-Quik tube tester showing tube numbers clearly visible on front panel. Obsolescence is eliminated by availability of new overlay panels.

emission current or gas current (negative grid current). In *Fig.* 2 we noted that the grid would tend to go more positive if negative grid current flowed.

In *Fig.* 3, a typical *if* stage, we see that if there is any negative grid current, the bias voltage in that stage and

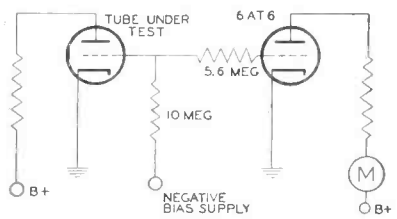

Fig. 6—Grid emission test circuit used in Dyna-Quik tester.

other associated stages will go more positive because of the flow of current through *Rl*. Making the grid more positive will drive the tubes to saturation, causing clipping or overloading.

After detection, a video signal normally appears as shown in *Fig.* 4. If the signal is clipped in an *if* stage it will look like *Fig.* 5. Now the horizontal oscillator will try to synchronize both on the blanking signal (A) and on the very black portions of the video (B). This results in pulling or shaking of the picture. To achieve this sensitive grid emission or gas test, the circuit shown in *Fig.* 6 was employed.

The tube under test has its normal plate voltage applied, but the grid is biased beyond cut-off so that no plate current flows. This bias is applied through the 10 megohm resistor. The same 10 megohm resistor is also in the grid circuit of a 6AT6 d.c. amplifier and the conditions in this tube are such that it, too, is biased just beyond cut-off. Under these conditions, no plate current flows in the 6AT6 and no reading is obtained on the meter in its plate circuit.

However, if the tube under test is gaseous, or its grid is contaminated with some of the cathode coating, then current will flow from grid to plate and through the 10 meg resistor back to the grid again. This will produce a positive voltage drop across the 10 meg resistor, lifting the cut-off bias on the 6AT6 and producing a meter deflection. Upon seeing this deflection, the technician immediately knows that the test tube is defective and a replacement is indicated.

Automatic Line Voltage Compensation

Every effort has been made to make the operation of this instrument as fast and simple as possible. Toward this end, automatic line voltage compensation has been incorporated into the tester. A voltage sensitive bridge monitors the line voltage at all times and automatically adjusts the sensitivity of the *Gm* bridge to compensate for these line voltage variations. This eliminates the necessity of readjusting the line voltage for different types of tubes and at different line voltages.

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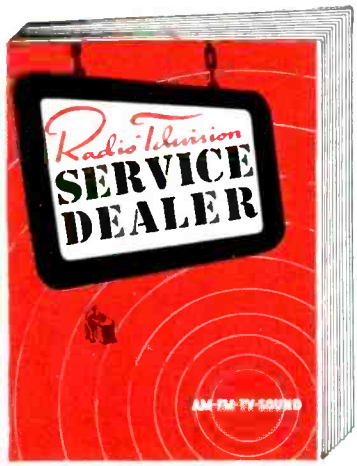

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PROBEMETER

A Signal Tracing Absorption Meter Designed For Trouble-Shooting Radio and TV Receivers

by **Enginering Staff**
Research Inventions & Mfg. Co.

THE "Probe Meter" is a broadly tuned probe and absorption meter designed to trace signals thru a T.V. or radio, from above or below chassis. No connecting or extension wires are necessary when tracing signals; however, if greater sensitivity is desired or when measuring voltage, the plug-in ground return wire is used. A convenient pin jack outlet is provided for use with a scope or phones.

Externally, the "Probe Meter" is a combined probe, meter, tuning, and attenuation control. The possible positions of the control are labeled OSC. IF, RF, VIDEO, HZ. SWP., ARC., AUDIO., an attenuation range and 500 V.D.C.

Circuit

Internally, the "Video Probe Meter" utilizes a broadly tuned circuit (See *Fig. 1*) using a high efficiency germanium diode for detection. The coil is so tuned that it encompasses directly and harmonically with most general frequencies associated with a TV or radio. The circuit is a double tuned series arrangement containing a high and a low frequency coil. The high frequency coil responds generally to megacycles; and the low frequency coil absorbs energy in the kilocycle and lower megacycle range, and also acts as a peaking coil.

Broad tuning or selection is accomplished with a ¾ meg. potentiometer. With this control the impedance of the circuit can be varied and signals can be attenuated. With the use of this potentiometer, extremes of frequencies can easily be selected. Direct contact to a "live" circuit forces a signal into the meter and increases the broad band characteristics of the probe (by-passing the tuned effect), thus enabling attenuation with the same impedance control. The coil is wound so that its fundamental and harmonic reception is greatest (more sensitive) to wanted TV frequencies. (IF's 22*mc*, 44 *mc*.)

The 500 V.D.C. scale can be used conveniently when testing for *dc* voltages. (20,000 ohms/Volt.)

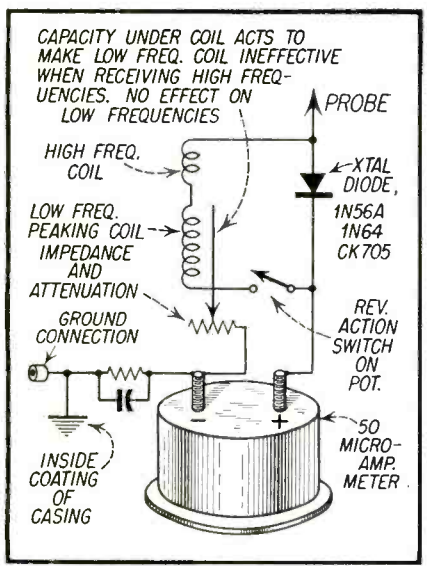


Fig. 1—Functional schematic of internal connections of Probemeter. 50 microamp. meter is used.

Signal Tracing

When tracing signals above chassis (in the home), the pick-up loop or ring is slid over each succeeding *if* or video amplifier tube. In a weak signal area, the strongest channel is used and the oscillator fine tuning on TV is adjusted for maximum reading. When tubes are shielded, the tube shield is loosened from chassis ground and the probe is touched to shield to obtain a reading.

Where internally shielded tubes are encountered, such as the 6AU6, the pick-up loop is slid to the extreme bottom of tube. If a strong signal is available, radiation can be detected from the second or third *if* stage; however, it is usually difficult to detect a signal thru internally shielded tubes. An interesting feature of the pick-up loop is that it is flexible and expandable and can be used on tubes of various sizes. Where it is difficult to detect radiation or signal from a tube, the tube is removed and the probe inserted directly into grid pin of the socket. It is not necessary to know which pin is the grid; if a signal is present the meter can determine that. All pins are tried until needle deflection is observed. This pin will be the grid. By the same process it is very easy to locate the grid circuit (input) and plate circuit (output) on tubes of which the pin connections are unfamiliar.

Fig. 2—Actual photo of Probemeter illustrates ease with which it may be applied to circuits being tested. Complete unit is shielded.

This *rf* probe and absorption meter is basically designed to select and differentiate between *high frequencies* (above 1 megacycle) and *low frequencies* (below 1 megacycle). The positioning of the indicator knob selects the two basic settings.

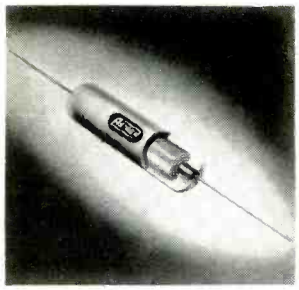
The probe is selective to the higher frequencies when the indicator knob is turned to the extreme *clockwise position* (VIDEO, OSC. IF. RF.). These frequencies (above 1 megacycle) include the carrier, local oscillator, *if*, video, sound *if*.

The meter will receive low frequencies (kilocycles) when the indicator knob is in *any other position* (except the high frequency position) including the attenuate position. However, the greatest sensitivity or selectivity to low frequencies is in the adjacent range, labeled (VIDEO, HZ. SWP., ARC.). This position is used for testing low frequency content of video, horizontal

[*Continued on page 44*]

NEW COMPONENTS

In requesting more detailed information on these products, please write the code number of the product on a postcard and send it, along with your company letterhead or business card, to New Products Dept., SERVICE DEALER, Suite 510, 67 West 44th St., New York 36, N.Y.



Astron Capacitors

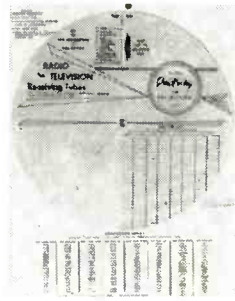
The Astron Corporation's Blue Point Capacitor utilizes an advance-type thermosetting impregnant which exhibits high capacitance stability, low power factor and high insulation resistance over its temperature range of −40°C to + 85°C. The unit is small, has excellent resistance to vibration and shock, withstands continuous 85°C operation without derating, and has extra clear marking for ease of identification and installation and wide range of values. For data, check C19.

Mall Kit

A home economy kit, featuring 22 pieces, has been announced by the Mall Tool Co. Specifications of the Model 149B Drill are: Capacity, 1/4" steel and 1/2" wood; motor, ac-dc, 25 to 60 cycle; chuck, geared key type; voltage rating, 2.3 amps; bearings, ball and bronze oilite; free speed, 2500 RPM; load speed, 1500 RPM; length 8" overall; net weight, 3 lbs., equipped with 7 ft. cord, plug and ground. Included in this 22-piece kit are: geared chuck drive; pedestal; 9 drill bits; a 5" rubber backing pad; 6" polishing pad; six abrasive discs; paint stirrer; side handle and steel carrying case. For data, check C13.

Airport Pin Locator

Airport Television and Radio Co. has developed a simplified vacuum tube computer, the Quick-Way Tube Pin Locator, which determines what each tube pin signifies at the socket base. The unit operates with a turn of the dial, covers hundreds of receiving tube types. When set to tube number, it selects all pin locations. A new tube log imprinted on the face eliminates obsolescence. For data, check C12.



Stackbin Shelves

Sectional Stackshelves are individual shelf units that stack and interlock without tools or bolts. Each Sectional Stackshelf can be easily arranged and rearranged to suit user's convenience. Stackshelves are made of heavy gauge sheet steel with a baked-on enamel finish, have an all welded construction for long life. Individual Stackshelves can be made in a variety of depths and heights. Widths are standard 37" so that units of varying depths and heights can be stacked to fit user's requirements. For further data, check C15.

G-C Phono Drive Kit

A new dealer phono-drive kit, called the "G-C P400 Phono Kit," is being produced by General Cement Mfg. Co. There are 51 exact replacement drives in the new kit, making it easy to service a majority of popular record changers and tape recorders. The G-C line includes a total of 78 different styles being available to meet every phono servicing problem. A complete reference chart, suitable for wall mounting, is packed with each kit. For data, check C16.

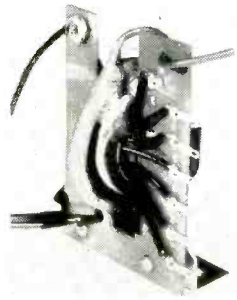
Hersee Co., 20 Old Colony Ave., Boston 27, S
Radio Speaker Switch 9137 Antenna Switch

Cole-Hersee Switches

Cole-Hersee Co. is marketing switches for use in automobiles equipped with power operated antennas and front and rear seat speakers. Push-pull momentary antenna switches No. 9137 and 9136 are used to raise and lower power-operated antennas from the driver's seat. Three position rotary switches Nos. 7543 and 7595 permit independent or simultaneous operation of front and rear seat speakers. Each of these switches is supplied with ivory plastic knobs firmly attached with a hardened set screw. For data, check C18.

Merit Flybacks

Merit Coil & Transformer Corp. is now manufacturing two flyback transformers for exact replacement. The HVO-50 is an exact replacement for Trav-ler and may be used to replace part numbers TV-X-104 through and including TV-X-114 used in more than 75 Trav-ler models and chassis. The HVO-52 is an exact replacement part for Hallicrafters, Coronado, Silvertone and Truetone. It can be used to replace parts numbers 55C133, 55C143 and 55C144, used in more than 50 models and chassis. For data, check C14.

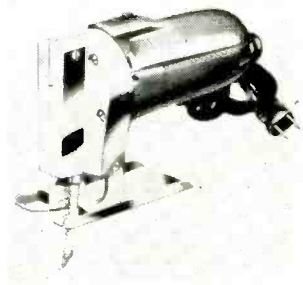


Radiart Display

With some 45 models available, the Radiart Corp. announces modernization and expansion of its VIPOWER line of vibrator-powered converters. To merchandise this line most effectively, Radiart is making available to distributors, free with initial stock orders, an impressive "Consumer Department," 2-color, metal rack, occupying less than 2½ feet of floor space, which strikingly displays a wide variety of converters. The line covers a range of AC-to-DC power outputs from 2 to 350 watts. For details, check C11.

Merad Cement

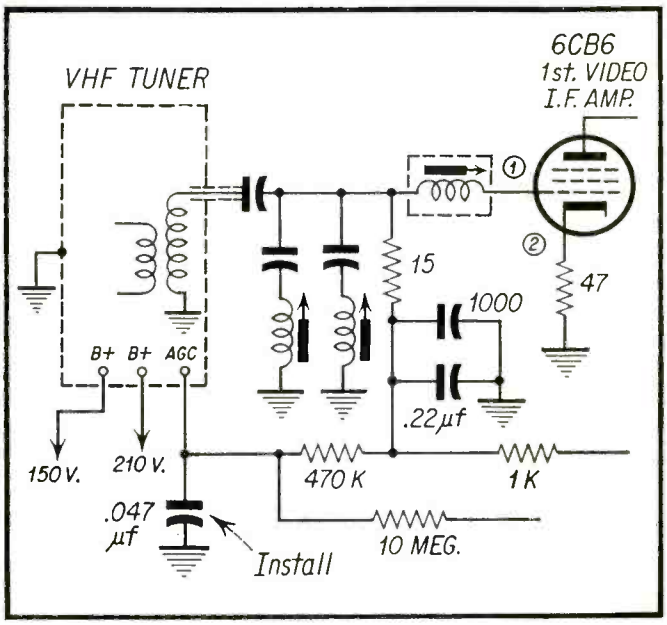
New, fast-drying industrial coatings and adhesives of extreme bonding strength which will not shrink or embrittle are now available in "custom" formulations from Merad Laboratories, Inc. Merad coatings and adhesives are solvent-release synthetic resin formulations which will not shrink or embrittle under the most adverse conditions. They become stronger with age, and in most cases are stronger than the materials they bond. Chemically inert, the formulations will not cause rust or corrosion. Drying rate can be controlled from a few seconds to 24 hours. A smooth, clear, glossy film is guaranteed with no sagging or wrinkling at bonding points. For data, check C17.



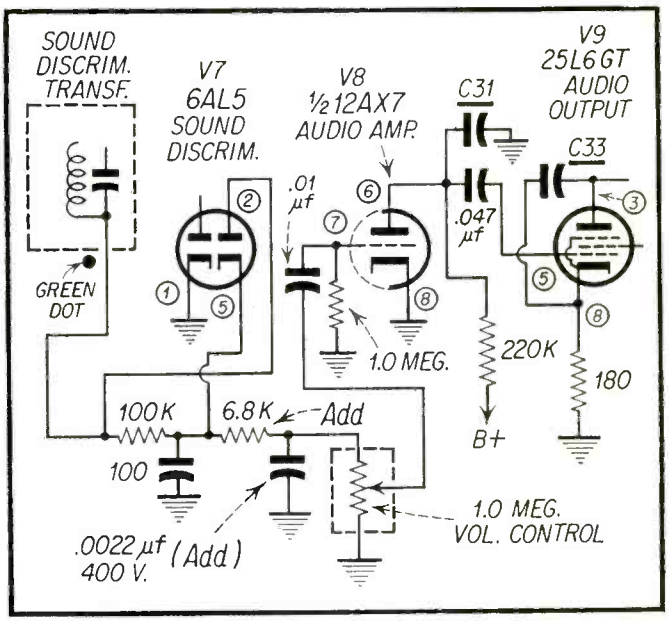
WEN Saw

This new Model 505 Saw, introduced by WEN Products, has a simple method of counterbalancing the reciprocating parts that holds vibration to a minimum, and a fan which blows an airstream over the work to keep the guide line free of sawdust. The Saw is 6¾" long, 5" high (less blade) and has a shipping weight of 4½ lbs., individually packed. It is powered by a 115 volt, a.c./d.c., 1.8 amp. motor. Fine, medium and coarse blades are supplied with each saw. Blades have a 5/8 inch stroke and the motor delivers 2650 strokes per minute under load. For further data, check C10.

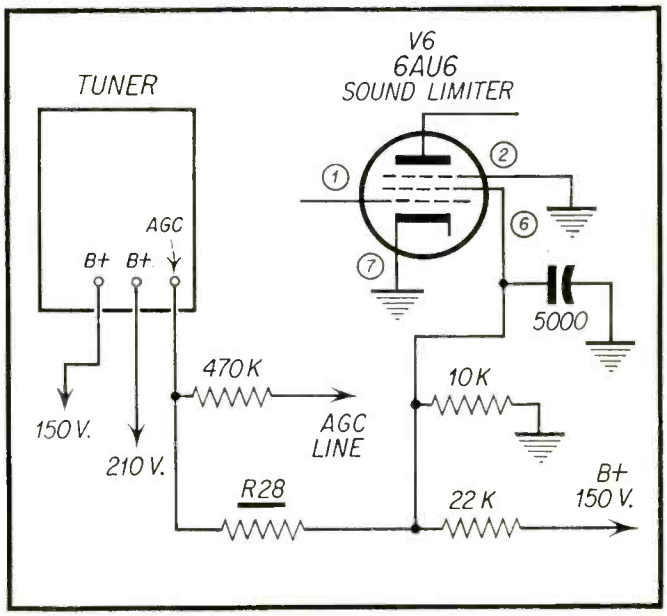
Mfr: Emerson **Chassis No.** 120220-D, 120239-D, F
Card No: EM120220-1
Section Affected: Pix
Symptom: Moving hum bar in pix in areas where receiver and transmitter sources of power are not in sync.
Reason for Change: Circuit improvement.
(Chassis incorporating this change have been coded as follows: $120220\text{-}D_B$, 120239_B, 120239_A).
What to Do:
Install: .047 μf — 400 V condensers between tuner *agc* lug and ground.

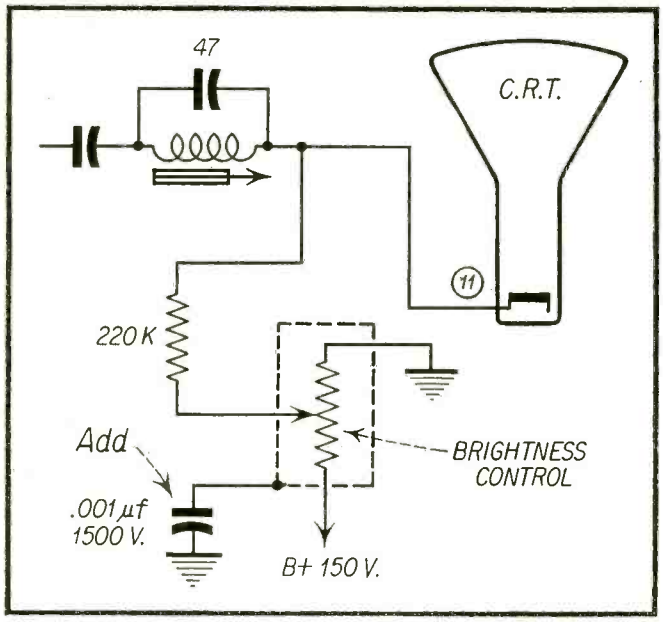


Mfr: Emerson **Chassis No.** 120220-D, 120239-D, F
Card No: EM120220-2
Section Affected: Sound
Symptom: Audio response not up to par.
Reason for Change: Circuit improvement.
(Chassis incorporating this change have been coded as follows: $120220\text{-}D_C$, $120239\text{-}D_C$).
What to Do:
Install: 6.8K ½W resistor in top side of volume control.
Also, .002 μf — 400 V condenser across volume control.
Change: *C31* (.0047 μf) to .001 μf — 400 V and *C33* (.47 μf) to .01 μf — 600 V.
Note: If audio buzz is encountered try different 12AX7 tubes. If audio buzz persists restore set to original condition except that *C33* is left at .01 μf — 600 V.



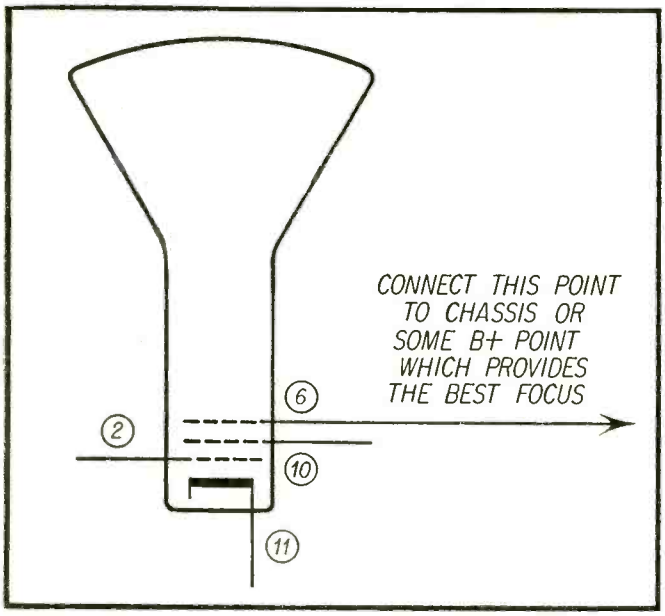
Mfr: Emerson **Chassis No.** 120239-F (17")
Card No: EM120220-3
Section Affected: Sound
Symptom: Audio buzz in strong signal areas.
Cause: Tuner overload.
(Chassis incorporating this change are coded $_D$)
What to Do:
Change: *R28* (10 meg) *agc* delay resistor to 15 meg.





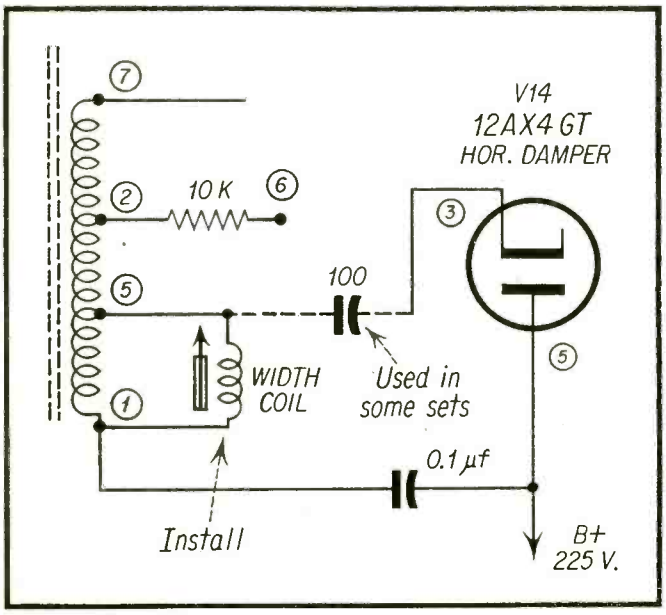
Mfr: Emerson **Chassis No.** 120220-D, 120239-D

Card No: EM120220-4
Section Affected: Sound
Symptom: Buzz pickup
Reason for Change: Reduce buzz pickup.
(Chassis incorporating this change are coded as follows: 120220-O_H, 120239-D_H).
What to Do:
Add: 1000 μμf — 1500 V ceramic condenser between brightness control case and chassis.



Mfr: Emerson **Chassis No.** 120220-D, 120239-D, -F, 120251-D, 120254-D

Card No: EM120220-5
Section Affected: Raster
Symptom: Focus not up to par.
Reason for Change: Better overall focus.
(Chassis already incorporating this change are coded as follows: 120220-D_I, 120239-D_I, 120239-F_E, 120251-D_A, 120254-D_A).
What to Do:
Reconnect.: Red lead from kinescope socket (Pin 6) and connect to B+ point which provides best overall focus.



Mfr: Emerson **Chassis No.** 120220-D, 120239-D, -F, 120251-D, 120254-D

Card No: EM120220-6
Section Affected: Raster
Symptom: Too much width.
Cause: Line voltage too high.
(Chassis incorporating this change are coded as follows: 120239-D_I, 120239-F_E, 120251-D_{HI}, 120254-D_{HI}).
What to Do:
Install: Width coil (part #708068 or equivalent).

RADIO-TELEVISION SERVICE DEALER

INDEX FOR 1955

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Rider TV Field Manual Service Data Sheets

Trade Flashes

TV Service Information Sheets

Video Speed Servicing Systems

Workbench

TRADE FLASHES

[from page 7]

Radio and Television Division of Sylvania Electric Products Inc., starting in April, 1956. Arthur L. Chapman, Vice President-Operations, said, "We have waited until we were confident a color set could be manufactured meeting our own requirements for color quality, reception and other factors. We feel it now can be done." Mr. Chapman said the Sylvania color sets would have 21-inch picture screens with 250 square inches of viewing surface. The picture tube to be used, he said, is "tested in our own production over the past year," during which Sylvania has manufactured color tubes for several other set makers.

H. G. Cisin's TV & Radio Tube Substitution Guide provides a serviceman with valuable data for the replacement of tubes in TV sets, radios and other electronic equipment in instances where the identical replacement type is unobtainable. All tubes suggested for substitution have characteristics similar to the tubes that are to replace them and will fit in the same socket and do not require any changes in wiring whatsoever.

America's electronics industry will attain sales and revenues of aproximately $10,800,000,000 in 1956, nearly a billion dollars greater than the 1955 volume, Don G. Mitchell, Chairman and President of Sylvania Electric Products Inc., predicts. Mr. Mitchell also estimated that the industry's volume would exceed $15,600,000,000 by 1960, and $22,000,000,000 by 1965. In discussing the potential of television, Mr. Mitchell pointed out that about 7,600,000 sets will be sold to the public during 1955, representing television's biggest year to date. The dollar volume of factory sales of television receivers will total $1,055,000,000. He estimated that TV set sales to the public in 1956 would be approximately 7,500,000, about 200,000 being color sets. This would total a factory-door value around the billion dollar mark. In 1960, combined sales of monochrome and color sets are expected to total about 9,600,000, a new record, with dollar value of about $1,521,000,000. At the end of the ten-year span, in 1965, it is likely that 11,600,000 sets will be sold, at a factory price level of nearly $2,000,000,000. In contrast to the relatively small percentage of color sets in the 1956 total, Mr. Mitchell pointed out, about 31 per cent of all sets sold to the public in 1960 will be

color sets, and 72 per cent of total set sales in 1965.

"Color is on the way, after a slow start," Mr. Mitchell said. "But it will be some time before color sets will be marketed in large quantities, and it will be about six years before color television unit sales catch up with black-and-white."

Radio set production passed the 1.5 million mark in October, the highest output level attained in a four-week reporting period since February of 1948, the Radio-Electronics-Television Manufacturers Association reported recently. From January through October, 11,527,568 sets were turned out compared with 8,040,230 in the same period of 1954 when total production was just over 10.4 million. Unit output of television receivers declined to 759,735 in four-week October, RETMA reported, compared with 939,515 in September, a five-week period. During October a year earlier, 921,476 TV sets had been manufactured. Through October, 6,520,241 television receivers were manufactured compared with 5,654,791 turned out in the same period of 1954. Of the October TV output, 109,574 sets were manufactured with UHF tuning facilities, bringing the 10-month total to 977,537. FM radio production increased to 38,920 in October while an additional 5,749 TV sets with FM tuners were manufactured.

The Radio-Electronics-Television Manufacturers Association filed an extensive petition with the Federal Trade Commission requesting amendment of two Trade Practice Rules for the Radio and Television Industry which are scheduled to become effective Dec. 28. The two rules which RETMA recommended be amended relate to the method of designating television screen sizes and a requirement that television picture tubes using repossessed glass in their manufacture be designated as "used." In connection with Rule 9, Deception as to Size of Picture, the RETMA petition points out that as promulgated by the FTC the rule offers "perhaps 20 different methods of measurement" as opposed to one standard system of screen size designation now used by the industry. The current "industry practice is neither deceptive nor unfair, and the change suggested . . . would be against the public interest," RETMA charged, "since the resulting confusion would be enormous." Comments on Rule 12 were confined to cathode ray tubes and the effect which the rule would have on the universal industry practice of re-using the outside container or envelope. Under the FTC proposal, a cathode ray tube in which a

used envelope is employed, but which is subjected to the same manufacturing process and tests as a tube using new glass, would have to be marked "used." RETMA contends there is no difference in the quality of picture tubes with re-used containers from those with unused containers if both have all new functional parts and if both have been subjected to the same manufacturing processes and standards.

An electronic tube warehouse and commercial service office has been established by the General Electric Tube Department at Seattle, Wash., to keep pace with the expansion of the electronic tube market in the northwest, according to W. C. Walsh, western regional manager of distributor sales. The tube warehouse is located at 220 Dawson Street, Seattle.

The first complete line of 21-inch color television receivers soon will be available to the public, it was announced by C. P. Baxter, Vice-President and General Manager, RCA Victor Television Division, Radio Corporation of America. The sets, all featuring RCA's simplified 26-tube circuits and the RCA 21-inch tricolor picture tube, will carry nationally-advertised list prices ranging from $695 to $995.

"Now for the first time, we are prepared to market a line of 21-inch color receivers. The receivers are of proven RCA Victor technical quality and ease-of-operation and will be produced in sufficient quantity, and supported by promotional activity of sufficient magnitude, to convince everyone, beyond any shadow of doubt, that color television will be big business for the industry in 1956," said Mr. Baxter.

ANSWERMAN

[from page 19]

Now, if the positive *dc* voltage applied to the cathode and grid of the *agc* amplifier tube is reduced for some reason the tube conducts more electrons, resulting in a greater negative voltage being developed in the *agc* system. Also, if this *dc* voltage is reduced it results in a lower voltage supplied to the plate of the video amplifier. The video amplifier tube under these circumstances provides less signal at its output to be applied to the grid of the *agc* amplifier bringing about the development of an even greater amount of negative *agc* voltage. The total result can be a biasing of the *rf* and *if* stages to such an extent that the signal is cut off in these stages. This would be evident by a measurement of the negative voltage at the plate of the *agc*

amplifier which is normally —20 volts.

As can be noted the entire trouble hinges around the lower voltage being supplied to the cathode of the *age* amplifier tube. Most probably this is caused by an increase in the value of *R501,* the 4300 ohm resistor which is a large wattage voltage dropping resistor in the B plus circuit.

The reason that sound is heard when a horizontal tube is taken out of the socket is because this also removes the positive pulse that is normally coupled to the plate of the *age* amplifier for the development of the negative *age* voltage. Without the pulse no negative voltage can be generated and thus the *if* circuits are opened up and signals pass.

Although this case involves a different receiver and circuit, the condition is somewhat similar to one considered a few months ago. It is presented because of the frequency of occurrence of this type of failure and the consistent confusion that is experienced in servicing this type of difficulty.

Dear Sir:

Do you know any easy method of troubleshooting the printed panel chassis? It is very difficult to circuit trace these chassis since generally the printed wire is on one side and the components are on the other. I find that by the time I go from one side to the other of the printed panel working my head back and forth like the pendulum on a metronome I have a stiff neck.

Are there any points about servicing of these panels that will speed up my repair work?

S. T.
St. Louis, Mo.

One means of simplifying and speeding up the servicing of these printed wire panels is to place a 50 or 60 watt bulb in back of the panel. Generally, the panel is thin enough so that the components are silhouetted on the etched wire side.

There have been some suggestions made with regard to this to the manufacturers such as printing the symbols and connections of the components in black ink on the printed wire side but nothing has come of it yet.

Another point that should be realized is that not all pigtails must be removed from the panels. In most cases it will be easier to leave the component lead in the panel with sufficient length so that the pigtail of the new component can be mechanically connected and then soldered to the original pigtail. This avoids the necessity of heating the panel and possibly causing damage. It would seem to be advisable to follow this procedure whenever possible.

Many technicians have questioned

TV set manufacturers as to whether these panels are available as replacement items. In almost all cases the reply has been in the affirmative but there has as yet not been any great need for them. Very seldom does the whole panel require replacement. If, as an example several etched leads should become damaged it is a simple job to connect the points together with ordinary hookup wire.

Dear Sir:

I have a condition in a Motorola TS-531 chassis where the sound is affected with a sync buzz and a slight amount of background noise. I know it is sync buzz because it is variable with the fine tuning control. I have made all the usual checks, such as tubes, voltages, adjustments and nothing has been of any help.

Can you suggest anything additional I can try?

K. P.
Madison, Wisc.

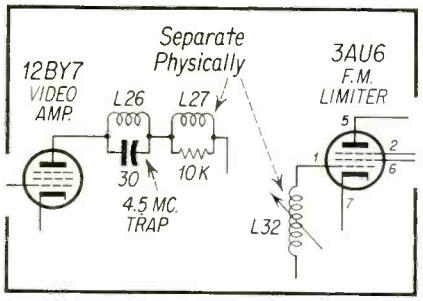


Fig. 3—Partial schematic of Motorola TS-531 circuitry.

Very frequently a condition of the type you have described can be minimized by component lead dress. In general, leads with strong video signals dressed near to grid leak resistors in the audio amplifier system can induce enough voltage to bring about this type of interference.

It is also possible that the video peaking coil, *L27*, is in close proximity to the sound *if* system such as the first *if* sound coil, *L32*. See *Fig. 3*.

Mr. Answerman:

How do I check the new tubes such as the 3CB6, etc., since they are not listed for my tube checker? Do these tubes correspond to the six volt type except for the filament voltage?

T. C.
Los Angeles, Cal.

This is correct in that no case comes to mind where it doesn't apply. Where there exists a prototype of the 6 volt variety that is now designated as having a 3 volt filament the other tube characteristics are identical. These tubes are the new 600 ma. type with the con-

trolled heaters and they are generally employed in the series string receivers.

In the case you point out involving the 3CB6 tube its other characteristics are exactly the same as the 6CB6 tube except for their filament voltages which can be adjusted for on tube checkers. It is most important that this filament voltage setting on the tube checker be made before the tube is inserted. Otherwise, the filament knob may be in its filament setting for 6 volt tubes and damage can be caused to the filament of the 3 volt tube under test. Aside from this consideration the characteristics of the 6 volt equivalent tube is used in testing.

FLASH-MATIC [*from page 22*]

with the contacts of the plate circuit relay. The cam operated switch contacts may be seen in *Fig. 4* within the dashed rectangle representing the motor unit. The beam of light may now be removed from the photocell, and even though the contacts of SW-3 will open, the motor continues to turn since the circuit is held closed by the parallel contacts of the cam operated or "homing" switch.

The motor continues to turn until the cam makes one complete revolution. At this time, the cam once more actuates the switch trip latch, opens the homing switch, and the motor stops rotating. The gear arrangement is such that when the index cam makes one revolution, the turret tuner is turned from one channel to the next.

Clockwise rotation is produced in a similar manner. The second triode of the 6BX7GT is the control tube. As mentioned previously, one side of the line is permanently connected to terminal #1 of the motor unit. When SW-4 (see Zenith schematic in insert) is actuated, it connects the other side of the line to terminal #4 of the motor unit, and the motor begins to turn the tuner in a clockwise direction. The clockwise homing switch then takes over. By the cam action previously described, the homing switch opens and stops the rotation when the tuner has moved to the next channel.

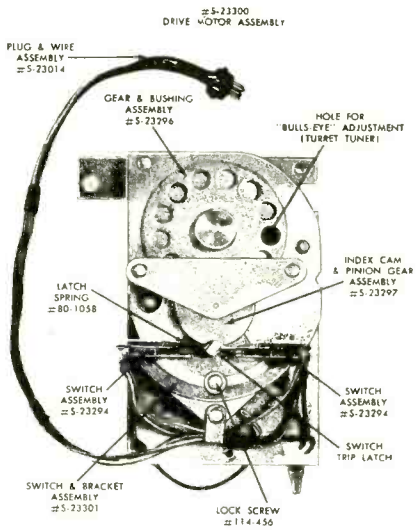


Fig. 5—Drive Motor assembly

The Switch SW-5 shown in *Fig. 4* allows the motor to be operated from the panel without the use of a light beam. When it is depressed it feeds the positive voltage from SE-2 through a 47K resistor to the grid of V3A by means of the CCW sensitivity control. This causes a heavy flow of plate current and actuates the plate relay. The action then proceeds as previously described. The location of this switch may be seen in upper lefthand corner of *Fig. 1*.

Service Hints

1. Examination of the schematic of the control unit reveals that all four tubes are operated with *ac* rather than *dc* on the plates. The relays and solenoids are actuated by the current flow during the positive swing of plate voltage. For this reason, plate voltage should be measured with the meter set up for *ac* rather than the usual *dc* measurements.

2. There are three different control

units in production. They are identified by color dots marked near the "Auto-Manual" switch of the control chassis. The unit we have described is identified by two dots, one yellow and one blue. One of the other two units is identified by a single yellow dot, and the other by a single red dot. Circuit operation is similar for all units but there are slight differences which were made necessary by differing characteristics of the photocells. When replacing photocells therefore, make certain that the correct type is used. The photocells are not interchangeable for all three units.

3. Trouble shooting procedures are similar to those commonly used by servicemen. If any of the control circuits fail to operate, the trouble may be isolated to either the switching circuit or the control circuit by moving the switch contacts by hand. If the switching action takes place when this is done, the trouble must lie in the control circuit itself. If the switching action does not take place when this is done, then the control circuit is probably operating and the trouble will be found in the switching circuit.

WORKBENCH

[from page 27]

also eliminated from the picture. *L153* and *L152*, the 47.25 *mc* and 38 *mc* traps were not touched as the picture quality was now excellent. See *Fig. 2*.

The picture *if* carrier is 45.75 *mc* in this receiver. The sound *if* carrier is 41.25 *mc*. These two frequencies beat together and form the sound intercarrier frequency of 4.5 *mc*. The purpose of *L151*, (the misaligned trap) is to remove the 41.25 *mc* sound *if* carrier in order to keep it out of the video amplifiers. It is obvious therefore that because this trap was misaligned the 41.25 *mc* frequency was getting into the video amplifiers thus causing the sound bars.

Dumont RA-105

The receiver was turned on and it was observed that this receiver had insufficient vertical sweep. Adjusting the vertical size control did not correct the problem. The 6SN7, V221 vertical output tube, and ½ 6SN7, V220B, vertical generator were replaced but had no effect. See Fig. 3.

There are a certain number of components to check when up against a problem of this kind. Before making any checks however, it is important to check the vertical linearity of the raster by varying both the vertical size and vertical linearity controls. If the vertical linearity of the raster is satisfactory, then a number of components can be eliminated as possible causes of

trouble. In this case, the vertical linearity of the raster seemed to be correct. Thus, I repeat, all components that could cause defective vertical linearity were eliminated as a possible cause of this trouble.

Now the dropping resistor to the vertical output transformer T202 was checked. *R315* and *R316* checked correctly at 10K each. Next the load resistor of the vertical oscillator, *R309*, was resistance checked. It also checked correctly at 820K. The filter condenser *C265A*, 30 *μf*, was next clipped out and replaced with a new one but it had no effect. At this point, the vertical output transformer, T202, was our next possibility. However, before replacing the vertical output transformer, a few voltage checks were made. The plate and cathode voltages of V221, the vertical output tube were checked at pins

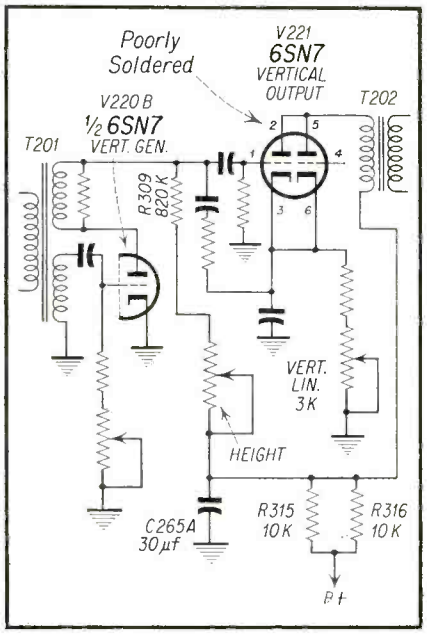


Fig. 3—Partial schematic of DuMont RA105

#5 and #3. While this was being done it was noticed that pin #2 which was tied directly to pin #5 was poorly soldered. Immediately a voltage check was made at pin #2. The meter read zero. The raster was observed after pin #2 was soldered. The vertical size was now more than enough. The vertical size control was now adjusted and the receiver functioned properly. (Naturally, with pin #2 disconnected only ½ of the 6SN7 is operating.)

PROBEMETER

[*from page 31*]

oscillator or sweep signal, audio, radio oscillator and radio sound IF's, vertical

oscillator, arcing, noise pulses and sync pulses. Low frequencies give little or no indication when the pointer knob is in the extreme clockwise position (VIDEO, OSC, IF, RF) (high frequency position).

Audio is generally received in the 3rd position (VIDEO, AUDIO). For low frequencies, the knob is turned slightly for maximum indication.

Strong high frequency signals can be received when the indicator knob is not at the high frequency position. This depends upon the strength of the signal and whether a direct contact test is made. Thus, strong high frequency signals can be attenuated. This is usually necessary at the latter *if* or video stages.

To establish that video is present at the socket of the picture tube (grid or cathode pin) an approximately equal reading must be obtained on both the high and low frequency positions of the meter. Equal proportions of high and low frequencies indicate good video. If the signal at the video output stages indicates only on the high or low frequency position, then the indicated signal is not video. When making this test care must be taken however that the receiver selector is on channel, that the fine tuning oscillator is tuned to maximum frequency response, and that the receiver antenna is turned in the proper direction. Generally, when high frequency only is indicated at the cathode or grid of the picture tube, the pix *if* signal has not been detected (at the detector). The indicated high frequency would be caused by the pix *if* signal, beats or oscillations.

Predominance of low frequency response can be caused by open peaking coils, mis-alignment, oscillations, improper or defective circuits, etc.

Many TV sets (especially those with *un-shielded horizontal* and high voltage power supplies) are saturated with the 15 *kc* horizontal sweep signal (chassis and wiring). Thus it is possible, with the probe meter to get a horizontal reading at any point on the chassis. Any unrelated circuit, wiring, or any point that will afford a path or act as an antenna for the signal. To determine if the offending signal is the horizontal sweep signal, simply turn control to the high frequency position (OSC, IF, RF), or to verify, remove horizontal oscillator or output tube. (Note: When the control is in the high frequency position it is extremely difficult to get a horizontal or low frequency reading.)

When checking B plus voltage (use plug-in ground wire) the knob is turned to the extreme counter-clockwise position until the switch is activated. The meter will indicate B plus or *ac* when the knob is in the attenuate position. This reading is not to be con-

fused with the signal reading when testing under the chassis. Excessive *ac* can usually be detected in the B plus circuit or supply. A .1μf condenser is connected in series with the meter to block out the *dc* voltage.

The effect of *age* must not be forgotten when attempting to measure gain. *AGC* can nullify the gain at the 1st stages. To disable the *age* circuit, a tube is removed in the latter stage (2nd or 3rd *if*), or, if available, the *age* control is turned off.

Color TV

The Probe Meter is especially useful for troubleshooting color TV circuits. Here, proper balance and proportion of signal is important. Oscillators can be tested immediately. Tracing and comparing signals can be done with comparative ease. A test to determine the amount of signal entering the grid of each of the three guns can be done immediately after the back is removed.

COLOR

[*from page 26*]

sync pulses. Also connected in the output of the sync separator is a sync delay network which provides the delay shown in (C). Thus, the retrace pulses developed in the horizontal output transformer have this same delay.

Returning now to the chroma signal we notice that the output of the chroma amplifier (E) is in the same time phase as waveforms (A) and (B). For this reason the time of the burst signal as shown in (E) now coincides with the delayed retrace pulses shown in (C). As a result the color burst signal coincides with the delayed sync pulses, and the output of the Burst Gate tube contains only the color burst signals as shown in (D).

ASSOCIATION NEWS

[*from page 16*]

logically believe that since the Salinas station advertises in this area, reception must be good. But Association service shop owners, after several months of battling to bring in a good picture with Channel 8's weak signal in many Valley areas, are forced to advise set owners that the KSBW-TV signal locally is highly reluctant.

Associated Radio-TV Servicemen of N. Y.

ARTSNY reports that it has reopened its Manhattan Clinic. The new

address is 401 East 74th Street. The recent initial issue of the ARTSNY "Newsletter" is excellently prepared. Its "newsy" and intimate style should make all future issues something to be looked forward to for all radio and TV servicemen in the New York Metropolitan area.

Philadelphia Radio Servicemen's Assoc., Inc.

P.R.S.M.A. presented Gordon Jolly of Westinghouse at the Franklin Institute on Tuesday, December 6, 1955. Mr. Jolly spoke on printed circuits and how to repair them.

Radio & TV Servicemen's Ass'n of Pittsburgh, Pa., Inc.

C. R. Rogers of Sylvania Electric Products, Inc., presented a lecture on the current Sylvania TV chassis and means of streamlining service procedures on November 8, 1955.

San Francisco TV Service Guild

One of the guild shoppers purchased a package of tubes in one of the local drug stores equipped with a "Test-It-Yourself" tube checker. The tubes bore absolutely no brand or date markings except one which was an N. U. 6AL5. Furthermore, they were wrapped in boxes of green and black color bearing the name National Electronics. What a "racket" this could turn out to be!

NEW FM TUNERS

[*from page 12*]

circuit. A low impedance output is obtained from the cathode follower to provide the audio voltage to the audio output amplifier.

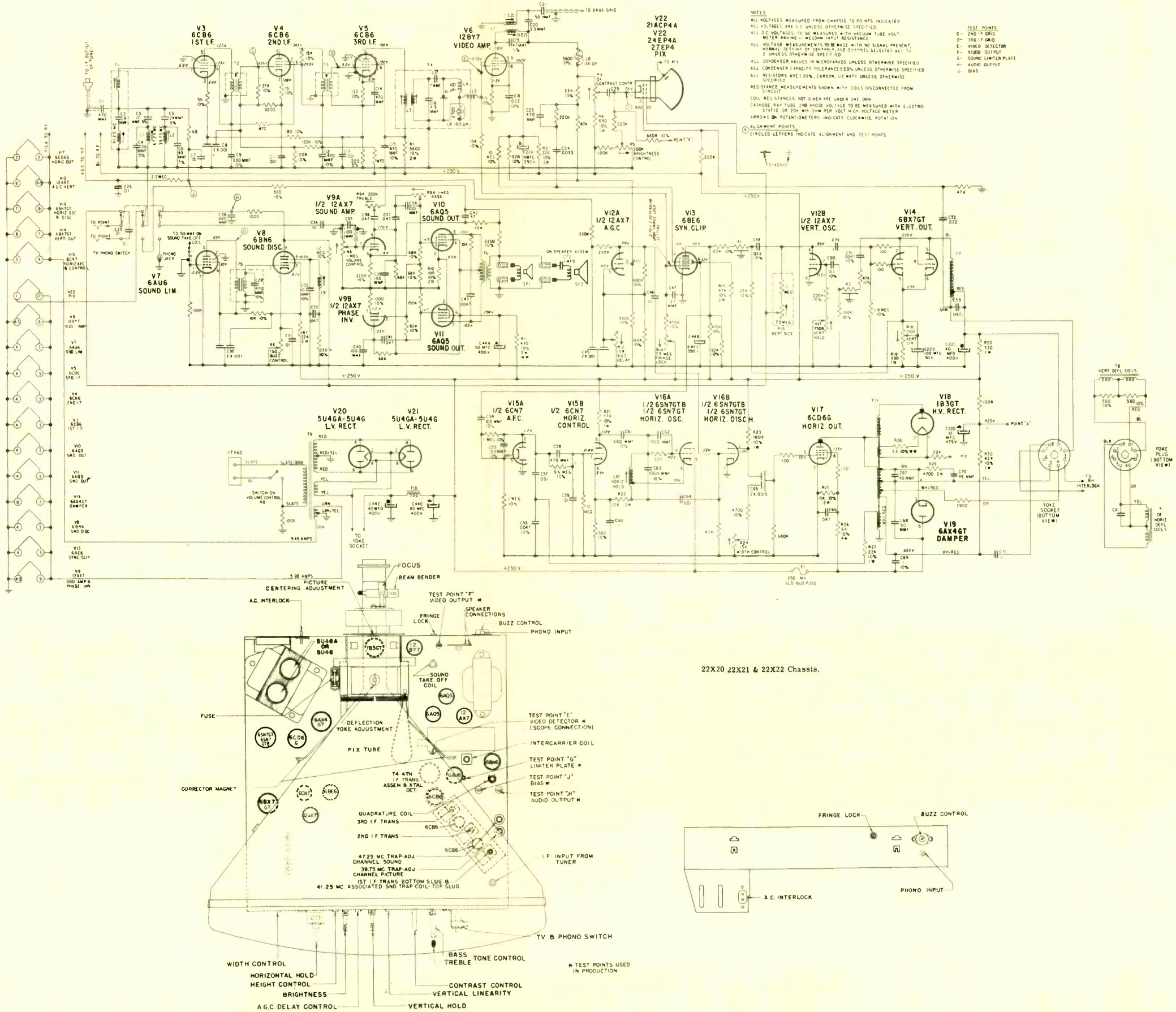
Audio Output Ratings and Frequency Response

The output audio level is often provided among tuners characteristics and can be stated in terms of voltage, distortion percentage and noise level of the system. An audio output rating might be given for a particular tuner as .5 volts (rms) with 1% distortion and a noise level 60 *db* below the output audio level.

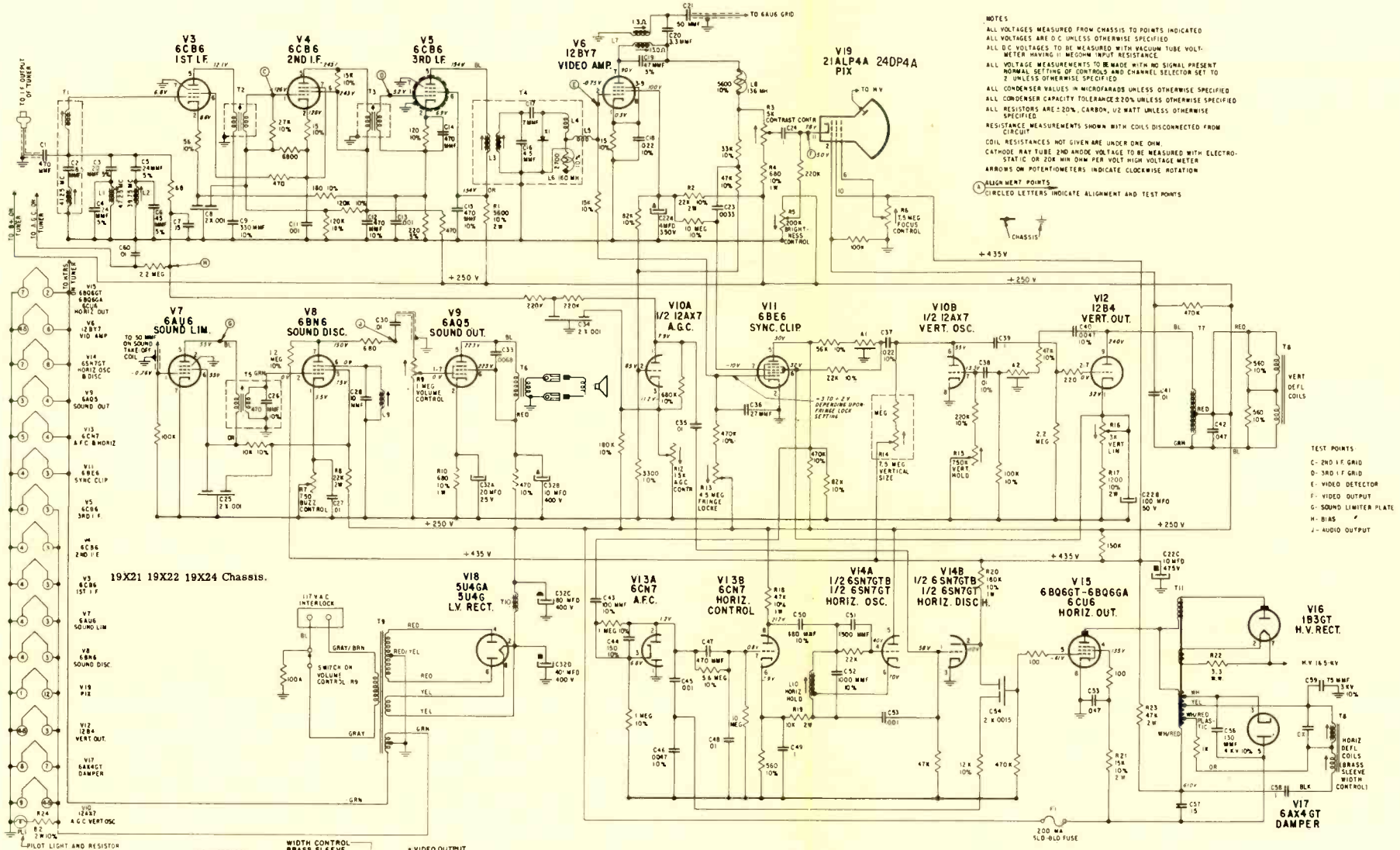
The frequency response at the output of the tuner is also a very important aspect in high fidelity reproduction. A frequency range of the audio signals from 30 to 15,000 *cps* is to be expected and generally the response is much better than this being in the order of 20 to 20,000 *cps*.

Following articles will delve into these stages found in FM tuners, discussing and analyzing their various circuits.

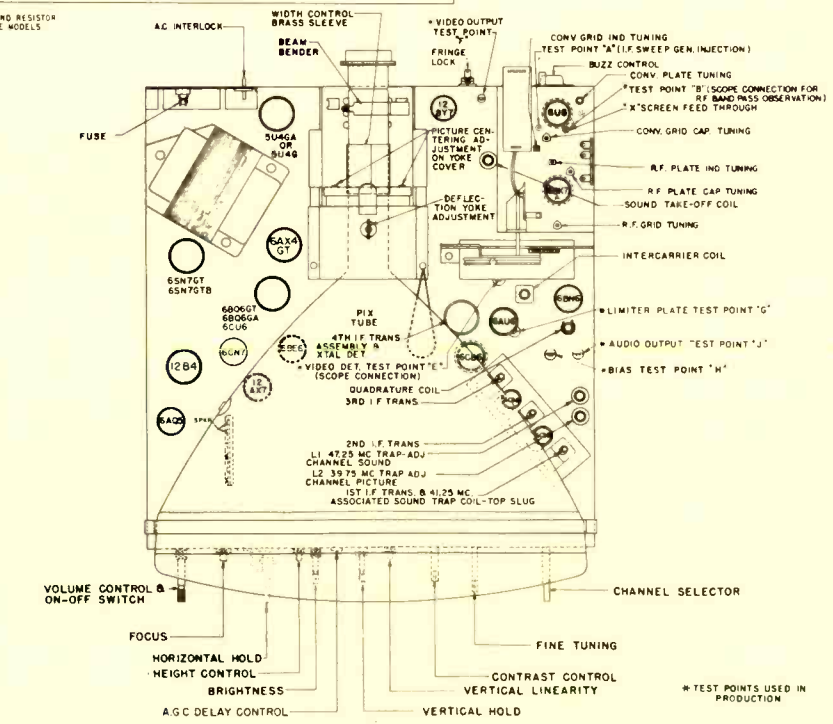
Adverising Index



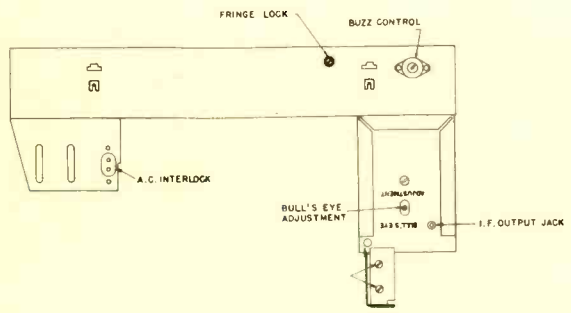
22X20 22X21 & 22X22 Chassis.

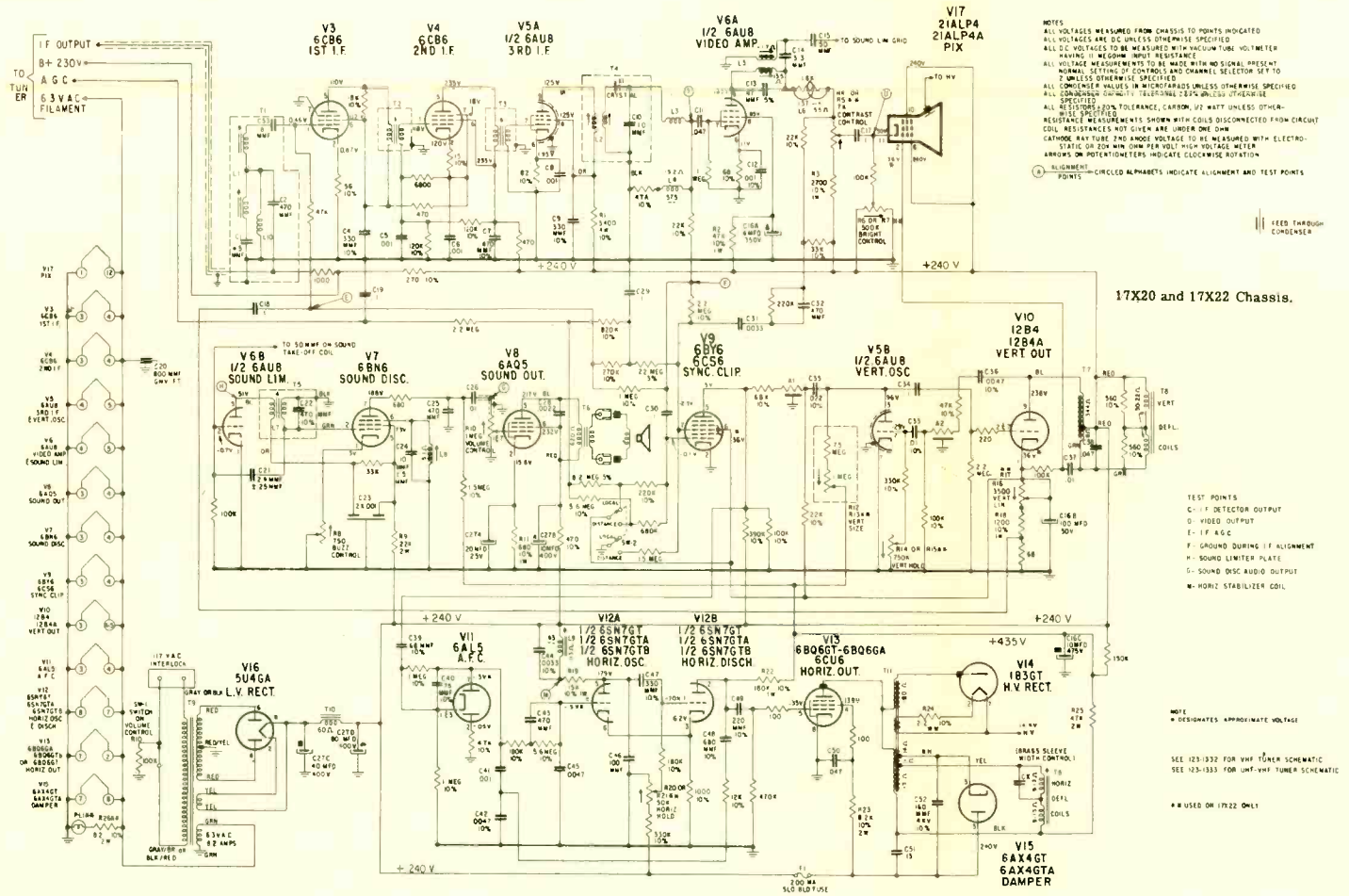


19X21 19X22 19X24 Chassis.

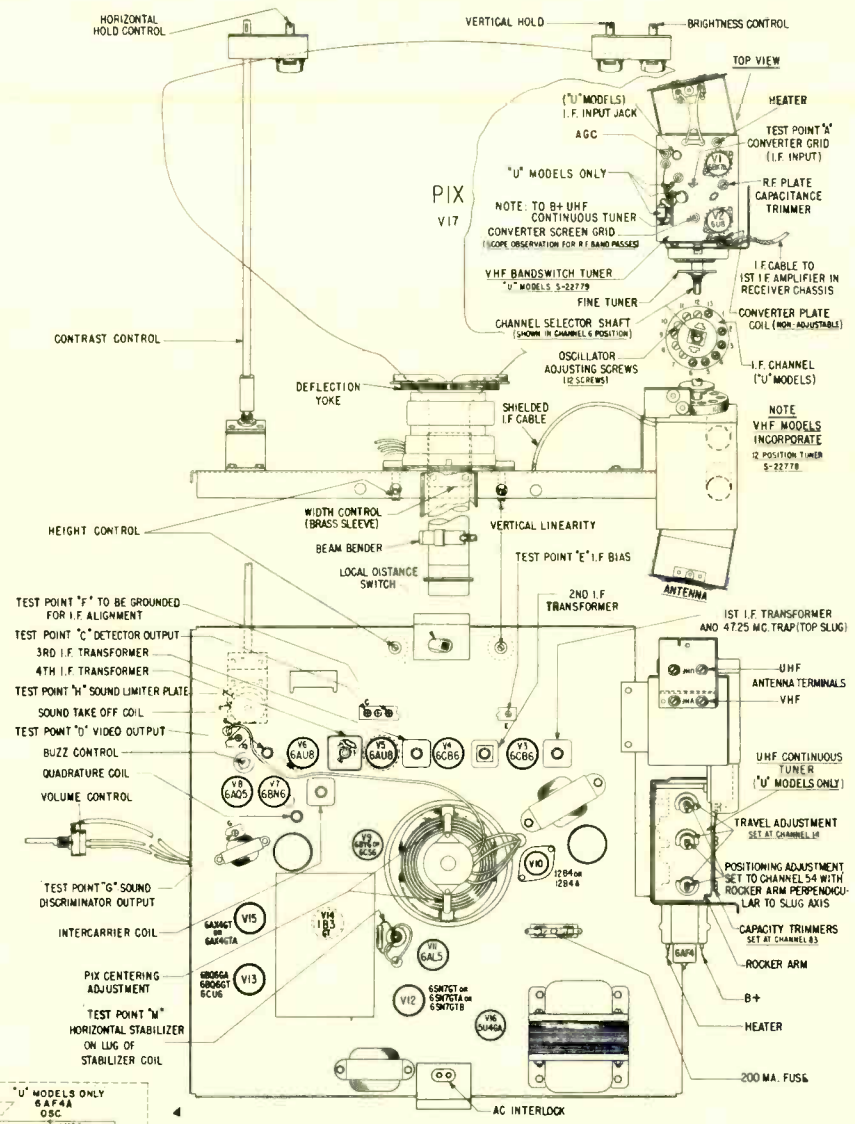


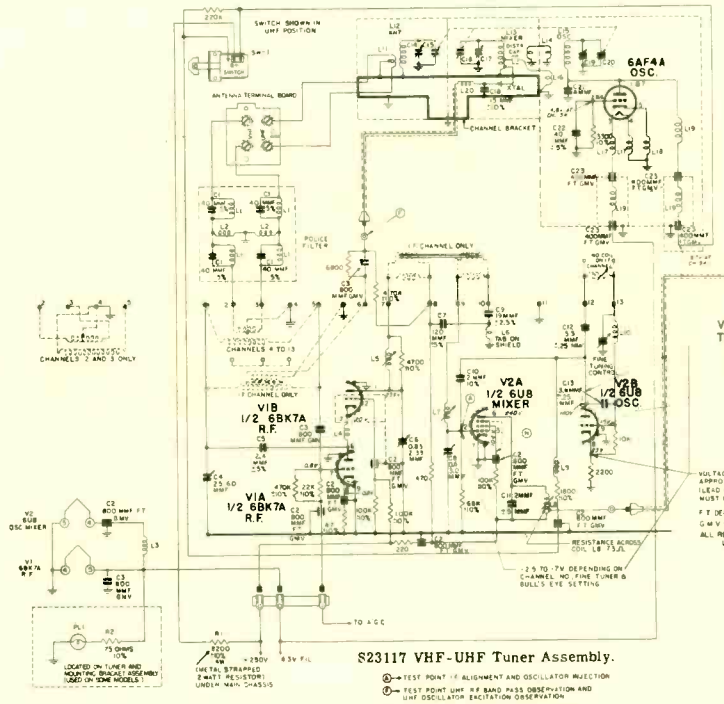
Tube and Trimmer Layout 19X21 19X22 19X24 Chassis.





17X20 and 17X22 Chassis.





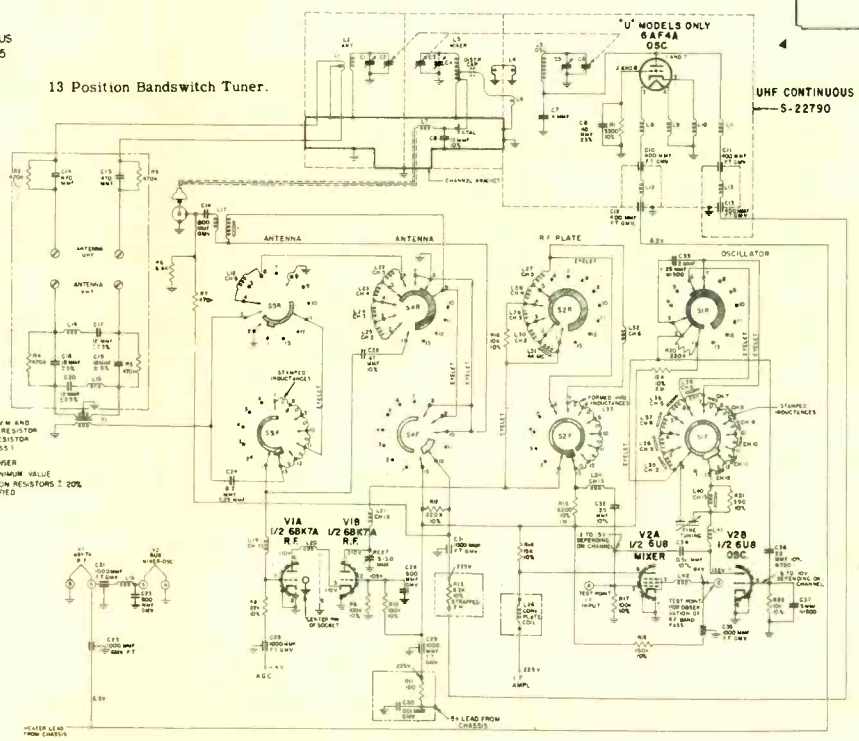
UHF CONTINUOUS TUNER S-23115

S23117 VHF-UHF Tuner Assembly.

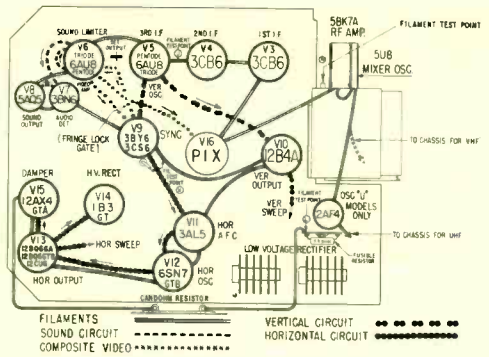
① — TEST POINT FOR ALIGNMENT AND OSCILLATOR INJECTION
② — TEST POINT UHF R.F. BAND PASS OBSERVATION AND UHF OSCILLATOR EXCITATION OBSERVATION
③ — TEST POINT VHF R.F. BAND PASS OBSERVATION

VHF 13 POSITION TUNER S-23113

13 Position Bandswitch Tuner.



VHF TUNER S-22779



16X20 Chassis.

Schematic Diagram Single Channel UHF Adapter.

Schematic Diagram Flash-Matic Remote Control.

Tube and Trimmer Layout 16X "U" Models. 17X Same except for Tube Lineup.

Schematic Diagram 3X01 Hi-Fi Amplifier as used in Models X2280E & R.

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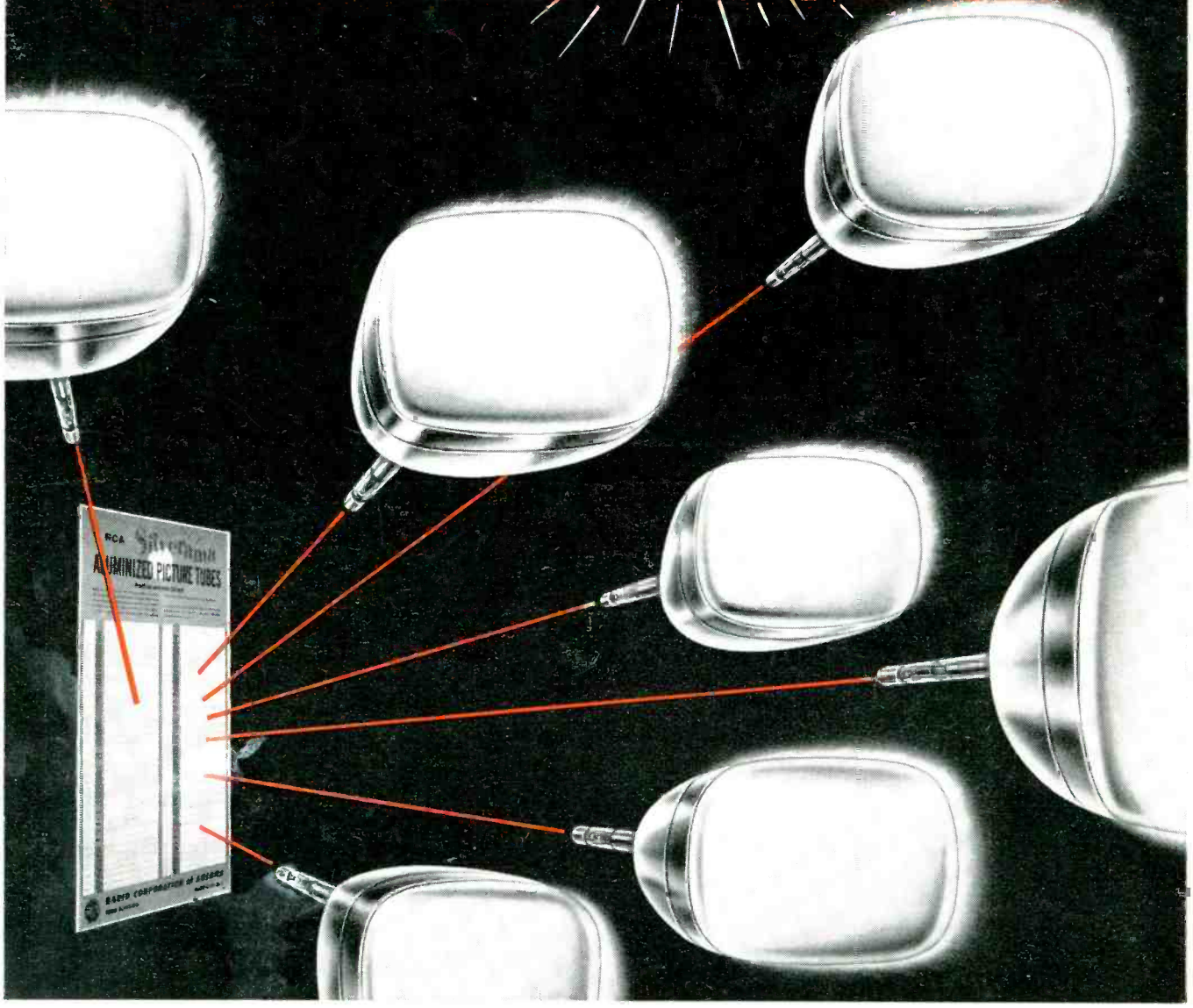

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