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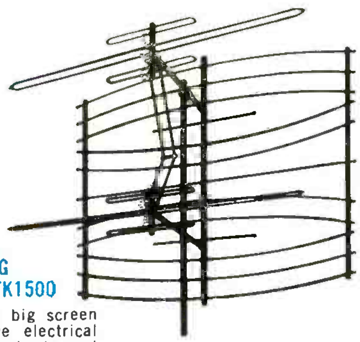

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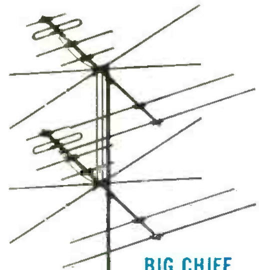

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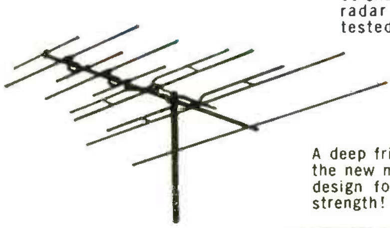

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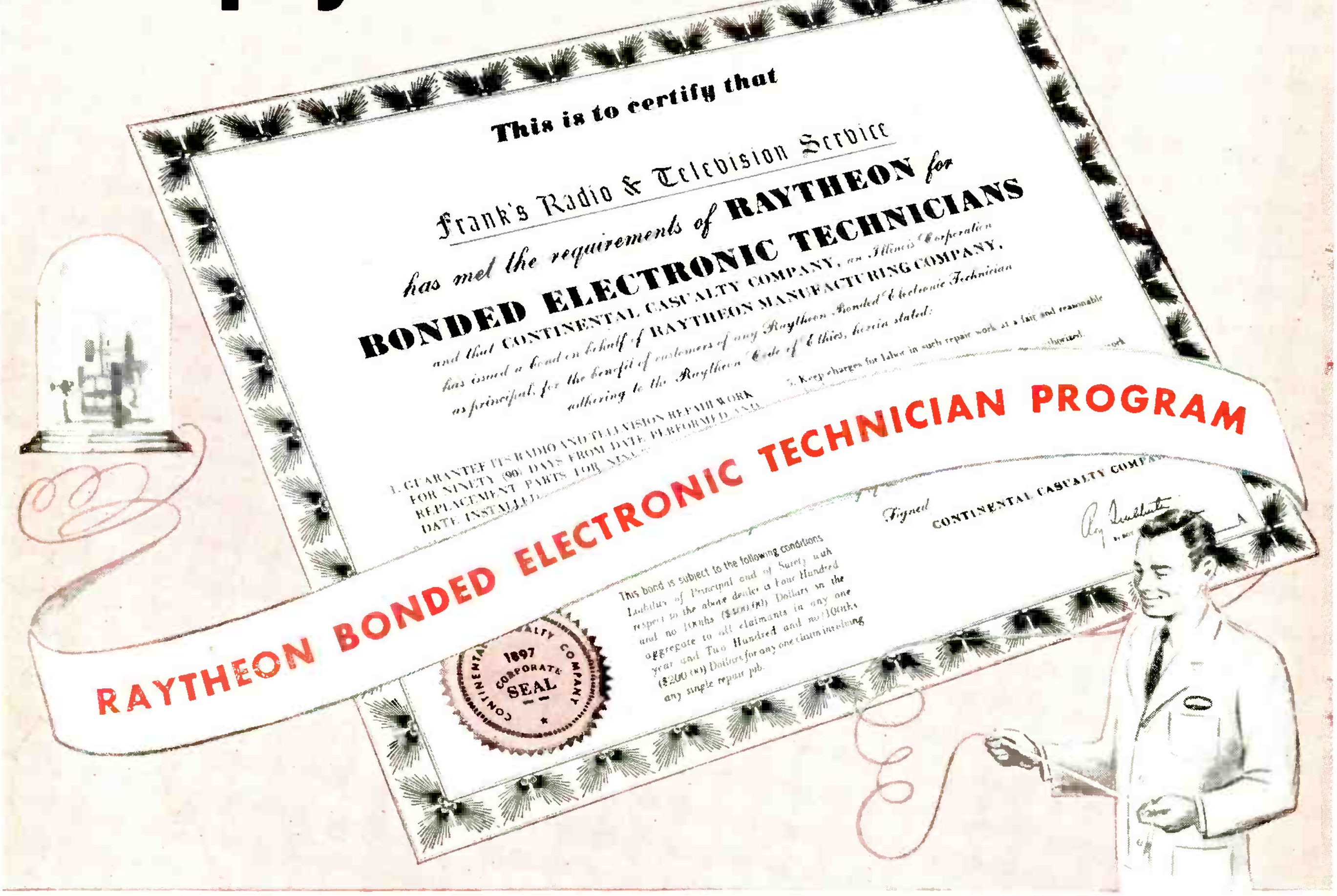


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VOL. 16, NO. 5 MAY, 1955

## FEATURE ARTICLES



## CIRCUIT AND SERVICE FORUM



## DEPARTMENTS



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# EDITORIAL...

by S. R. COWAN
PUBLISHER

### Color TV Outlook

Those of us who are privileged to watch and compare color TV programs with their black and white counterparts acknowledge that color is finer in every way. For pleasurable viewing black and white is third rate compared to color. That being so, why is color so slow in coming?

Interrogation of leading manufacturers about their 1955 color TV production schedules discloses conflicting opinions; but none at great variance. Estimates are that from 30 to 80 thousand color TV sets will be produced this year—unless—something unforeseen *at the moment occurs* shortly.

Frankly, say most "TV experts", the biggest deterrent to mass color TV set production is the picture tube problem; primarily its cost.

Picture tube makers are fully cognizant of what's expected of them. Their engineering and research staffs are working "all out" on the project. Success may be hours, days or months away. Honestly, no one knows at this minute when the problems will be solved. Your guess is as good as mine.

### Tube Tester Innovation

For years we have urged service dealers to charge customers, who come into their shops with a bag of tubes, a nominal sum for each tube tested. The charge is justified. It helps pay for the cost of tube testers. Also, it pays in part for the time the service dealer devotes to his customer. Most service dealers followed our recommendation about charging for this service, some preferred not to do so.

Now an instrument manufacturer has put on the market a "Test-It-Yourself" type of tube checker which service dealers can buy and place in a location convenient for their customers to use themselves. In this age of "do-it-yourself" merchandising we believe the instrument manufacturer in question has hit upon an excellent idea. Human nature is such that many customers would prefer to do their own tube testing, and abide by their own findings. Be that as it may, we like the Test-It-Yourself idea for an entirely different reason. We feel that some "doubting Thomas" species of human will, after setting numerous knobs and levers on the checker, come to appreciate more fully the complex nature of electronic equipment design and the skill required by servicemen. And as a net result, henceforth they will hold servicemen in higher esteem. Besides, they'll buy more tubes—especially when they themselves find tubes which an impartial checker shows as being "weak."

### Service Field Magazines

According to the latest reports issued by firms that are engaged to audit the paid circulation and gross distribution figures of magazines, proudly we announce that "Service Dealer" has many more paid subscribers and thousands more servicemen readers than our contemporary publications.

Since the inception of "Service Dealer" over 16 years ago our prime goal has been to improve the financial position of all radio-TV service dealers and to enhance their recognition and public acceptance. We hope to improve the service profession's living standard in every respect. It has not been an easy task—and as a task—it is far from being finished.

But it is truly gratifying to know that month after month more professional full time servicemen and owners of established firms that do servicing are readers of this magazine than any other. Our entire staff's efforts are solely pointed to the serviceman's and service profession's welfare. Its a comforting thought that upwards of 60,000 full-time professionals are part of our family.

### Technical Courses By Manufacturers

Many leading manufacturers have conducted seminars for servicemen in all parts of the country. Many of these courses are streamlined to such an extent that they are not of optimum effectiveness.

Rarely does a clinic include instruction on servicing other electronic apparatus such as FM tuners, phonograph record players, Hi-Fi equipments, automobile or 2-way communications receivers, etc. For example, how many lecturers have you heard discourse on servicing *any* of the myriad types of industrial electronics equipment? Thousands of G. M. cars have headlights controlled by autronic eyes. Could you service such an electronic device? Probably not, unless you took the Delco Radio Course, given free by United Motor Service.

Believe it or not, all around every service shop there are millions of electronic tubes functioning in devices that are not home radio or TV receivers. Hundreds of millions of dollars worth of potential service income on non-radio-TV items are bypassed annually by the average service firm. The bulk of this business, and it's mighty profitable business too, goes to a limited number of astute firms that have had the foresight not to rely solely on radio-TV. They don't have "all their eggs in one basket." We'll cover this broad subject in the months ahead.

# "I WANT THE TUBES WITH THE GOOD HOUSEKEEPING GUARANTY SEAL!"

"TV and radio tubes are mysterious things to me, but that Good Housekeeping Seal is a tried and true friend. I trust any product that has earned it. So when you replace tubes in *my* sets, be sure they're CBS tubes . . . *the tubes with the Good Housekeeping Guaranty Seal.*"


## Check and Remember

1. It's a *woman* you talk to on most service calls.
2. CBS is addressing its national advertising especially to women.
3. 53% of *all women* are influenced in their purchases by the Good Housekeeping Guaranty Seal.
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*Use CBS tubes . . . the tubes in which women have confidence.*

Millions will see or hear about CBS tubes on TV and radio . . . and in national magazines throughout 1955.

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# SERIES SERIES SERIES SERIES SERIES filaments

### using the new 600 ma. tubes

by Steve Travis

WITHIN the past few months a significant step has been taken in television receiver design that will have a far reaching affect upon future circuitry. It is the purpose of this article to present the information concerning this advancement.

The improvement referred to has been brought about by the introduction of a new group of vacuum tubes. These tubes are similar to previously common prototypes but for one very distinct difference, that is, they are designed to allow the same amount of filament current to flow through all of them. Thus, although they use various voltage values across their filaments such as 3.15, 4.7, 6.3, 7, 12.6, and 25.2 volts, they are engineered to pass 600 *ma* through the heaters. These tubes are referred to as the 600 *ma* group.

Before delving into service information concerning these 600 *ma* tubes a greater appreciation of their purpose will be gained by a knowledge of the situation before their advent on the TV scene. In the design of ac/dc radios the connecting of vacuum tube filaments in series has been a common practice. The voltage across each tube filament is that required by the tube, and the total voltage across the series string should be the sum of the voltages across all the filaments plus the voltage drop across the voltage dropping filament resistor if one is used. This total adds up to the line voltage of 115 volts. With an arrangement of this type it is evident that there is no need for a power transformer winding since all the filaments of the tubes in the radio are connected in series across the power line.

Television receivers have been designed using this arrangement, but these receivers have not been too common because of the problems arising from the differences in heater current ratings and the variations in heater warm-up time. Furthermore, as shown in *Fig. 1*, when connecting up tubes drawing 300, 450 and 600 *ma* of filament current in series additional provisions are required such as paralleling resistors or other tubes to bypass the proper portion of the heater current from those tubes that cannot carry the full current.

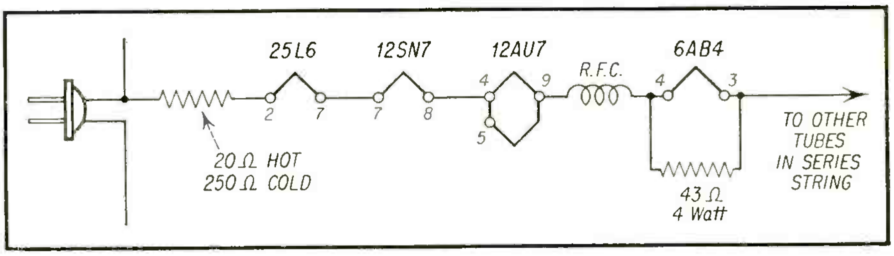



Fig. 1—Partial schematic of conventional series group. Series resistor on left is a thermistor the resistance of which is higher when cold.

*Figure 1* indicates that if a 600 *ma* tube is in the string there must be 600 *ma* flowing through the whole series circuit. Tubes which require less than 600 *ma* must have a shunt to bypass the remainder of the current around them. As an example, a tube which uses 450 *ma* filament current generally has a 42 or 43 ohm resistor in parallel with it (6.3V/.15A = 42 ohms) to allow the balance of 150 *ma* to flow so that the total current will be the amount that flows through the entire series circuit. As can readily be seen, if this tube is removed from the socket for checking purposes while the set is in operation additional trouble is introduced. The shunt resistor usually becomes overheated and burns out. Thus, the problems of servicing receivers of this type are generally more difficult.

One of the more important reasons for the unpopularity of series filament receivers is caused by improper voltage distribution which occurs while the heaters are warming up. This is the direct result of the warm-up periods of television circuit tubes not being equal. When a tube is cold the heater resistance is low. This resistance increases during the initial period to several times the cold value when it reaches its proper operating condition. The heating period or the time required to reach normal operating temperature is a function of the design of the heater. Because of the different cathode designs of various tubes, different physical forms or windings of heaters are required. As one example, the area of the emitting material that is to be heated in a picture tube is a spot 35/1000 of an inch on the face of the cathode element. This requires a type of filament winding different from that employed for other tubes such as a 5U4 or a 6BQ7 tube to bring the material on the cathode to its proper emitting temperature.

The voltage distribution across a string of filaments is determined by the resistance of the individual filaments. As stated previously, the resistance of the heaters increases as the tube warms up. But all tubes don't warm up or reach the proper operating temperature

| 600 Ma. TUBE | PROTO-TYPE | Filament Voltage | TYPE | CONSTRUCTION | CIRCUIT EMPLOYMENT |
|---|---|---|---|---|---|
| 2AF4 | 6AF4 | 2.35 | 7 Pin Miniature | Triode | UHF Osc. |
| 3AL5 | 6AL5 | 3.15 | 7 Pin Miniature | Twin Diode | FM Detector |
| 3AU6 | 6AU6 | 3.15 | 7 Pin Miniature | Pentode | IF Amp. |
| 3AV6 | 6AV6 | 3.15 | 7 Pin Miniature | Twin Diode, Triode | Detector, Audio Amp. |
| 3BC5 | 6BC5 | 3.15 | 7 Pin Miniature | Pentode | IF Amp. |
| 3BE6 | 6BE6 | 3.15 | 7 Pin Miniature | Pentagrid | Converter |
| 3BN6 | 6BN6 | 3.15 | 7 Pin Miniature | Pentode | FM Discriminator |
| 3BZ6 | 6BZ6 | 3.15 | 7 Pin Miniature | Pentode | High Freq. Amp. |
| 3CB6 | 6CB6 | 3.15 | 7 Pin Miniature | Pentode | High Freq. Amp. |
| 3CF6 | 6CF6 | 3.15 | 7 Pin Miniature | Pentode | IF Amp. |
| 3CS6 | 6CS6 | 3.15 | 7 Pin Miniature | Pentagrid | Sync. Sep. |
| 3BY6 | 6BY6 | 3.15 | 7 Pin Miniature | Pentagrid | Amplifier |
| 4BQ7A | 6BQ7A | 4.2 | 9 Pin Miniature | Twin Triode | RF Amp. |
| 4BZ7 | 6BZ7 | 4.2 | 9 Pin Miniature | Twin Triode | RF Amp. |
| 5AM8 | 6AM8 | 4.7 | 9 Pin Miniature | Diode, Pentode | Video Det., IF Amp. |
| 5AN8 | 6AN8 | 4.7 | 9 Pin Miniature | Triode, Pentode | Video Det., IF Amp. |
| 5AQ5 | 6AQ5 | 4.7 | 7 Pin Miniature | Pentode | Video Amp. |
| 5AT8 | 6AT8 | 4.7 | 9 Pin Miniature | Triode, Pentode | Osc. Mix. |
| 5BK7A | 6BK7A | 4.7 | 9 Pin Miniature | Twin Triode | RF Amp. |
| 5J6 | 6J6 | 4.7 | 7 Pin Miniature | Twin Triode | Osc., Mix. |
| 5T8 | 6T8 | 4.7 | 9 Pin Miniature | Triple Diode, Triode | FM Det., Audio Amp. |
| 5U8 | 6U8 | 4.7 | 9 Pin Miniature | Triode, Pentode | Osc., Mix |
| 5V6GT | 6V6GT | 4.7 | 8 Pin Octal | Pentode | Low Freq. Amp. |
| 5X8 | 6X8 | 4.7 | 9 Pin Miniature | Triode, Pentode | Osc., Mix. |
| 5AS8 | 6AS8 | 4.7 | 9 Pin Miniature | Pentode | Detector, Video Amp. |
| 6AX7 | 12AX7 | 3.15 | 9 Pin Miniature | Twin Triode | Sync. Amp., Sep. |
| 6AU7 | 12AU7 | 3.15 | 9 Pin Miniature | Twin Triode | Hor. Osc. |
| 6AW8 | 6AW8 | 6.3 | 9 Pin Miniature | Triode, Pentode | Sync. Sep., Video Amp. |
| 6S4A | 6S4 | 6.3 | 9 Pin Miniature | Triode | Vertical Output |
| 6SN7GTB | 6SN7GTA | 6.3 | 8 Pin Octal | Twin Triode | Hor. and Vert. Osc. |
| 7AU7 | 12AU7 | 7 | 9 Pin Miniature | Twin Triode | Hor. and Vert. Osc. |
| 12B4A | 12B4 | 6.3 | 9 Pin Miniature | Triode | Vertical Output |
| 12BH7A | 12BH7 | 6.3 | 9 Pin Miniature | Twin Triode | Vertical Osc. |
| 12BY7A | 12BY7 | 6.3 | 9 Pin Miniature | Pentode | Video Amp. |
| 12AX4GTA | 12AX4GT | 12.6 | 6 Pin Octal | Diode | Damper |
| 12BK5 | 6BK5 | 12.6 | 9 Pin Miniature | Pentode | Audio Output |
| 12BQ6GTA | 6BQ6GTA | 12.6 | 7 Pin Octal | Pentode | Hor. Output |
| 12CU6 | 6CU6 | 12.6 | 8 Pin Octal | Pentode | Hor. Output |
| 12L6GT | 25L6GT | 12.6 | 8 Pin Octal | Pentode | Audio Output |
| 12W6GT | 6W6GT | 12.6 | 7 Pin Octal | Pentode | Vertical Output |
| 25CD6GA | 25CD6G | 25 | 6 Pin Octal | Pentode | Hor. Output |

Table One — The New 600 Milliampere Tubes

at the same time because of their inherent designs and purposes. It is only when the tubes have attained proper filament temperature that the resistances are correct and produce the desired voltage drops across them. Therefore, during the warm-up period the line voltage divides across the series line according to the instantaneous values of tube resistances. Since the IR drop (voltage drop) across any filament is proportional to its resistance, one tube may have more voltage impressed on it than another. This is one of the reasons for tube burnouts in circuits of this type.

One of the devices used to prevent premature burnouts is the thermistor (See *Fig. 1*). The latter is a negative temperature coefficient resistor, that is, its maximum resistance occurs when it is cold and its minimum resistance when it is hot. This property compensates for the opposite manner in which tube heaters behave. However, expense and long warm-up considerations have forced the tube industry to come up with a better answer.

### The New 600 Milliamperes Tubes

Very recently there has been introduced a complete line of 600 *ma* filament current tubes for all of the functions required in a TV receiver. With these 600 *ma* tubes the series circuit will certainly become the more common means of connecting vacuum tube filaments just as printed wire panels are fast becoming common in modern TV receivers. Only two major TV receiver manufacturers have not changed to the new 600 *ma* filament series string as yet. These companies, no doubt, are contemplating their use and will most probably have versions available soon. A further important advantage obtained through the use of these new tubes is that it does away with parallel networks completely and permits the tubes to be lined up in series without paralleling the filaments with resistors or other tubes.

To insure dependable performance in these new 600 *ma* tubes the heater-cathode voltage breakdown rating has been increased; also the tolerance of the 600 *ma* string tube has been brought to a much closer level concerning the filament current it is designed to conduct. Where formerly, in manufacturing, the tubes were permitted a variation of plus or minus 50 *ma*, this has been reduced to plus or minus 25 *ma* in those tubes designated for series filament use. In addition, the use of larger filament wire size provides an added ruggedness to the new group.

Perhaps the most important feature that has been designed into the 600

*[Continued on page 61]*

# TRADE FLASHES

• • •

Directors of Daystrom, Inc. and Weston Electrical Instrument Corp., have signed an agreement of merger under the terms of which Weston would be merged into Daystrom. The merger calls for the issuance of one share of Daystrom stock for each share of Weston. It is planned that the business and assets acquired from Weston will be transferred to a wholly-owned Daystrom subsidiary to be named "Weston Electrical Instrument Corporation." According to the announcement, the Weston operations will be continued under the same management and personnel as at present, and the Weston name will be retained on its products.

**Alpha Wire Corporation, 430 Broadway, New York 3, N. Y., have announced their ALPHLEX line of *in stock* extruded plastic tubing. It is available in a wide range of sizes and colors, from #24 through 2½" diameter, in long lengths and cut to order. It conforms to MIL specs and UL standards, and is competitively priced.**

*To aid in the selection of the type of linearity which the application of a potentiometer demands while remaining consistent with economic considerations, the Engineering Dept. of Clarostat Mfg. Co., Inc. presents its definitions of four commonly accepted types. These types of linearities are listed, with illustrations, in ascending order of difficulty of manufacture and cost; the brochure is available from the concern at Dover, N. H.*

***Emerson Radio and Phonograph Corporation has completed its move of the company's administrative headquarters and plant located in the Port Authority Building, 111 Eighth Avenue, New York City. The executive offices have been transferred to the three-story building which was added last year to the Emerson manufacturing plant in Jersey City, New Jersey. The New York factory facilities will also be relocated in the Jersey City plant.***

In the belief that nothing is so vital to a television serviceman as accurate information and field-proven servicing techniques, RAM Electronics Sales Company, Irvington, N. Y., has inaugurated a series of TV Forums to be held in every major television area in the

U. S. At the latest of these in New Orleans, La., Mr. Albert Friedman, RAM product development engineer, discoursed and conducted a question-and-answer period on trouble-shooting high voltage sweep and deflection circuits, theory and application of sweep circuits, relation of monochrome sweep circuits to color, and repair and service techniques and hints. More than 250 TV servicemen attended this forum. For details when a RAM forum will be held in your area, write directly to RAM, address above.

**A series of 12 television dealer service schools on printed circuits and automation production techniques were held in the Atlanta, St. Louis and Columbia, S. C., distributors' territories during April, it was announced today by Max Schinke, national service manager of Admiral Corporation. Admiral's color motion picture on AUTOMATION was shown at these meetings. In addition, factory technicians demonstrated the servicing and repair of a printed circuit television chassis.**

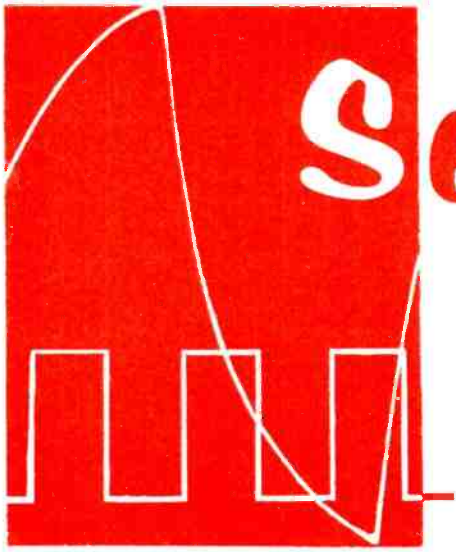
*A new replacement flyback transformer, model EFB-148, for early Zenith television models has just been developed by the Rogers Electronics Corporation, 43 Bleecker Street, New York City. The EFB-148 flyback transformer installs easily, without the need for drilling on for further fussing. Every unit is packaged individually with complete schematic wiring diagrams.*

***The 1955 Electronic Parts Distributors Show officially opens its doors at the Conrad Hilton Hotel here Monday, May 16th at 10:00 A.M., with 289 exhibitors in 203 booths in the Exhibition Halls and 174 display rooms on the hotel's fifth and sixth floors. The Show runs through Thursday, May 19th. Exhibitors from all forty-eight states and nearly a score of other countries are pre-registered for what promises to be one of the most rewarding shows in the industry's history.***

*Harry G. Burnett, advertising manager of CBS-Hytron, a Division of Columbia Broadcasting System, Inc., has announced the appointment of William O. Hamlin as Supervisor of Technical Information Service. Born at East Orange, N. J., in 1922, and a former resident of Stratford, Conn., Hamlin came to CBS-Hytron from Sylvania, where he was technical editor of Sylvania News.*

***An experimental transistorized automobile radio that operates directly from a 6-volt car battery and requires only about one-tenth of the power used by a conventional car radio has been describ-***

*[Continued on page 53]*



# Servicing with the SQUARE-WAVE GENERATOR

## Part 3—Concluding Installment

by Oscar Fisch

IN the preceding installment, (April 1955), it was shown that a square wave generator can be useful in localizing trouble to the video amplifier area of the TV receiver. In this connection it was pointed out that before an intelligent diagnosis can be made, the serviceman must know what waveforms to expect when the amplifier is operating normally. A block diagram of the bench setup was given previously *Fig. 1* shows a schematic of a typical video amplifier and indicates the manner in which the square wave generator and the scope are connected. Here are a few suggestions which may prove helpful:

1. Remove the video detector tube from its socket. This prevents the possibility of interference from noise or stray pickup signals via the video *if* amplifier.

2. If the receiver uses a germanium diode as a detector, remove the last video *if* tube instead, since the crystal is not easily removed.

3. Remove the horizontal output tube from its socket. This avoids stray pickup of pulses at the horizontal frequency which may interfere with the pattern observed on the scope.

4. Use a low capacity probe in conjunction with the oscilloscope when checking at the higher frequencies. If this is not done rounding of the corners may be observed because of the bypassing effect of the scope leads on the high frequency harmonics components of the wave.

5. Keep the output of the generator as low as possible consistent with a good readable pattern on the scope. This avoids distortion due to overloading either the video amplifier stages or the scope's vertical amplifier.

6. If the scope amplifier introduces too much distortion of its own, connect point "B" of *Fig. 1* directly to one of the vertical deflection plates of the scope. The other vertical plate should be grounded. Terminals for this purpose are usually provided at the rear of the scope. You can tell whether the scope amplifier is introducing objectionable distortion by feeding the square wave output of the generator directly into the vertical terminals of the scope, and observing the waveform. A fairly good square wave indicates little distortion by the scope amplifier.

Once these details have been taken care of we can proceed with an observation of wave forms. At the outset, it should be realized there is no substitute for experience, and the technician using a square wave generator should make it a practice, whenever he can, to observe wave forms and correlate them with picture quality. The waveforms shown in following illustrations should be of help for comparison purposes. *Fig. 2* shows the output waveform when a 40 cycle square wave was fed into the input of a normally operating video amplifier. At first glance it might seem that this is a seriously distorted wave. However, this is a normal response at this frequency for the average video amplifier. *Fig. 3A* represents the normal response at 100 *cps*. Both of these patterns were obtained using an ordinary

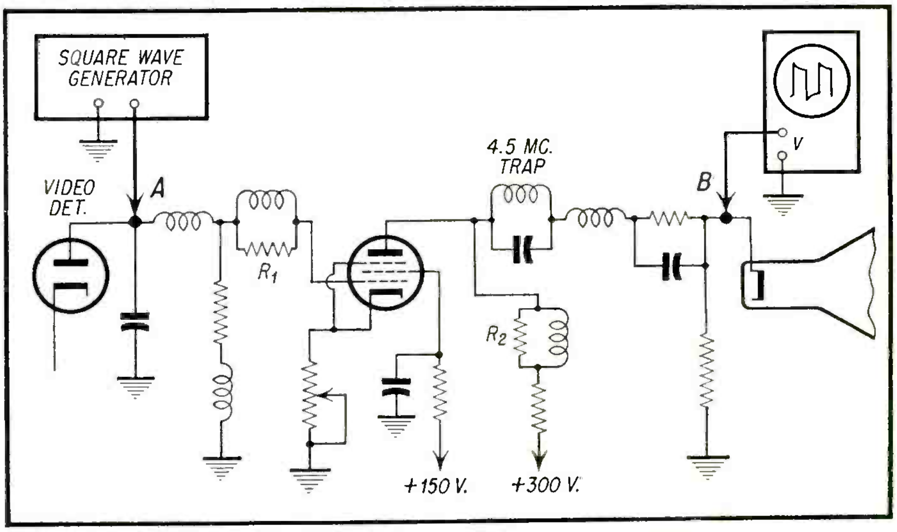



Fig. 1—Typical video amplifier circuit.

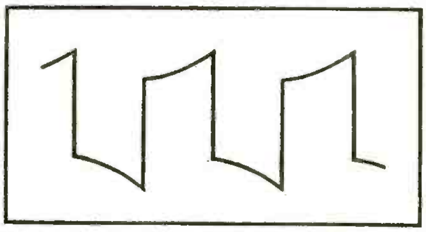


Fig. 2—Waveform of normal amplifier using a 40 cps square wave input signal.

isolating probe for the oscilloscope. (50.000 ohm resistor in series with the vertical test prod of the scope). Using a low capacity makes no observable difference in these two waveforms.

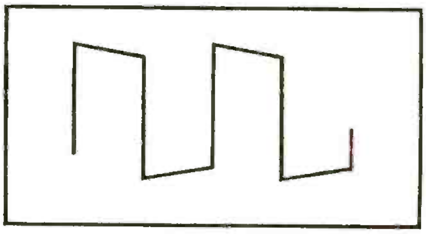


Fig. 3A—Waveform of normal amplifier using a 100 cps square wave input signal.

*Figs.* 3*B*, 4, and 5 were the patterns obtained for the normal amplifier at frequencies of 50 *kc*. 100 *kc*. and 250 *kc* respectively, using the resistive isolating probe with the oscilloscope. *Figs.* 6, 7, and 8 show the waveforms obtained at

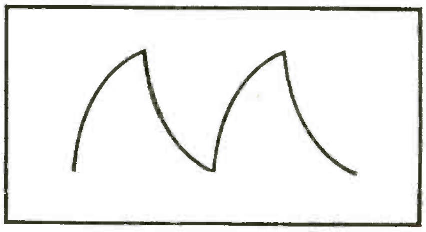


Fig. 3B—Normal amplifier, 50 kc; using a simple resistive isolating probe.

the same frequencies but using a low capacity probe. A comparison of these waveforms with those of *Figs.* 3*A*, 4, and 5 shows very strikingly the importance of using this probe. The wave forms of *Figs.* 3, 4, and 5 are badly distorted.

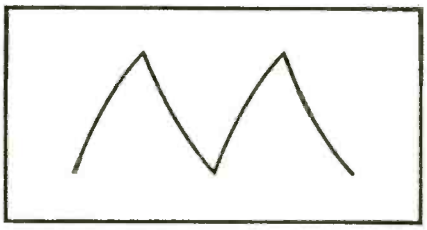


Fig. 4—Normal amplifier, 100 kc; resistive isolating probe is used with the scope.

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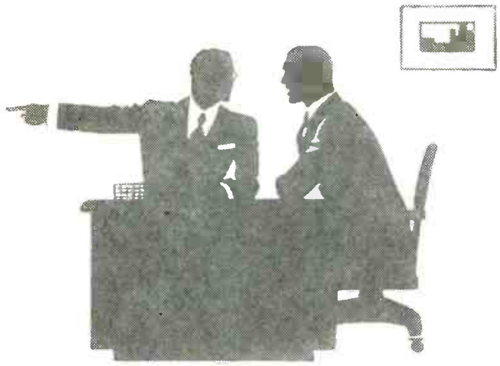

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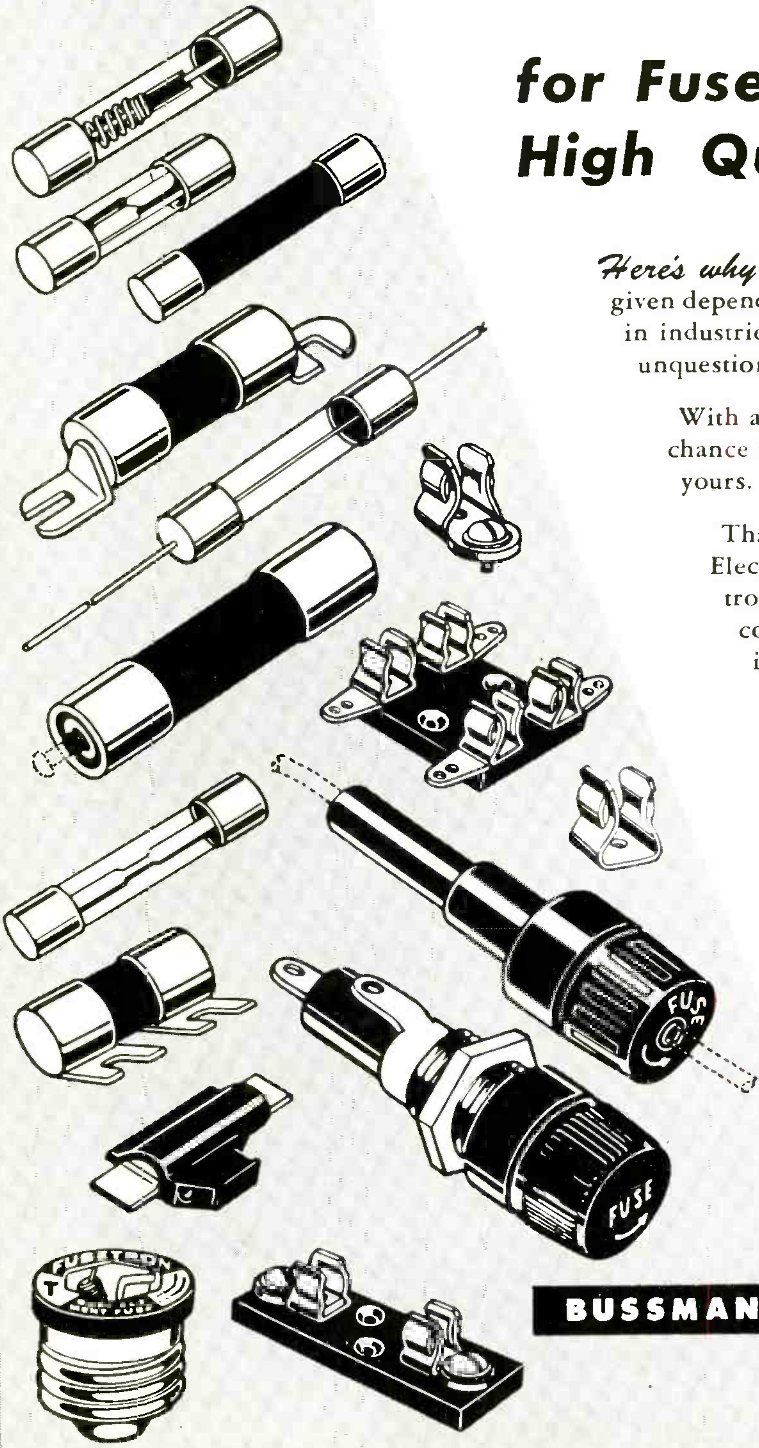


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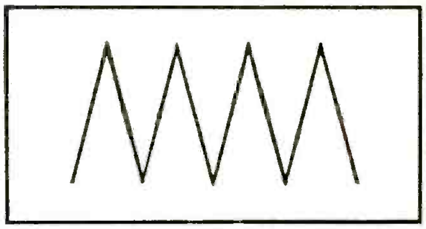

Fig. 5—Normal amplifier, 250 kc; resistive isolating probe is used.

but through no fault of the amplifier under test. In this case the input capacity of the scope plus the capacity of the leads are the offenders. To carry the procedure one step further, waveforms were observed at the same three frequencies of 50 *kc*, 100 *kc*, and 250 *kc*, with the video amplifier output connected directly to the vertical deflection plates of the oscilloscope. The waveforms observed were essentially the same as those of *Figs*. 6, 7, and 8 indicating that the scope amplifier was sufficiently good for this purpose.

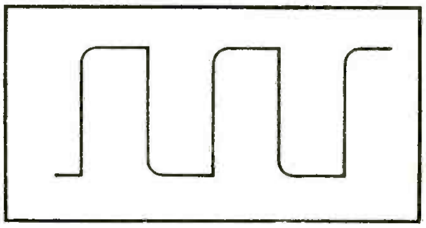

Fig. 6—Same as Fig. 3, but using a low capacity probe with scope.

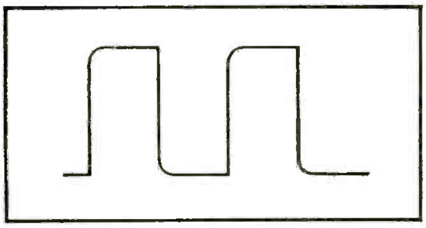

Fig. 7—Same as Fig. 4, but using a low capacity probe with scope.

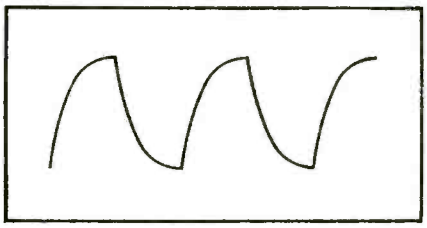

Fig. 8—Same as Fig. 5, but using a low capacity probe with scope.

*Figs*. 9 and 10 are examples of patterns observed when trouble occurs which seriously affects low frequency response. Possible causes of such trouble *ask your jobber for the whole story of the...*

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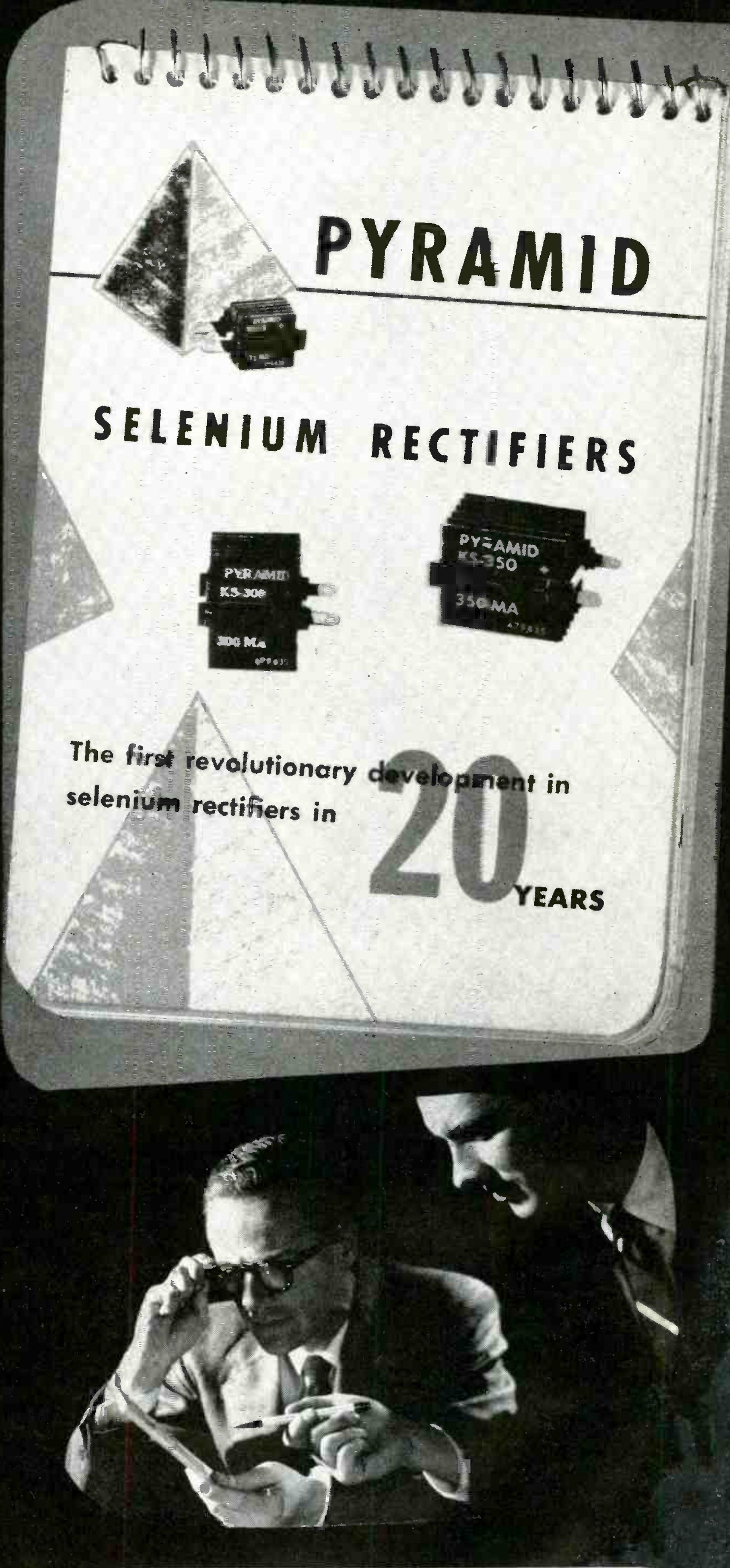


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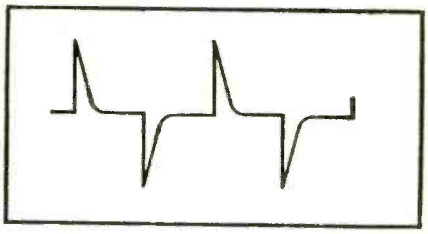


Fig. 9—Extremely poor low frequency response; 40 cps.

might be defective coupling condensers, screen or cathode bypass condensers, screen or grid resistors, and low frequency compensation circuits. Poor low frequency response may show up on

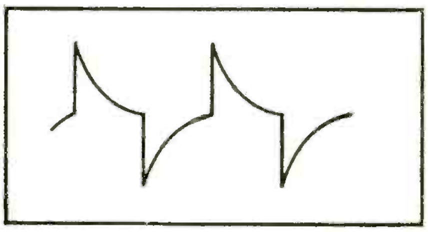


Fig. 10—Same trouble as in Fig. 9; 100 cps.

the screen as a change in shading from the top to the bottom of the raster or the "paint brush" effect, where large objects appear smeared. Picture syn-

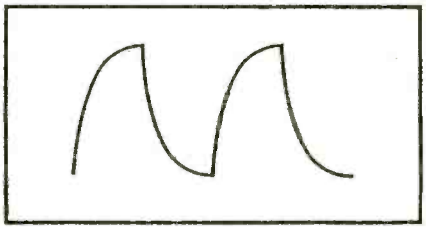


Fig. 11—Poor high frequency response; 100 kc.

chronization may be affected due to excessive distortion of the rectangular sync pulses.

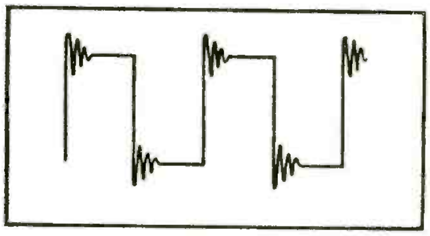
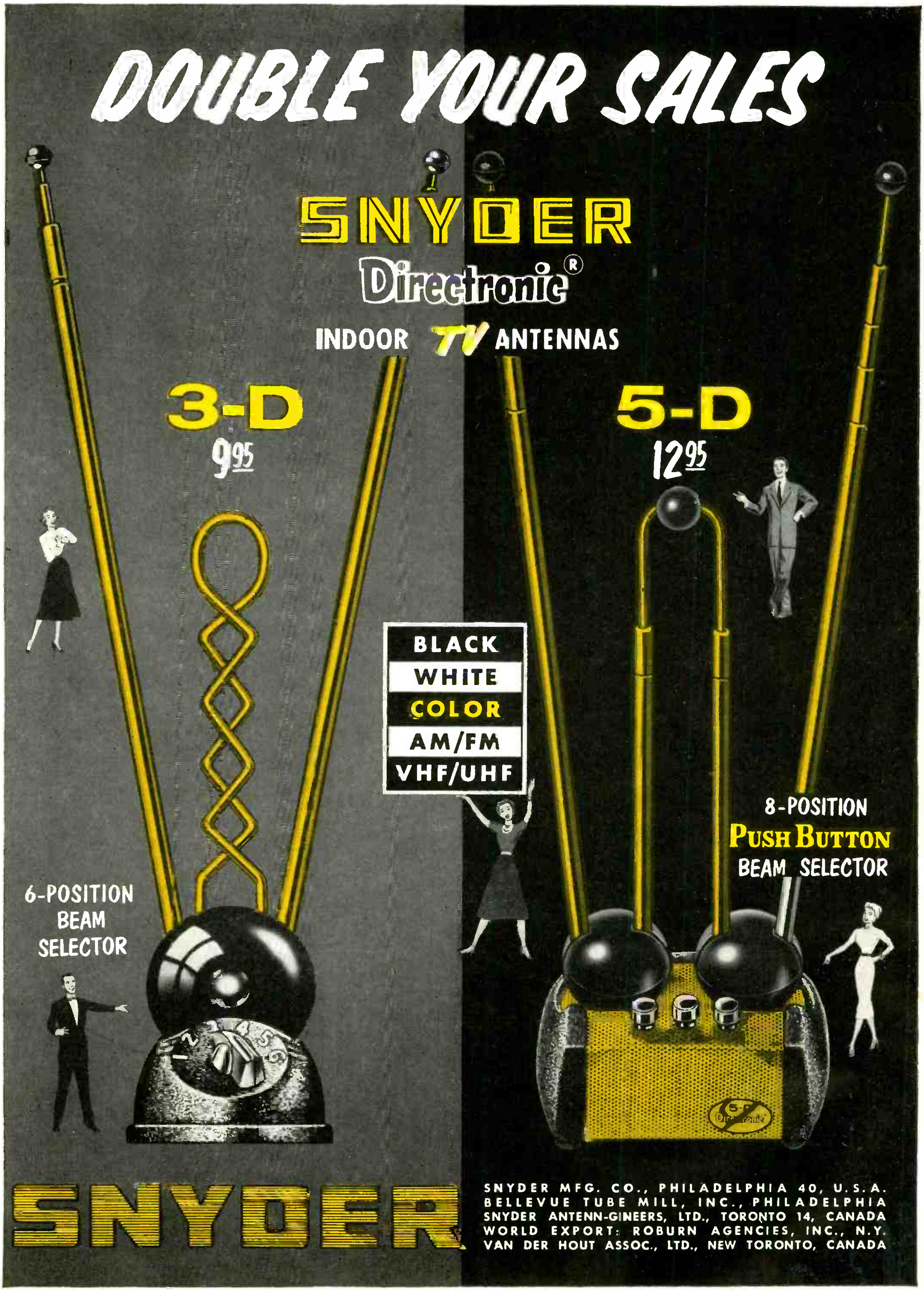


Fig. 12—Poor transient response; poorly damped peaking coils.

*Figure 11* indicates the amount of distortion observed on a 250 *kc* fundamental square wave when the picture detail began to get fuzzy. This may be used as a rough guide, and any wave form considerably worse than this would

*[Continued on page 56]*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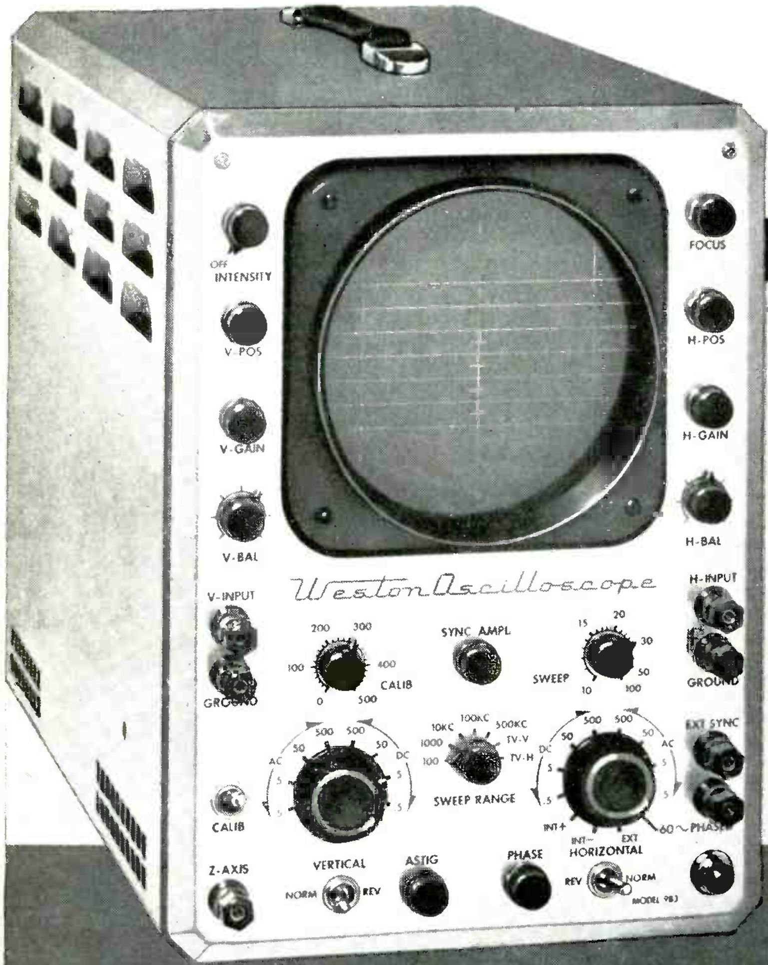
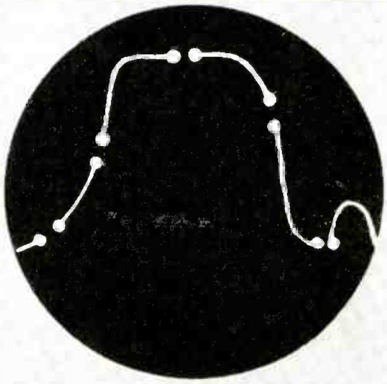



## WAVEFORM ANALYSIS



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The scope contains identical vertical and horizontal push-pull amplifiers with a choice of AC or DC coupling without affecting either sensitivity or bandwidth. Both amplifiers have compensated step attenuators and cathode follower input.

*It has excellent square wave reproduction with overshoot of only 2 to 5% with a rise time of 0.1 microsecond. The scope response is essentially flat throughout the specified range of 4.5 mc and is usable to 6 mc.*

The unit has provisions for internal calibration, internal phased sine wave, and Z-axis intensity modulation. Reversal of polarity of both horizontal and vertical signals is easily accomplished by means of toggle switching. *Tube replacements are non critical, and etched circuitry facilitates quick and rapid maintenance.*

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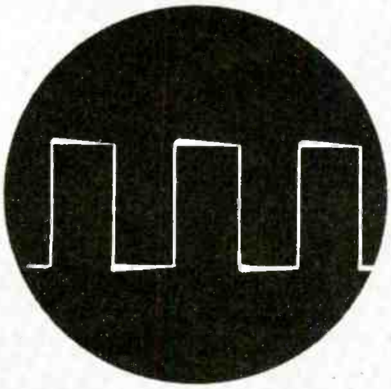
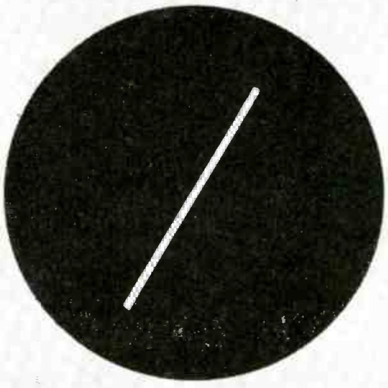
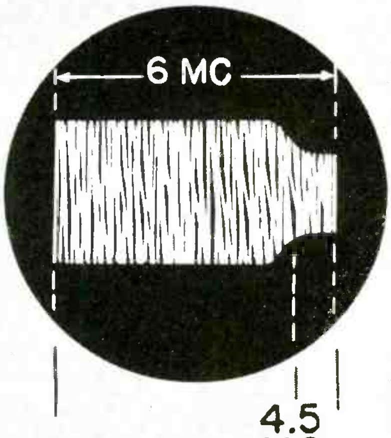
|  |  |  |
| Overshoot is only 2 to 5%. Rise Time is 0.1 Microsecond. Square wave depicted 250 kc. | Phase shift between horizontal-vertical amplifiers, 0-100 kc-0°, to 1 mc within 2°; by internal adjustment with gain controls at max 0° phase shift possible on any specific frequency to 6 mc. | Note flatness throughout specified range; usable to 6 mc. |

# 980 LINE OSCILLOSCOPE

## SPECIFICATIONS: MODEL 983 OSCILLOSCOPE

**Wide Band Frequency Response:** Flat within 1.5 db from 0-3.58 mc and within -3 db to 4.5 mc on both vertical and horizontal amplifiers. Transient response: overshoot 2 to 5%. Rise time: 0.1 microsecond.

**High Deflection Sensitivity:** 15.0 millivolts per inch, RMS, on both vertical and horizontal amplifiers.

**Phase Shift:** Between horizontal-vertical amplifiers, 0-100 kc-0°, to 1 mc within 2°; by internal adjustment with gain controls at max 0° phase shift possible on any specific frequency to 6 mc.

**Calibrating Voltages:** 500 millivolts, 5 volts, 50 volts, 500 volts, peak to peak. Readily available and adjustable by front panel controls.

**Z-Axis Modulation:** Input terminal mounted on front panel.

**Sweep Frequencies:** 10-500,000 cps, variable. Preset TV/V position—30 cps. Preset TV/H Position—7875 cps. Retrace Time—better than 2% to 100 kc; at 500 kc less than 10%.

**Internally Phased Sine Wave:** Adjustable through 170°.

**Vertical and Horizontal Polarity:** Reversible.

**Input Impedance:** Vertical Amplifier (without Shielded Cable), 1 meg shunted by 60 mmf. Vertical Amplifier (with Shielded Cable), 1 meg shunted by 120 mmf. Vertical Amplifier (with Low Capacitance Probe), 10 meg shunted by 12 mmf. Horizontal Amplifier (without Shielded Cable), 1 meg shunted by 60 mmf.

**Power Supply:** 105/125 volts, 50/60 cycles.

**Tube Complement:** (1)-1V2, (1)-5U4-GA, (6)-6BQ7A, (4)-12BY7A, (4)-6AH6V, (1)-6U8, (1)-5UP1, (1)-0D3, and (1)-5NO60T.

**Case:** Grey hammertone finished steel.

**Panel:** Aluminum finish with etched, black markings.

**Size:** 10" x 14" x 19.5" **Approx. Weight:** 40 lbs.

## OTHER WESTON 980 LINE INSTRUMENTS

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# ASSOCIATION NEWS

by Samuel L. Marshall, Editor

### Radio Television Guild of Long Island (N.Y.)

In a recent meeting at the State Capitol in Albany Governor Averill Harriman heard various members of the Industry express their views on licensing.

The service technician was represented by Mr. Joseph B. Forman, representing The Empire State Federation of Electronic Technicians Associations (ESFETA) as well as The Radio Television Guild of Long Island. He was instructed to take a positive stand for licensing provided the technician could sit in on its formation. Forman also attacked bait ads as detrimental not only to the consumer but a blot on the character of the legitimate serviceman. He cited examples of gyp operations and strongly urged legislation to eliminate these practices.

### Long Island Electronics Technicians Assn. Inc. (N.Y.)

A very interesting "1954-1955 Annual Report of Board of Directors" can well be emulated by other associations who want to bring to the forefront a review of their year's activities and accomplishments.

### National Alliance of Television & Electronic Service Ass'ns.

In the March issue of the NATESA Scope, Frank Moch minces no words editorializing on "factory service at retail". Following is an excerpt of his thoughts on the subject:

"Any independent who purchases the products and/or services of any manufacturer, distributor or jobber who has not proved, beyond doubt, his willingness to cooperate with independent service in the fulfillment of its destinies, is digging his own grave. This is particularly true of component producers who stand to lose as much as we, should independents be squeezed out.

"As far as set producers are concerned, remember that the best set in the world cannot be sold without advertising. Most manufacturers spend millions to sell their sets and yet every single independent, every single day, has rendered what the public accepts as favorable expert opinion on sets without ever receiving one cent compensation.

*[Continued on page 26]*

# P.A. in Supermarkets

by | Gene Hessel

PUBLIC address paging and background music systems are reaching unprecedented peaks of popularity and there is a big reason—public demand. There is hardly a place where the public gathers where such a system is not in use. Families dining out take the soft and dignified music they enjoy for granted. Theatres, churches, schools, factories and department stores are enjoying the benefits resulting from careful installation of Public Address paging and background music systems. These installations provide an ideal opportunity for increased earnings in a non-seasonal and specialized radio-TV field for the Service Dealer.

### Supermarkets—Natural Prospects

Growing up with the Public Address Paging and Background music system is the Supermarket or Self-Service Food Market—a spot where a good sound system is almost a "MUST". In such a location a system of this type performs a threefold duty: (1) it supplies background music for both customer and employee; (2) it is used for paging either customer or employee; and (3) it makes possible announcements of store specials or features, or any different store promotion throughout the store at any desired time. This latter practice is really efficient as has been proven by experience. If the music is suddenly terminated and is replaced by a voice over the public address system announcing that, "At counter #3 a free air ship balloon will be given with every purchase of Mrs. Kornfruits Krispy Krackers" Counter #3 will be surrounded in a very short time by many customers.

In the following paragraphs a typical Address Paging and Background Music system is described. The market selected is of the Self-Service type and has a main shopping area of 45,000 sq. ft. A lunch counter is provided for patrons where an inter-com system from counter to kitchen has been installed. This device aids greatly in the expediting of orders. Inter-communication to the various utility and store rooms from the Manager's office is effected with two new types of University Cobra Horn Paging speakers, Model CIB and CMIL, see *Fig. 1*. Two of the CIB units are installed in the general storeroom which comprises a fairly large area. The CIB speakers will handle 12 watts and mount quite easily with a universal bracket. The triangular base of the speaker bracket is fastened to the top of the University CTR-20 matching transformer with three screws, the mounting bracket of the CTR-20 then supports both the transformer and the speaker. The CMILs which are 3 watt speakers are used in the meat cutting room and in the fruit and vegetable room where less power is required.

The control equipment necessary for this particular sound installation is in the manager's office and is mounted in a small conventional type of relay rack. Music for this store is supplied by a continuous tape playing mechanism which employs a double track fourteen-inch pre-recorded tape running at three and three-quarter inch per second. This gives a total of eight hours of program material after which time the program repeats itself. The chances are remote that any customer would stay around long enough to hear the same program twice. If the store manager desires, announcements, advertisements for the various commodities handled by the store etc., can be interspersed throughout the music. The music selected is of a popular vein and can be pre-recorded by a recording studio, a radio station, or is available in commercial tapes.

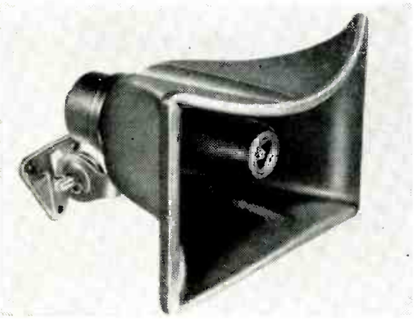

Fig. 1a—University Cobra horn paging speaker Model CIB.

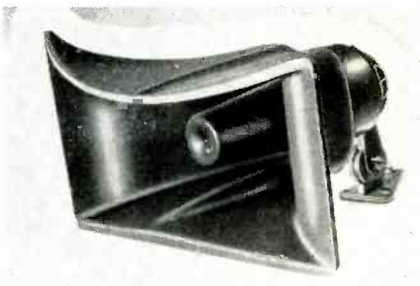

Fig. 1b—University Cobra horn paging specker Model CMIL.

The tape playing mechanism is fed into the low level input of a 30 watt power amplifier of good quality as shown in *Fig.* 2. The tape playing mechanism used is a Magnecord 814 which has a 500 ohm zero level output. This is fed through a line matching transformer to the input of the 30 watt amplifier. A microphone is used for paging employees or emergency announcements to the public, should this be necessary. The microphone stand is equipped with a push-to-talk switch which silences the microphone when it is not in use. When the switch is depressed the music is temporarily silenced. The advantages of this arrangement are quite evident.

A most important consideration is the selection of suitable loudspeakers and their placement. In general, the architectural structure of buildings such as Super Markets make them very poor acoustically. It is therefore necessary to use as many speakers as possible to insure keeping the over-all sound level at a minimum with a maximum of coverage. In this installation 12 University Model #6200 12" cone speakers are used with excellent results. The physical size of the 6200 is especially desirable since it is of a shallow design (4¼" deep) making it ideal for mounting into a ceiling type installation (see *Fig.* 3). It has power handling capacity of 30 watts and a frequency response of from 45 to 10,000 cps. Each of the 6200s is equipped with a good quality line matching transformer, whose primary impedance is 2500 ohms. The speakers are laid out in three rows of 4, effecting excellent objective coverage throughout the shopping area.

Fig. 2—Bogen Model J330 amplifier has three mike inputs.

Lowell type baffles (*Fig.* 4) are used to flush mount the cone speakers into the ceiling. They are constructed completely of spun aluminum and therefore are very light in weight. The Lowell enclosure consists of a steel "High Hat" can which is lined with a sound absorbing material. This can is attached directly to the overhead I beams from which the ceiling itself is supported. The baffle section of the Lowell enclosure is similar in appearance to the average air conditioning ducts normally installed into ceiling. The clean aluminum surface blends with the general styling of the store fixtures and counters. The speakers are wired in a loop from the amplifier through the speakers and returning to the amplifier. See *Fig.* 5.

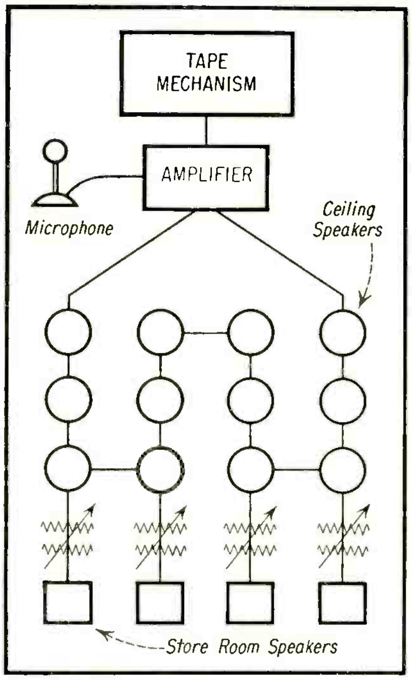


Fig. 5—Hookup of various components and speakers used in supermarket installation.

It is important to make certain that all speakers are connected in phase with each other. Before these speakers were installed they were checked and the terminals color coded on the bench. In order to insure having no interruption of sound (due to a break in the wiring system) the wire from the amplifier is fed through all the speakers and returned from the last speaker to the amplifier. For purposes of paging and supplying background music for employees working in the store room and the meat cutting areas, loudspeakers in convention type of wall baffles have been installed in these locations. Because it is impossible to pre-determine the volume needed in these areas, each speaker is equipped with an individual L pad. It is possible of course to increase or decrease the over-all store volume as desired, at the main amplifier itself, depending on the number of people in the store.


Fig. 3—University Model 6200.

Including the store room speakers, a total of 16 loudspeakers are used in the system. As mentioned previously, each is equipped with a line matching transformer with a primary impedance of 2500 ohms. This gives us a line impedance of 160 ohms which can be connected to the 250 ohm terminal on the power amplifier without too serious a mismatch. The amplifier which is used has a separate treble and bass control for proper tone balance. Number 14 stranded outdoor transmission line is used for loudspeaker cable connections.

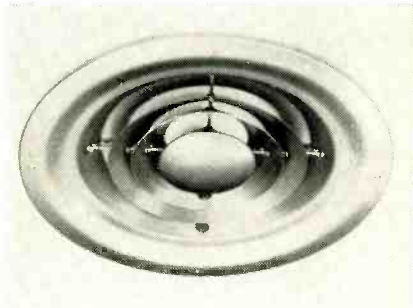

Fig. 4—Lowell diffusion baffle.

For a smaller market, in the interest of economy, a standard good quality automatic record player employing long playing records can do a good job of supplying the necessary background music. Other components of the system would be the same in all respects. While the initial cost of this type of installation would be less, it must be remembered that in the long run, constant replacement of records might prove to be more expensive than purchasing an automatic tape playing machine.

Since it is very easy to forget to shut off the automatic system over the weekend when the store is closed, an automatic time switch has been installed. This means that the system starts up and shuts off automatically at a pre-set time. The advantages of this time clock system are apparent. Availability is no problem since they are made by several manufacturers.

While the system just described is completely adequate for the market described, there are many more elaborate

*[Continued on page 61]*

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## ASSOCIATION NEWS

*[from page 20]*

This practice may have been reasonably sane as long as the very people for whose products you did such a tremendous sales job believed and practiced a live and let live philosophy."

### Television Service Association of Michigan

Alexander Weiss was re-elected president of the Television Association of Michigan at the annual election March 8. New officers elected were Charles Judd, first vice-president; Karl Heinzman, second vice-president; Ray Cobbledick, secretary; and Malcomb Wright, treasurer. The group also elected six directors: Edward Brown, Wm. Mattingly, Clayton Hibbert, Vernon Eberhardt, Harold Chase, and Jack Barton.

### Associated Radio & Television Servicemen—Illinois

ARTS scheduled an open house lecture on April 26. Speaking this evening were Harry Alter, President, The Harry Alter Company, Chicago. The Topic: "Keeping Marketing Within Bounds." Also heard was Paul H. Wendel, who spoke on "YOU—the Service Man." The guest Chairman and Moderator was Mr. Leonard Maher, Field Secretary, NARDA—Chicago.

### Radio & Television Electronic Technicians Assn.—N.Y.

R.A.T.E.T. announces a complete color TV series of lectures. Following is the date and subject schedule: May 5—Color Fundamentals; May 12—Color Circuitry; May 19—Troubleshooting and CRT; May 26—Alignment and Test Equipment.

### Associated Radio-Television Service Dealers—Columbus, Ohio

Congratulations to the above from Yours Truly (SLM) on the 11th year birthday of ARTSD News. The March 9th meeting was a Technical one, with James Parent and Robert Kerzman of Hickock Electrical Instrument Co. conducted the meeting. Application of test instruments as applied to Color TV and general alignment of B&W TV sets. A question and Answer period followed their interesting talk.

### Federation of Radio Servicemen's Associations of Penna.

At the March 20th meeting of the Pennsylvania Federation held in the Hotel Harrisburger, in Harrisburg, by unanimous decision the Federation of

*[Continued on page 55]*

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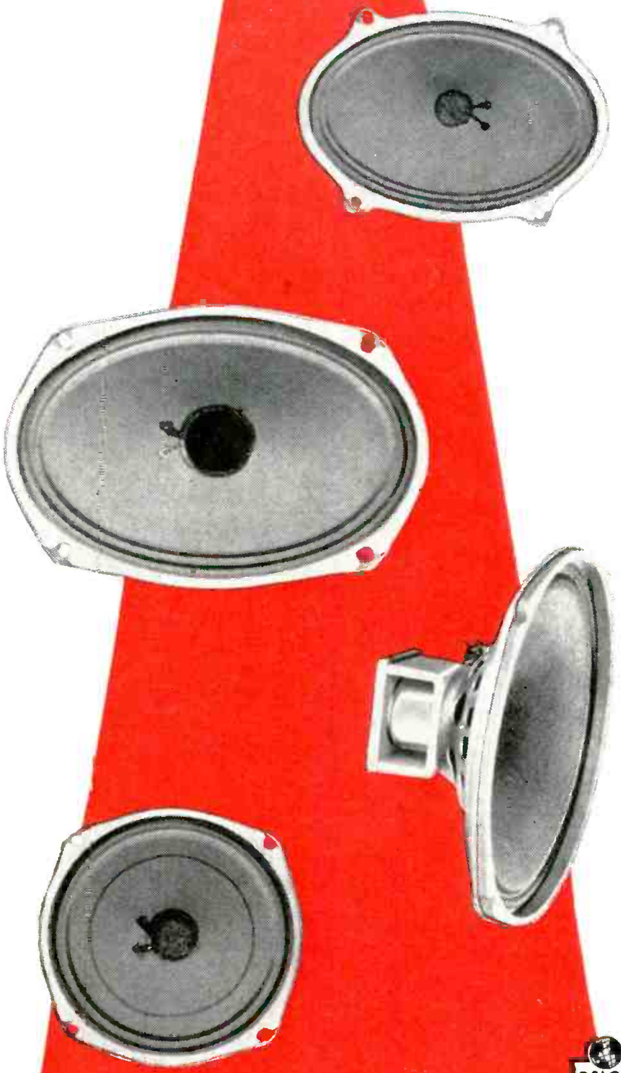

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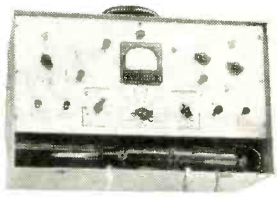

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# broad band antenna systems

by Douglas H. Carpenter
Chief Engineer, JFD Mfg. Co.

DURING the past few years there has been a gradual change in the nation's antenna requirements. Higher power grants, and finalized *vhf* frequency allocations have partially obsoleted the single channel antenna. Areas that were formerly serviced by one television transmitter now have several networks available. This process is still continuing, and has created a demand for all-channel antennas having characteristics equal to the single channel yagi on every *vhf* channel.

As a result, manufacturers of television antenna systems have concentrated on supplying and improving broad band arrays. When we discuss antenna systems we are speaking of passive networks or non-electronic circuitry. The limitations imposed upon the designer of such equipment are much greater than those in the general electronic field due to the fact that no secondary elements are available. There has been a great deal of interest expressed at dealer service meetings as to the actual electrical operation of the broad band antenna, and it is the purpose of this article to show how the most popular forms employ the same basic electrical principle to achieve performance on TV channels 2 through 13.

Three broad band antenna types manufactured by the JFD Manufacturing Co., Inc. are shown in the photograph of *Fig. 1* and are representative of the design trend followed to attain all channel reception. In order of their illustration they are the Star Helix Rainbow, Dodo, and Jet Helix Rainbow, trade name models. The same exact electrical principle of operation is employed in each antenna although the physical configuration is different. The gain curves, horizontal polar patterns and so forth are different, of course, because of the number and type of parasitic elements employed.

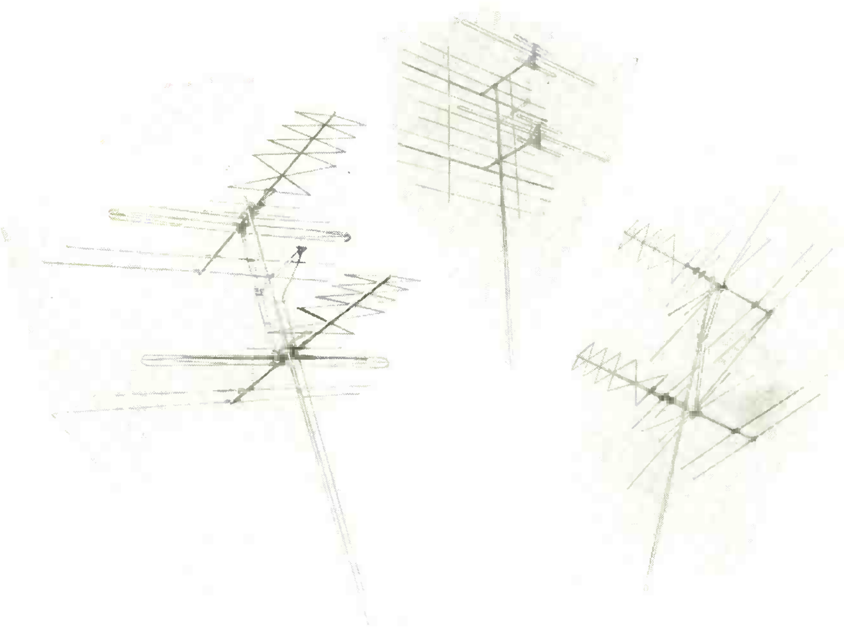

Fig. 1—Three broad band antenna types discussed in this article. Left: Star Helix Rainbow. Center: Dodo. Right: Jet Helix Rainbow.

If we wanted to design an antenna system for Channels 2 through 6 the problem would be greatly simplified, as here we are dealing with a continuous frequency range of 54 to 88 mc. There are many antennas that are used where only low channels are available, and generally they consist of a double driven element with a reflector and several directors to peak the high end of the low channels. This antenna or similar types cannot be used for reception of Channels 7 through 13, however, as here the pattern splits up into several lobes. *Fig. 2* shows the polar pattern of any resonant element operating at three times its fundamental half wave design frequency. This would be typical of a resonant element or antenna designed for Channel 3 operating on Channel 9.

*Figure 3A* shows the current distribution of a half wave element, and the direction of current flow. *Fig. 3B* shows

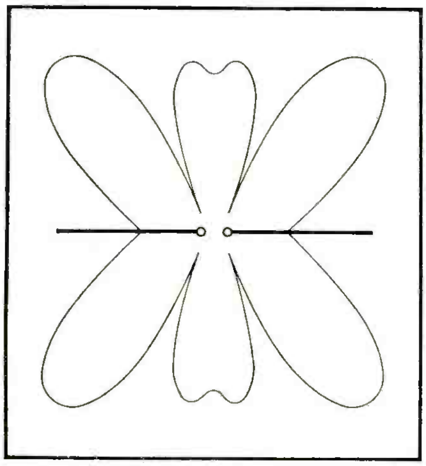

Fig. 2—Pattern obtained with 3/2 wavelength antenna.

this same element at three times this frequency and the current distribution that occurs. It can be seen that the antenna is divided into three parts; the center and two ends. The polarity or phase of the *center section* is exactly the same as that of *Fig. 3A* and the direction of flow is identical. The polarity of the two end sections are opposite, however, and the direction of current flow opposed to that of the center section. The net result is that we have a bucking current field resulting in the polar pattern of *Fig. 2* where the energy transmitted by such an antenna would be scattered and not concentrated into a single usable lobe.

The thought has probably already presented itself that a solution could be found if the center section could be removed. In this case, we would be left with the two in-phase end components resulting again in our single lobe pattern. Unfortunately, *physical* elimination of the antenna center would resonate the half wave point at the high end of the low TV channels, and the antenna would be full wave type on the high channels with a center impedance of approximately 1200 ohms. The ideal way to accomplish operation in both bands is to *electrically* eliminate the center component on Channels 7 through 13 and to substitute for it a component that is in phase with the end components. This condition would allow the current flow in the same direction along the entire dipole.

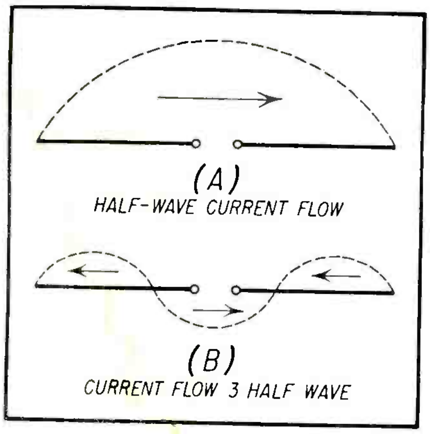


Fig. 3A—1/2 wave current flow.
Fig. 3B—3/2 wave current flow.

First let us consider the basic elements employed in the JFD Jet Helix Rainbow to accomplish this. *Fig. 4A* shows the three sections of the antenna that are important: the flat plane conical used for reception of Channels 2 through 6, and the high channel phasing element reflector and the high channel receiving element. It will be noted that the harness that connects the high channel element to the flat plane conical is transposed ½ turn. On Channels 2 through 6 the conical operates independently as the phasing element is short at these frequencies, and the length of harness plus the first crossover point of the helix have been so designed to act as a stub reflecting a high impedance at the conical terminals. On Channels 7 through 13 however, the phasing element serves to block energy normally received by the center of the conical, if we consider these two elements alone we would have the condition of *Fig. 4B*. It will be noted that the amplitude of the center current node has been greatly reduced. The direction of current flow in the high channel helix section is exactly the same as that of the undesired center component, but it is located in front of the conical at a definite spacing. Since the helix current flow is in the same direction as that of the undesired center section it is only necessary to transpose the interconnecting harness in order to change its phase 180 degrees at the conical terminals, and to re-insert it in phase with two end components. *Fig. 4C* shows the electrical result of this combination.

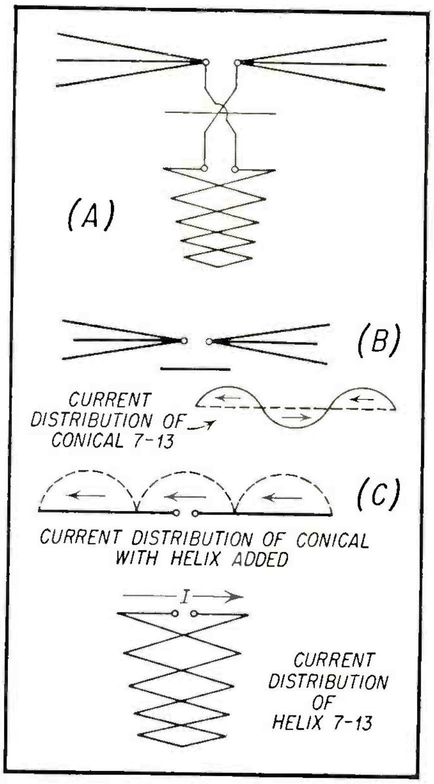


Fig. 4A—Jet Helix schematic. Fig. 4B—Current distribution of conical, channels 7-13. Fig. 4C—Current distribution of conical with helix added.

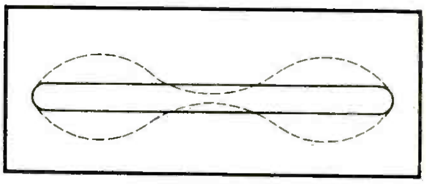

Fig. 5—Current distribution on a folded dipole.

The Star Helix Rainbow employs exactly the same elements with the addition of one extra phasing element. The current distribution on a folded dipole is shown in *Fig. 5*. Here we have a closed circuit and the current reverses itself on the top half. The second phasing element is used to further reduce the amplitudes of both center components before inserting the desired component from the helical section.

Another form of this principle is employed in the JFD Dodo where a second high channel dipole is used instead of the phasing element. Instead of reducing the amplitude of the undesired center component by blocking action the component from one dipole is used. It can be seen in *Fig. 6* that the harness from both small dipoles are transposed to a common take-off point, and that the harness from the large dipole is run straight. This, as in the case of the Jet Helix Rainbow and Star Helix Rainbow, is to insert the two components from the small dipoles in the correct phase: one to reduce the amplitude of the undesired component and one to substitute for it.

[*Continued on page 60*]

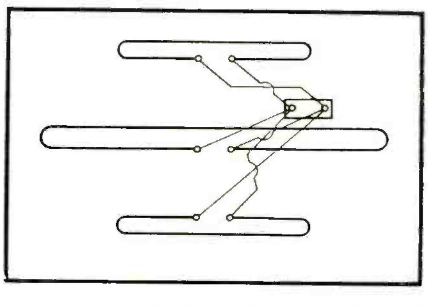

Fig. 6—Harness connections of JFD Dodo.

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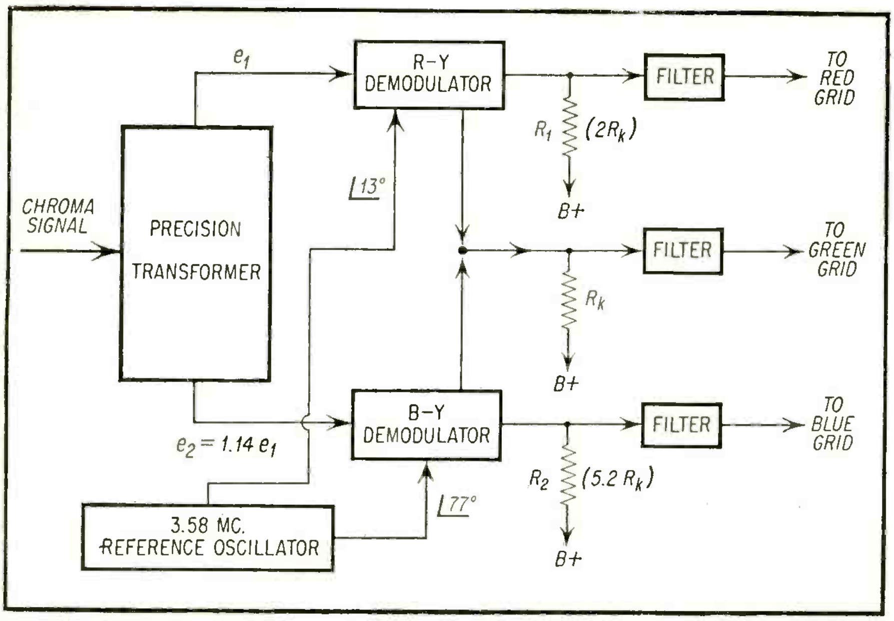


Fig. 1—Block diagram of high-level 2-triode demodulator system.

# CHROMINANCE Systems in Color TV Receivers


by BOB DARGAN and SAM MARSHALL


**Part 6**

In the previous installment we introduced high level 2-triode demodulation and pointed out that the 3.58 *mc* reference signal is required at 13 and 77 degrees for R-Y and B-Y respectively or 64 degrees apart. This is shown in the block diagram of *Fig. 1*, and the circuit diagram of *Fig. 2*.

We will now procede to derive the reasons for these unique demodulation angles, unique from the point of view that we have hitherto been accustomed to demodulate with the 3.58 *mc* axes displaced 90 degrees from one another. We will begin with a simplified diagram of *Fig. 2* from which we will develop the complete two triode demodulation circuit. It might be pointed out that *Fig. 2* as a circuit will work provided we matrix the R-Y and B-Y outputs to obtain G-Y.

At the outset, let us assume that the chrominance signal enters the transformer $T_1$, which feeds two secondary windings, $S_B$ and $S_R$. $S_B$ feeds the B-Y demodulator and $S_R$ feeds the R-Y demodulator. Under these conditions the vectorial diagram will be as represented in *Fig. 3*. It is important to emphasize that there is an exact correspondence between the phase of the 3.58 *mc* in-

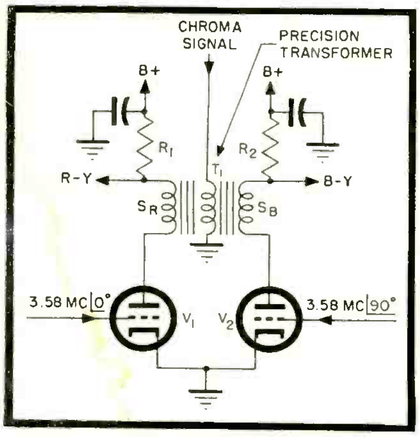


Fig. 2—Symplified circuit diagram of high-level 2-triode demodulator.

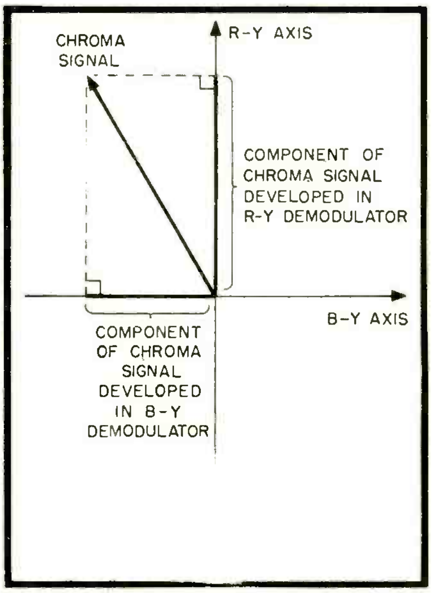


Fig. 3—Chroma signal is demodulated along R-Y and B-Y axis in R-Y/B-Y demodulator.

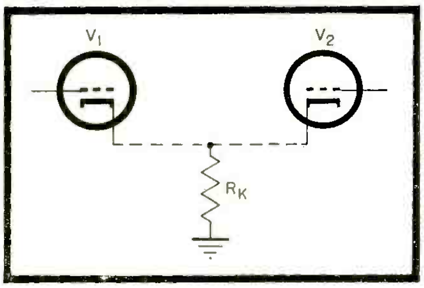


Fig. 4—$R_K$ inserted in cathode.

jected on the grid and the demodulated information between the plate and cathode.

Let us now alter *Fig.* 2 to include a small resistor in the cathode circuit as shown in *Fig. 4*. Doing so will result in a small voltage being developed across it which will be a combination of the R-Y signal in $V_1$ and the B-Y signal flowing in $V_2$. We are assuming here that the plate current through each tube is of such a nature that the voltage across each plate resistor is still maintained as R-Y and B-Y.

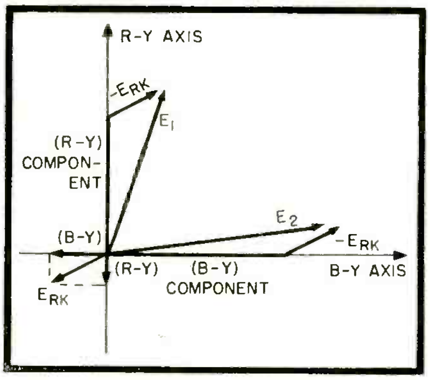


Fig. 5—Altered vector diagram.

Under these conditions we will have to alter the vector diagram of *Fig.* 3 to accommodate the small voltage drops in the cathode circuit. This is shown in *Fig.* 5 where we show the voltage $E_{RK}$ as the vector sum of the negative B-Y and R-Y voltage drops. Now, the voltage between the plate and cathode of the R-Y demodulator ($E_1$) will no longer be just R-Y but rather the difference of R-Y and $E_{RK}$. Therefore, we add a voltage at the top of R-Y in an opposite direction to $E_{RK}$ and the resultant of R-Y and $-E_{RK}$ is the voltage $E_1$. By a similar analysis the resultant of the voltage B-Y and $-E_{RK}$ is equal to the voltage $E_2$.

Observe, now, that the demodulation voltages from plate to cathode, $E_1$ and $E_2$, are no longer 90 degrees apart as was customary in previous demodulator circuits and assumed at the outset. This dictates that the angles of zero and 90 degrees on the grids of both tubes must be modified so that they are strictly in correspondence with the phase requirements of $E_1$ and $E_2$. Again, it must be emphasized that the difference between $E_1$ and R-Y is that $E_1$ is the voltage between plate and cathode and R-Y is the voltage between plate and ground.

By properly selecting the relative voltage on $S_B$ and $S_R$, the resistors $R_1$, $R_2$ and $R_K$, and the phase angle at the grids as shown in *Fig. 1*, the system can be made to produce R-Y and B-Y at each plate resistor and G-Y across the cathode resistor $R_K$. These requiremeters are again listed below for emphasis.

(1) $E_1 : E_2 = 1 : 1.4$
(2) Phase of $E_1$ is 13°
(3) Phase of $E_2$ is 77°
(4) $R_1 = 2R_K$
(5) $R_2 = 5.2R_K$

It would be instructive at this point to assume a transmitted signal such as a red bar, and to examine the various voltages developed at both demodulators. Let us assume that the incoming signal is such as to produce a one volt signal on the grid of the red gun. Under these conditions the following signal magnitudes must be present:

Y = .3 volt
R-Y = .7 volt
B = 0
B-Y = −.3 volt
G = 0
G-Y = −.3 volt

We will assume one of the above conditions, that is R-Y = .7 volt, and show how the other values are caused to be established in the circuit. At the outset Y must equal .3 volt by reason of the expression:

$$Y = .3R + .59G + .11B$$

where G and B are both equal to zero.

Reference to *Fig. 6* indicates that demodulation of the red signal is entirely along $E_1$, and because of the right angle relation of the signal with $E_2$ it has no component along the $E_2$ axis. Therefore the demodulating action will be restricted entirely to $V_1$.

An equivalent version of the demodulator circuit is shown in *Fig. 7* for the specific case under discussion. Here we observe that $V_1$ and $V_2$ are replaced

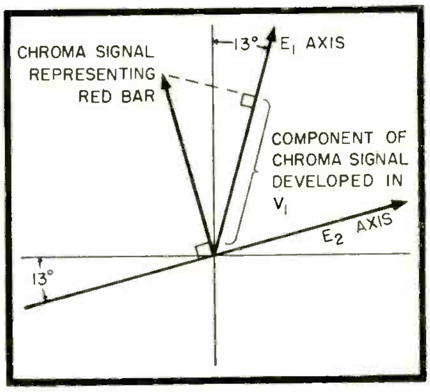


Fig. 6—Signal developed in $E_1$.

by equivalent switches conducting for a very short period of time during each 3.58 *mc* cycle at such times as to correspond to the phase angle of the 3.58 *mc* signal on the grid.

Note that $R_2$ is in parallel with $R_K$ by virtue of the switch action of $V_2$. Therefore B-Y has the same magnitude

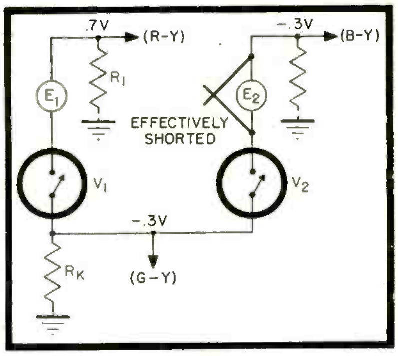


Fig. 7—Equivalent circuit.

as G-Y. Referring to the relationship for G-Y given in previous installments:

$$G\text{-}Y = -.51(R\text{-}Y) - .19(B\text{-}Y)$$

we obtain by substitution of G-Y for B-Y,

$$1.19(G\text{-}Y) = -.51(R\text{-}Y)$$

$$(G\text{-}Y) = -\frac{.51 \times (.7)}{1.19} = -.3 \text{ volt}$$

Since in the above case G-Y and B-Y are in parallel, B-Y is also equal to −.3 volt.

[*Continued on page 60*]

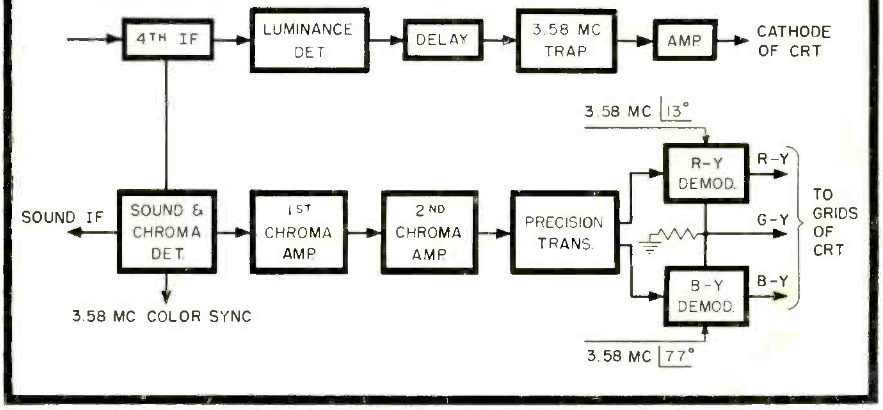


Fig. 8—Block diagram of high level 2-triode demodulator.

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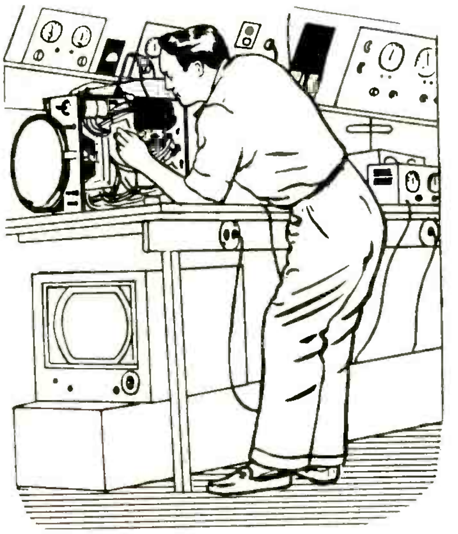


# The Work Bench

by **PAUL GOLDBERG**

***This Month:***

**MICROPHONIC & SOUND BAR PROBLEMS**

### Du Mont RA 109

The receiver was turned on and sound bars were noted in the picture, but only at and above normal volume control settings. Before replacing any tubes it had to be determined whether the trouble was caused by microphonic action or by inadequate filtering in the plate or cathode of the audio output stage. The speaker was next disconnected and the receiver was turned on again. The sound bars once more appeared at a high volume setting and disappeared at a low volume setting. As a more positive check a dummy load resistance of about 5 ohms was connected in place of the speaker. This was done to simulate normal conditions while eliminating the microphonic effect. Nevertheless, sound bars again appeared at a high volume control setting. Thus, the trouble was in the filtering.

First a new filter was shunted across *C222A*, the plate load filter condenser. This cut down the intensity of the sound bars to some extent. Next, a filter was placed across *C222B*, the plate load filter of the first and second audio amplifiers. This action decreased the intensity of the sound bars even more. A filter was then shunted across *C222D*, the audio output cathode filter. This eliminated the sound bars in the picture completely. It was noted, moreover, that *C222A, B*, or *D*, individually would not eliminate the sound bars. It was therefore decided that the entire can, *C222A, B, C*, and *D* be replaced. This was done and the receiver now functioned properly.

Let us see now how sound bars were produced in this case. Sound bars are horizontal bars that vary in step with the modulation of the signal of the station. The number of bars varies with the frequency of the audio signal. At moments when the sound frequency is 300 cycles, there are five horizontal dark bars; when the sound frequency is three thousand cycles there are fifty horizontal dark bars (one dark bar per 60 cycles). The intensity of the bars varies with the strength of the audio signal. When a receiver is operated at a high volume level, there are large audio frequency variations of current in the plate and cathode circuits of the audio output stage. These current variations impose a varying drain on the "B" supply. If the plate and cathode supply circuits are not adequately filtered the current variations in the audio output stage may produce an appreciable amplitude of audio frequency ripple in the "B" supply voltages. This ripple can affect the operation of various sections of the receiver, producing audio frequency variations in picture signal gain, in width, and in horizontal sync phasing. The general effect is the appearance of sound bars in the picture. The bars are not present at a low volume level because the voltage regulation is better at reduced loads.

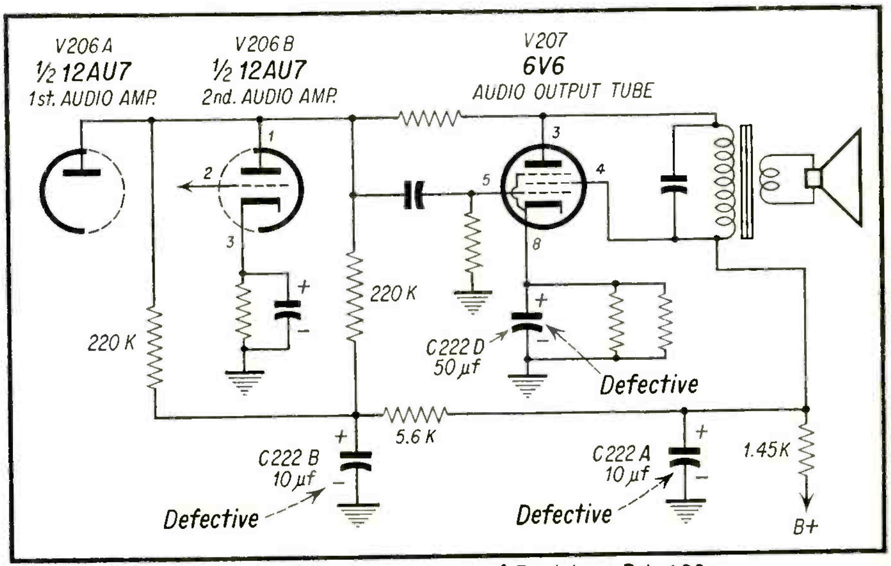



Fig. 1—Partial schematic of Du Mont RA 109

### Admiral 19E1

The receiver (in cabinet) was turned on and as the volume was turned up a microphonic whistle was heard from the speaker. The *rf* oscillator was then replaced with a number of new 6J6 tubes but still the microphonic whistle remained. It might be added that at low volume the whistle disappeared.

The speaker mounting screws and nuts were then removed and the speaker was suspended by hand in approximately the same location, but away from the cabinet; but this did not solve the problem. The receiver was next removed from the cabinet. Again at above normal volume the microphonic whistle was heard.

Suspecting a vibrating component in the tuner which usually causes this condition the side cover was then removed from the tuner to provide recess to the *rf* oscillator circuit. A long plastic

[*Continued on page 59*]

# Circuit Analysis

by Radio Television
Service Dealer
Technical Staff

***This Month's Circuit: Admiral 21A3Z Voltage Distribution***

Suppose you answered a call for service and found that very common combination of symptoms, namely, raster but no sound and no picture. Nine chances out of ten the wheels upstairs would turn and you would conclude that there was trouble somewhere in the tuner or in the video strip somewhere before sound take-off. You could be wrong though if you happened to run into a circuit similar to that used in many Admiral receivers.

*Figure 1* is a partial schematic of the Admiral 21A3Z chassis. Because of the unusual arrangement used for the distribuation of B+ voltage, a failure at V204, the audio output tube would result not only in the loss of sound, *but loss of picture as well*. Notice that the power supply delivers 265 volts at the filter choke *L501*. This is fed to the plate of the 6W6 audio output tube via the fuse, *R502*, and the primary of the audio output transformer. The cathode of the audio output tube, however, does not return to B–, or ground, through the usual cathode bias resistor. Instead, it is connected so that it supplies plate voltage for a number of other stages. *Fig.* 2 is a partial block diagram showing how these stages receive their B+ from the cathode of the audio output tube. In effect the audio output tube in this case acts as a dropping resistor, dropping the voltage from 265 at the plate to 145 at the cathode.

The advantages of this system of B+ distribution are twofold. First, by placing tubes in series, as is done here, the current handling requirement of the high voltage winding on the power transformer is reduced, thereby cutting costs. Secondly, as will be explained later, the audio output tube is made to serve still another function, namely, that of a voltage regulator for the 145 volt supply line.

*Figure 1* is a partial schematic which corresponds to that part of *Fig.* 2 shown in heavy lines. Actually, it is only one of the many parallel paths from the cathode of V204 to ground shown in *Fig.* 2. We are concerned here with this path because it is the one involved in producing the symptoms mentioned at the outset.

*Figure* 3 is a simplified equivalent circuit corresponding to the schematic of

*[Continued on page 52]*

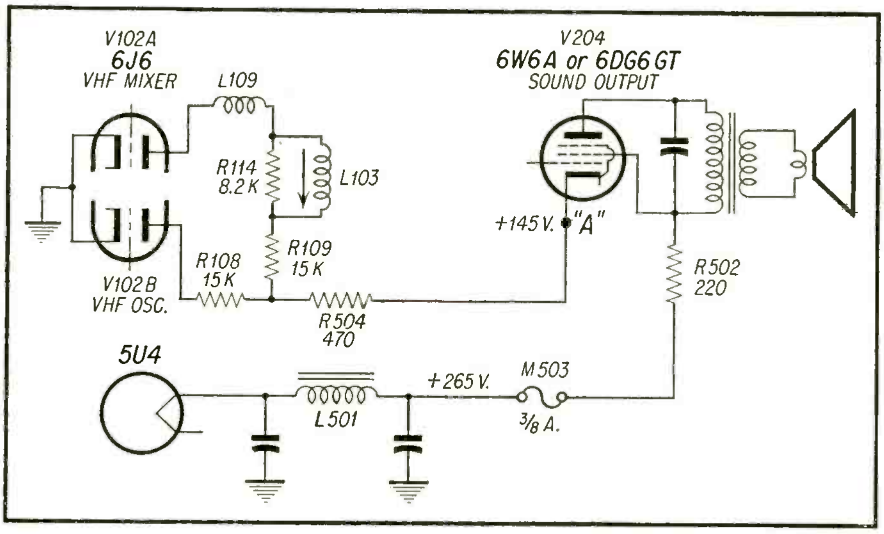



Fig. 1—Partial schematic showing B+ distribution in Admiral 21A3Z.

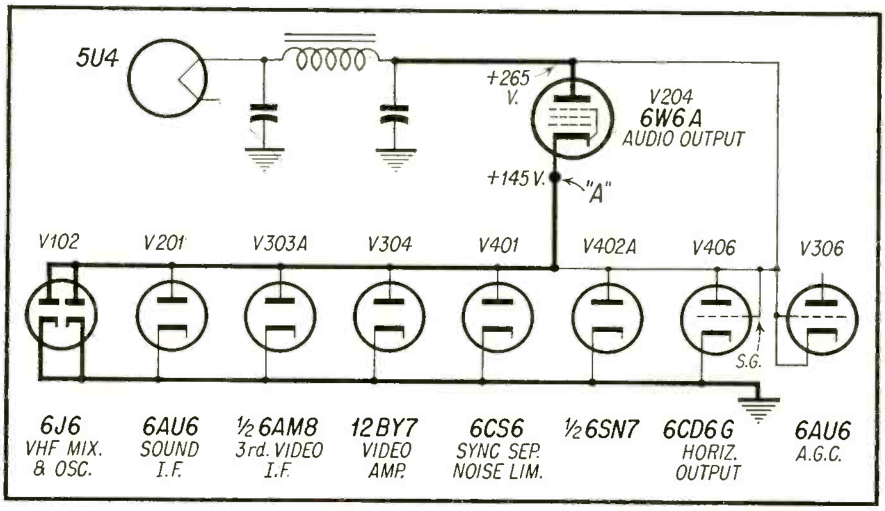



Fig. 2—Simplified diagram of B+ distribution in Admiral 21A3Z.

**Mfr:** Emerson **Chassis No.** 120140-B

**Card No.** EM 140-1 **Model No.** 680D

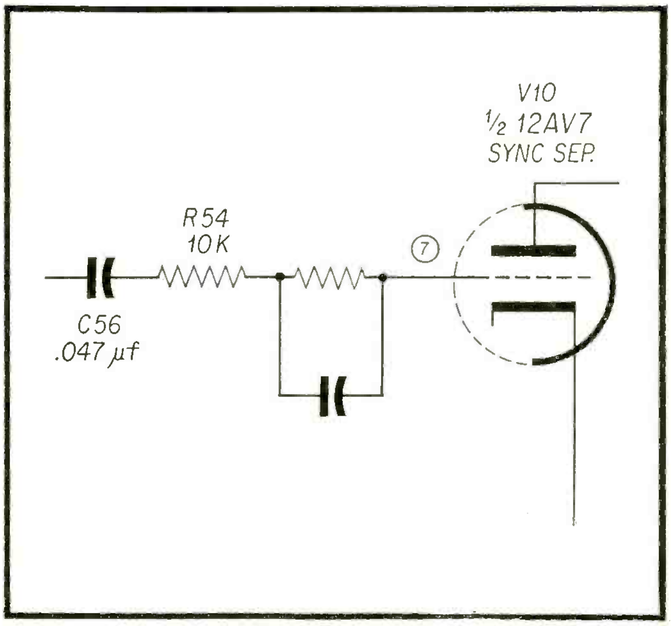
**Section Affected:** Sync

**Symptom:** Critical horizontal and vertical hold

**Cause:** Leaky condenser

**What to Do:**

Replace: *C56* (.047 *μf*)

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**Mfr:** Emerson **Chassis No.** 120140-B

**Card No.** EM 140-2 **Model No.** 680D

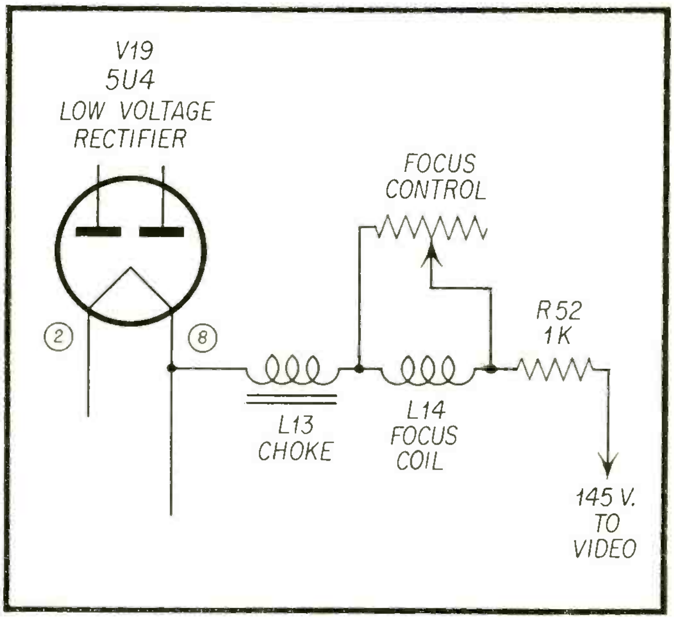
**Section Affected:** Pix and sound

**Symptom:** No pix or sound

**Cause:** Open resistor

**What to Do:**

Replace: *R52* (1K)

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**Mfr:** Emerson **Chassis No.** 120140-B

**Card No.** EM 140-3 **Model No.** 680D

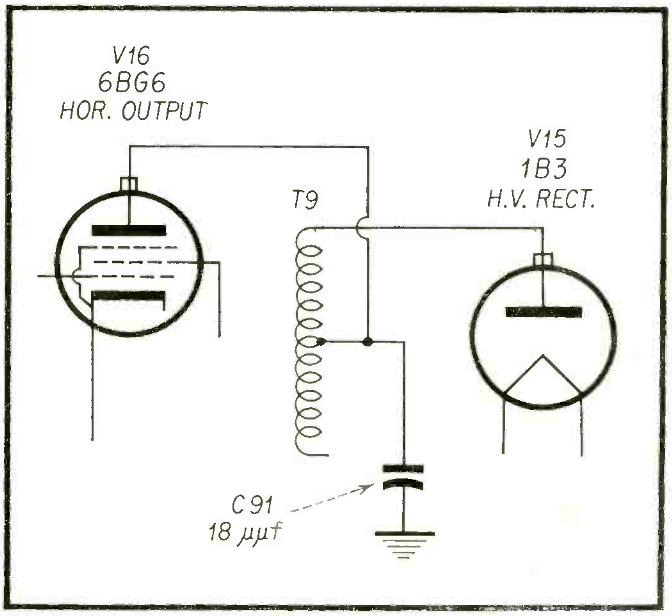
**Section Affected:** Raster

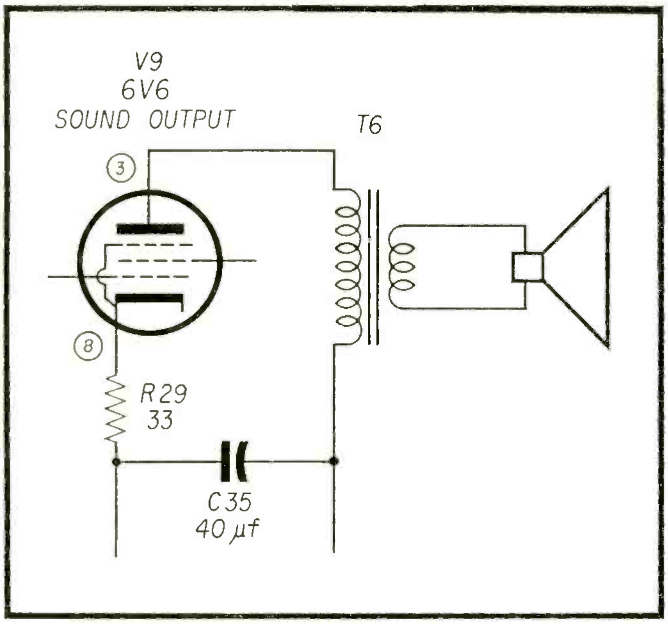
**Symptom:** Flashes in pix

**Cause:** Arcing condenser

**What to Do:**

Replace: *C91* (18 *μμf*)



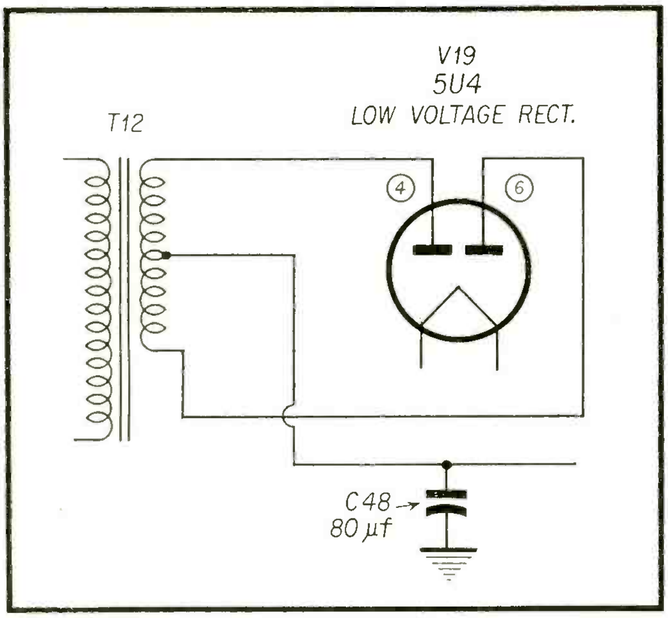



**Mfr:** Emerson **Chassis No.** 120140-B
**Card No.** EM 140-4 **Model No.** 680D
**Section Affected:** Pix
**Symptom:** Sound bars in pix
**Cause:** Leaky filter condenser

**What to Do:**

Replace: *C35* (40 µf)

---

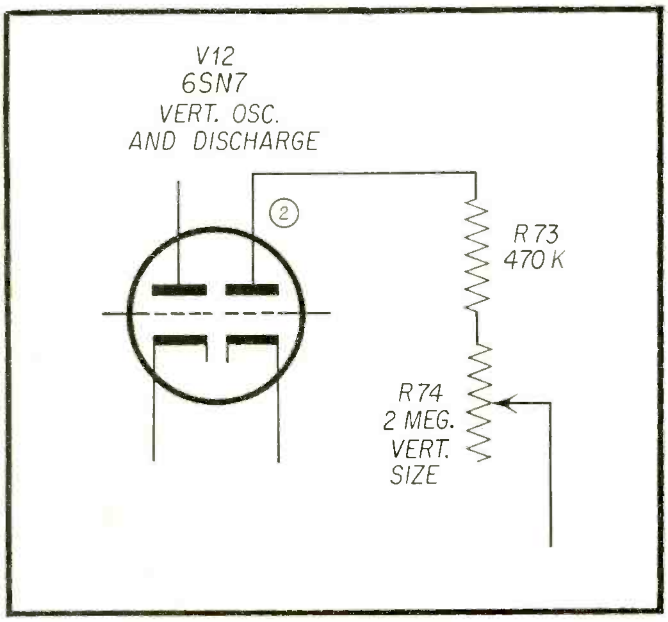



**Mfr:** Emerson **Chassis No.** 120140-B
**Card No.** EM 140-5 **Model No.** 680D
**Section Affected:** Sync
**Symptom:** Critical vertical hold and horizontal wiggle
**Cause:** Leaky filter condenser

**What to Do:**

Replace: *C48* (80 µf)

---




**Mfr:** Emerson **Chassis No.** 120140-B
**Card No.** EM 140-6 **Model No.** 680D
**Section Affected:** Pix
**Symptom:** Cannot reduce height properly
**Cause:** Vertical control changed in value

**What to Do:**

Replace: *R74* (2 meg.)

**Mfr:** Motorola **Chassis No.** TS-525

**Card No:** MO525-1

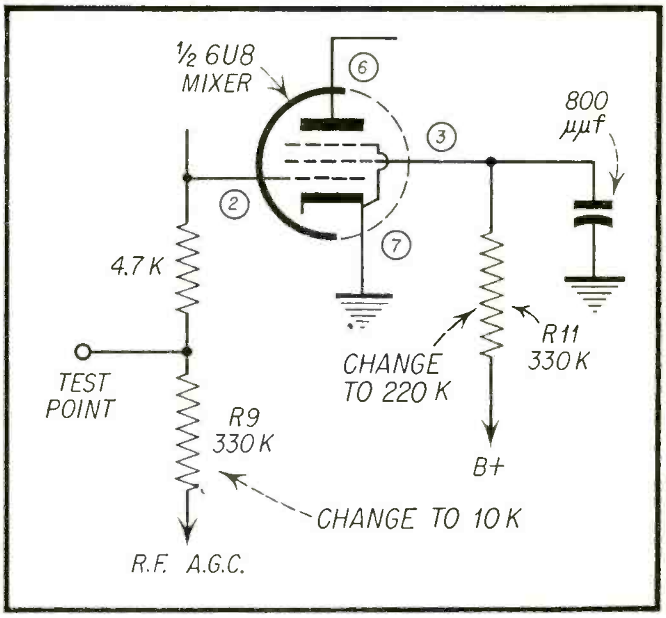
**Section Affected:** Pix and Sound

**Symptoms:** Excessive TVI

**Reason for Change:** Circuit improvement

**What to Do:**

Change: *R9* from 330K to 10K *also*, *R11* from 330K to 220K




**Mfr:** Motorola **Chassis No.** TS-525

**Card No:** MO525-2

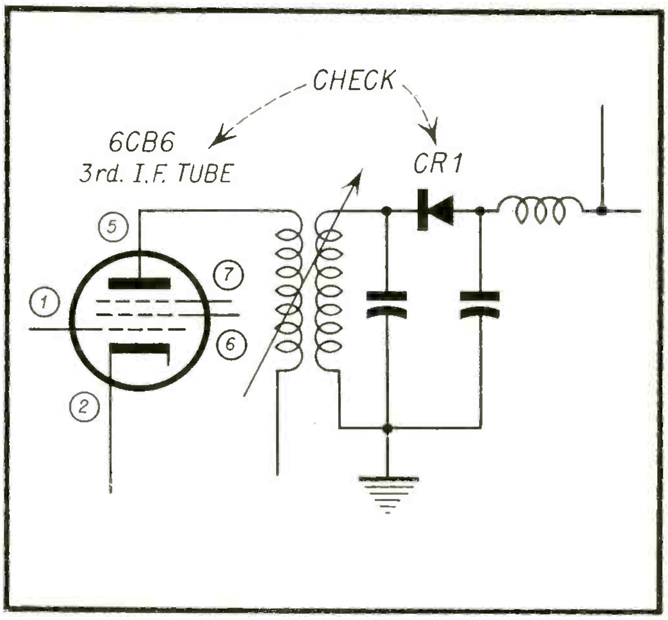
**Section Affected:** Pix

**Symptoms:** Horizontal Pulling

**Cause:** Component Failure

**What to Do:**

Change: 3rd *if* tube (6CB6) or video detector crystal (CR1)




**Mfr:** Motorola **Chassis No.** TS-525

**Card No:** MO525-3

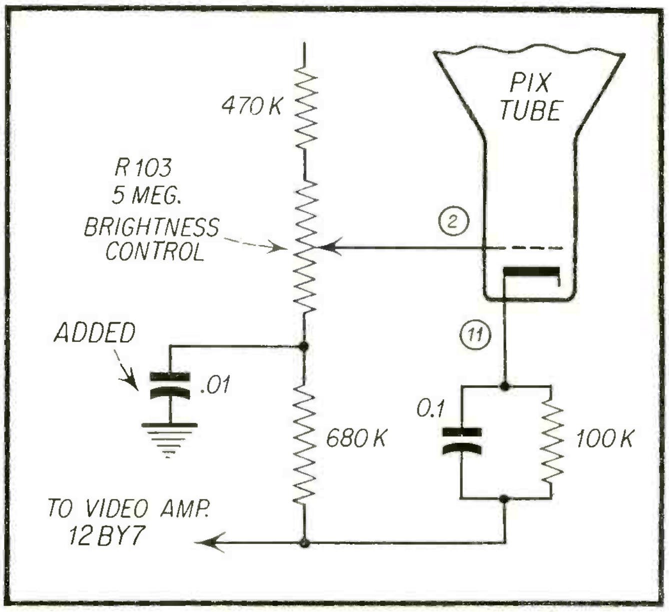
**Section Affected:** Pix

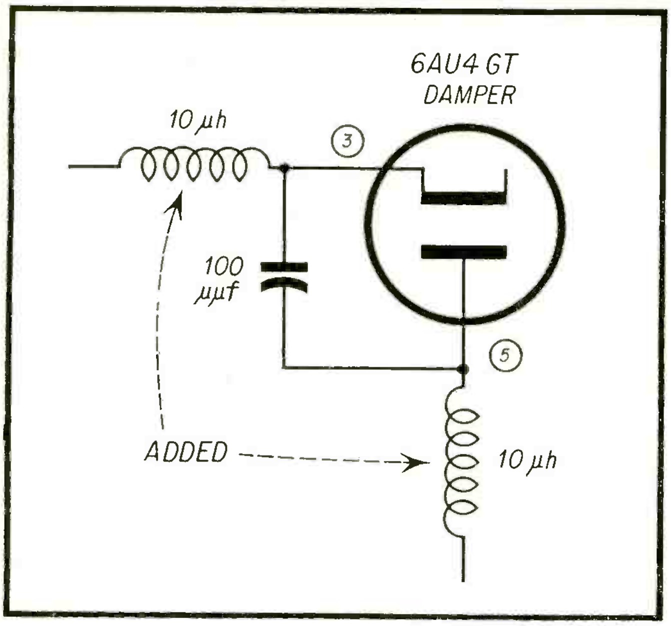
**Symptoms:** Picture Pulling

**Cause:** Coupling between horizontal hold control and brightness control leads

**What to Do:**

Add: .01 μf at brightness control






**Mfr:** Motorola **Chassis No.** TS-525

**Card No:** MO525-4

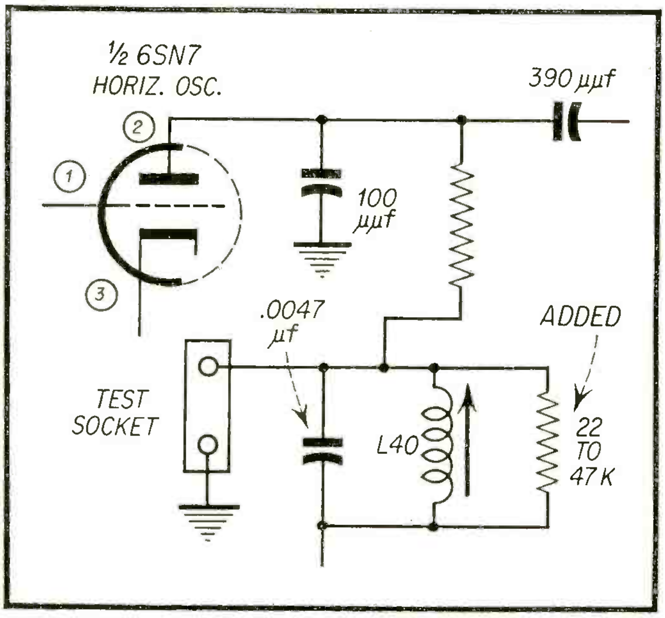
**Section Affected:** Pix

**Symptoms:** Horizontal Jitter

**Reason for Change:** Circuit Improvement

**What to Do:**

Add: 10 microhenry chokes in plate and cathode leads of damper tube




**Mfr:** Motorola **Chassis No.** TS-525

**Card No:** MO525-5

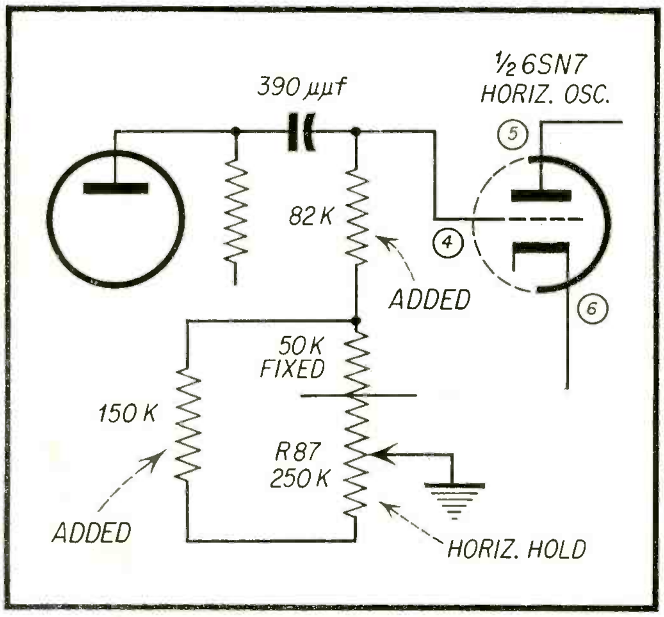
**Section Affected:** Pix

**Symptoms:** Horizontal jitter and hunting

**Reason for Change:** Circuit improvement

**What to Do:**

Add: 22K to 47K across horizontal osc. coil




**Mfr:** Motorola **Chassis No.** TS-525

**Card No:** MO525-6

**Section Affected:** Pix

**Symptoms:** Critical horizontal lock-in

**Reason for Change:** Circuit improvement

**What to Do:**

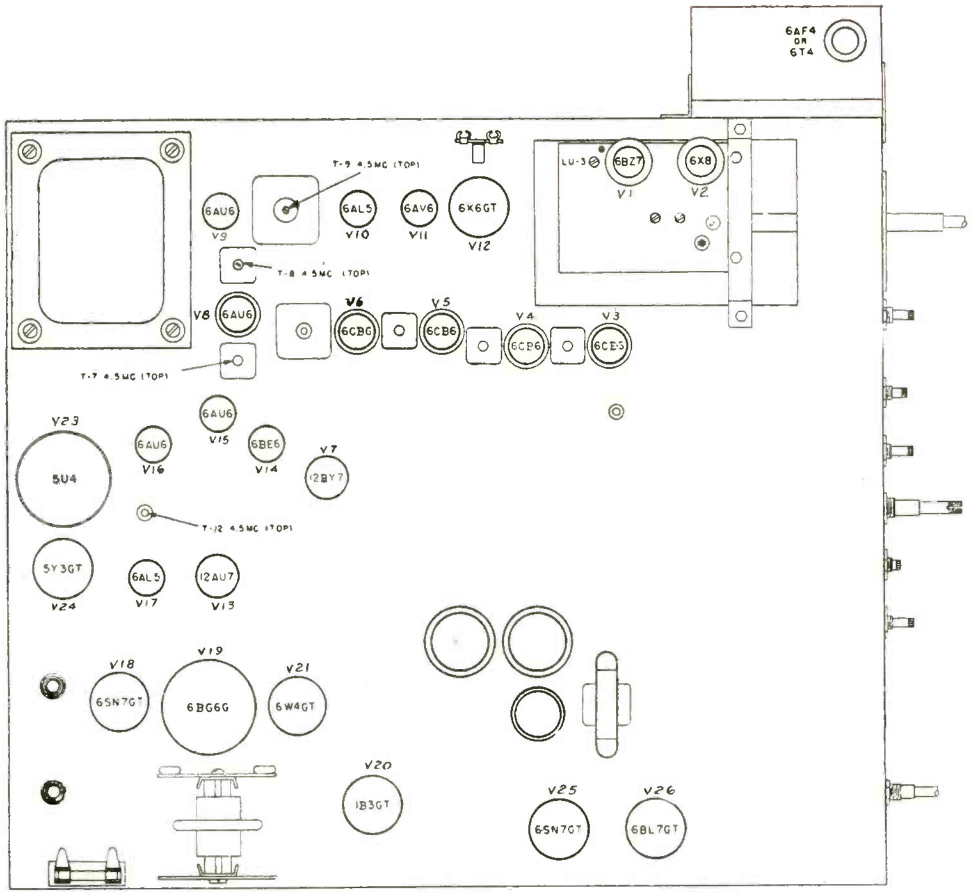
Check: Horizontal hold control
Add: 82K in series with hor. hold control
*Also:* 150K in shunt with hor. hold control

# SENTINEL

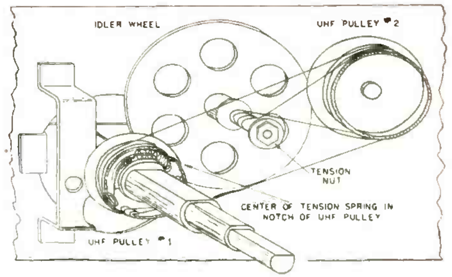
Model No.
IU-581, -582, -584, -585

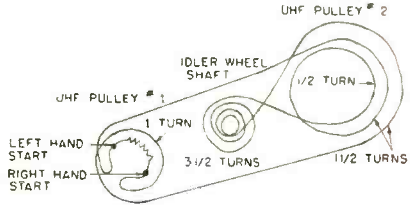
## TUBE LIST

| SYMBOL | TUBE | CIRCUIT FUNCTION |
|---|---|---|
| | 6AF4 | UHF Oscillator |
| V1 | 6BZ7 | VHF RF Ampl |
| V2 | 6X8 | VHF Converter |
| V3 | 6CB6 | Video IF Ampl |
| V4 | 6CB6 | Video IF Ampl |
| V5 | 6CB6 | Video IF Ampl |
| V6 | 6CB6 | Video IF Ampl |
| V7 | 12BY7 | Video Ampl |
| V8 | 6AU6 | 1st Sound IF Ampl |
| V9 | 6AU6 | 2nd Sound IF Ampl |
| V10 | 6AL5 | Ratio Detector |
| V11 | 6AV6 | Audio Ampl & Bias Clamp |
| V12 | 6K6GT | Audio Output |
| V13 | 12AU7 | Sync Ampl & Phase Splitter |
| V14 | 6BE6 | Noise Gate |
| V15 | 6AU6 | Sync Ampl |
| V16 | 6AU6 | AGC Keyer |
| V17 | 6AL5 | Phase Detector |
| V18 | 6SN7GT | Horizontal Oscillator |
| V19 | 6BG6GT | Horizontal Output |
| V20 | 1B3GT | High Voltage Rectifier |
| V21 | 6W4GT | Horizontal Damper |
| V22 | 21FP4A | 21" Picture Tube Electrostatic Focus |
| V23 | 5U4G | Low Voltage Rectifier |
| V24 | 5Y3GT | Low Voltage Rectifier |
| V25 | 6SN7GT | Vertical Oscillator |
| V26 | 6BL7GT | Vertical Amplifier |

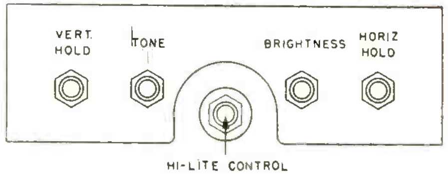



TOP VIEW




DIAL STRINGING

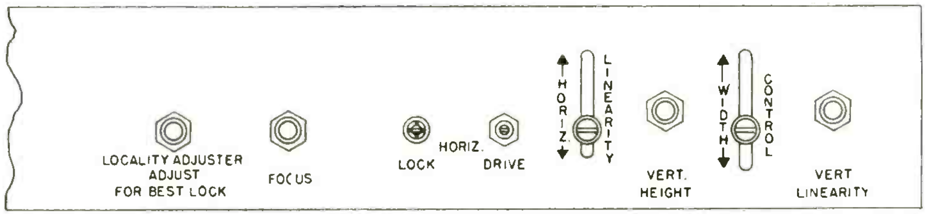



FRONT CONTROLS

## KEY VOLTAGES

| | | |
|---|---|---|
| B+, plate of damper, V21 | pin 5 | 300 vdc |
| Plate(s) of VERT. OSC., V25 | pin 2 | 145 vdc |
| | pin 5 | 135 vdc |
| Plate of Vert. Out., V26 | pins 2 and 5 | 280 vdc |
| Plate(s) of Hor Osc. V18 | pin 2 | 250 vdc |
| | pin 5 | 180 vdc |
| Grid of Hor. Out., V19 | pin 5 | -35 vdc |

(All voltages are measured with a VTVM connected between the tube pins and chassis.)




REAR CONTROLS

TV FIELD SERVICE
Pre-published from Rider "TV Field Service Manual"
by Rider & Alsberg

# ADJUSTMENTS

## GENERAL INSTALLATION INSTRUCTIONS

While each receiver is correctly aligned at the factory rough handling in transit, drift, etc., may throw the receiver off, so we suggest that the proper oscillator trimmers, ratio detector, and rear panel controls be checked for correct adjustment with a transmitted television pattern, in the customer's home at the time of installation. Be sure to have the receiver operating for one-half hour before making these adjustments. Listed below is the correct procedure to follow in making these adjustments.

(A) Check all operating channels, using FINE TUNING CONTROL for best picture detail. (See paragraph PEAKING THE VHF OSCILLATOR TRIMMERS.)

(B) Check LOCALITY ADJUSTER CONTROL located on back of chassis for proper setting.

(C) Set AGC LEVEL control.

## PEAKING THE VHF OSCILLATOR TRIMMERS

(A) Set channel selector knob to the highest VHF operating channel.

NOTE: If highest VHF operating channel is channel 6 or below disregard step (E).

(B) Remove channel selector and fine tuning knobs. This will expose the oscillator adjustment screws.

(C) Set fine tuning to center position (when white painted line on fine tuning pulley is centered on fine tuning shaft pulley).

(D) Use a non-metallic screwdriver such as polysterene or nylon.

(E) FOR CHANNELS 7 THRU 13. Adjust trimmer screw located at right of fine tuning pulley for best picture detail.

(F) FOR CHANNELS 2 THRU 6. Set channel selector to highest operating channel between 2 and 6. Adjust trimmer screw located below fine tuning shaft pulley for best picture detail.

## FRONT REMOVABLE SAFETY GLASS

To remove safety glass for cleaning purposes, remove screws from strip holding top of safety glass. Tilt top of safety glass forward and lift out.

## PIN CUSHION DISTORTION

When distortion or non-linearity at the left and/or right sides of the picture tube occurs: Adjust the anti-pin cushion magnet assemblies held by wing nuts on the deflection yoke mounting bracket and extending on both sides of the picture tube for least distortion and for best linearity.

## HORIZONTAL LOCK

If it is impossible to keep the test pattern or picture from continually moving or breaking up in a HORIZONTAL DIRECTION with the HORIZONTAL HOLD CONTROL adjust the HORIZONTAL LOCK CONTROL BY:

1. Set HORIZONTAL HOLD CONTROL to its mid position.
2. Turn the HORIZONTAL LOCK SCREW until pattern or picture locks in.
3. PATTERN or picture should now lock in evenly from either side of the HORIZONTAL HOLD CONTROL. An additional adjustment of the HORIZONTAL LOCK may be necessary to bring the locking into the center of the HORIZONTAL HOLD CONTROL.

## HORIZONTAL DRIVE

The correct procedure for setting the HORIZONTAL DRIVE CONTROL is as follows:

1. Set HORIZONTAL WIDTH CONTROL for maximum picture width, Control in uppermost position.
2. Set HORIZONTAL LINEARITY CONTROL to bottom position.
3. Turn HORIZONTAL DRIVE padder in until drive lines appear (bright vertical lines near center of screen).
4. Turn HORIZONTAL DRIVE padder out until drive lines disappear.
5. Reset HORIZONTAL WIDTH AND HORIZONTAL LINEARITY to their correct position.

## ADJUSTMENT FOR STATION BUZZ

If station buzz is excessive, adjust the ratio detector secondary adjustment screw located on top of the ratio detector for minimum buzz. MAKE SURE THAT THIS POSITION IS BETWEEN the two MAXIMUM buzz peaks that will be noticed when adjustment screw is turned to the right or left of the minimum buzz position.

# SENTINEL TROUBLE SHOOTING CHART

### ENGRAVED EFFECT IN PIX

Tuner fine tuning
Contrast con.
V2, V3, V4, V5, V6, V7, V16, V22
AGC Level and Vid. Load con.
Check Vid. Det. xtal 1N60 (Part of T6)
Check 0.047 $\mu f$ cap. connected to pin 2 of V7
Check Vid. Det. and Amp peaking coils

### VERT. BARS

Hor. Drive con.
V19, V21
Check 56 $\mu\mu f$ cap. connected to yoke terminals
Defl. yoke ringing

### PIX BENDING

Hor. Hold and Freq. con.
V16, V17, V18, V19
Locality and AGC Level con.
Check 0.0047 and 0.047 $\mu f$ caps. connected to pin 1 of V18

### WEAK OR NO PIX—SOUND WEAK—RASTER OK

Tuner fine tuning
V1, V2, V3, V4, V5, V6
Check Vid. Det. xtal 1N60 (Part of T6)
RF and IF alignment

### INSUFFICIENT BRIGHTNESS

Ion trap
Brightness and Hor. Drive con.
V19, V20, V21, V22, V23, V24
Low line voltage

### RASTER BLOOMING

Hor. Drive con.
V19, V20, V21, V22
Check HV Filter cap.
Check 1.2 Meg. Res. connected to HV Filter cap.

### NO RASTER—NO SOUND

Power input circuit
V23, V24
Check line fuse F1 (3 Amps)
Check filter choke

### NO RASTER—SOUND OK

Brightness con.
Check HV Fuse F2 (0.2 Amps.)
Ion trap
V18, V19, V20, V21, V22
HV trans. Hor. yoke CRT connections

### WEAK PIX—SOUND AND RASTER OK

Tuner fine tuning
Contrast con.
V3, V4, V5, V6, V7, V8, V16
Check Vid. Det. xtal 1N60 (Part of T6)
AGC Level, and Vid. Load con.

### POOR VERT. LIN.

Vert. Size and Lin. con.
V25, V26
Check 0.1 $\mu f$ cap. connected to pin 1 of V26
Check 100 $\mu f$ Elec. cap. connected to pin 6 of V 26
Vert. Out. trans.

### PIX JITTER UP & DOWN

Vert. Hold and Contrast con.
Locality and AGC Level con.
V13, V16, V25, V26
Check 0.0047 $\mu f$ cap. connected to pin 3 of V25

### SMEARED PIX

Tuner fine tuning
Contrast con.
V3, V4, V5, V6, V7, V16
Check Vid. Det. and Amp. peaking coils
AGC Level and Vid. Load. con.
Check 0.047 $\mu f$ cap. connected to pin 2 of V7
IF and RF alignment
Check Vid. Det. xtal 1N60 (Part of T6)

### SOUND BARS IN PIX

Tuner fine tuning
V1, V2, V3, V4, V5, V6
Check adjustment of T7
IF and RF alignment

### INSUFFICIENT RASTER HEIGHT

Vert. Size and Lin. con.
V23, V24, V25, V26
Check 0.1 $\mu f$ cap. connected to pin 1 of V26
Check 0.1 $\mu f$ cap. connected to pin 6 of V26
Vert. Out. trans.
Low line voltage

### NO VERT. DEFL.

V25, V26
Check 0.1 $\mu f$ cap. connected to pin 1 of V26
Vert. Defl. coils (yoke)
Vert. Out and Osc. trans.

### NO VERT. SYNC.—HOR. SYNC. OK

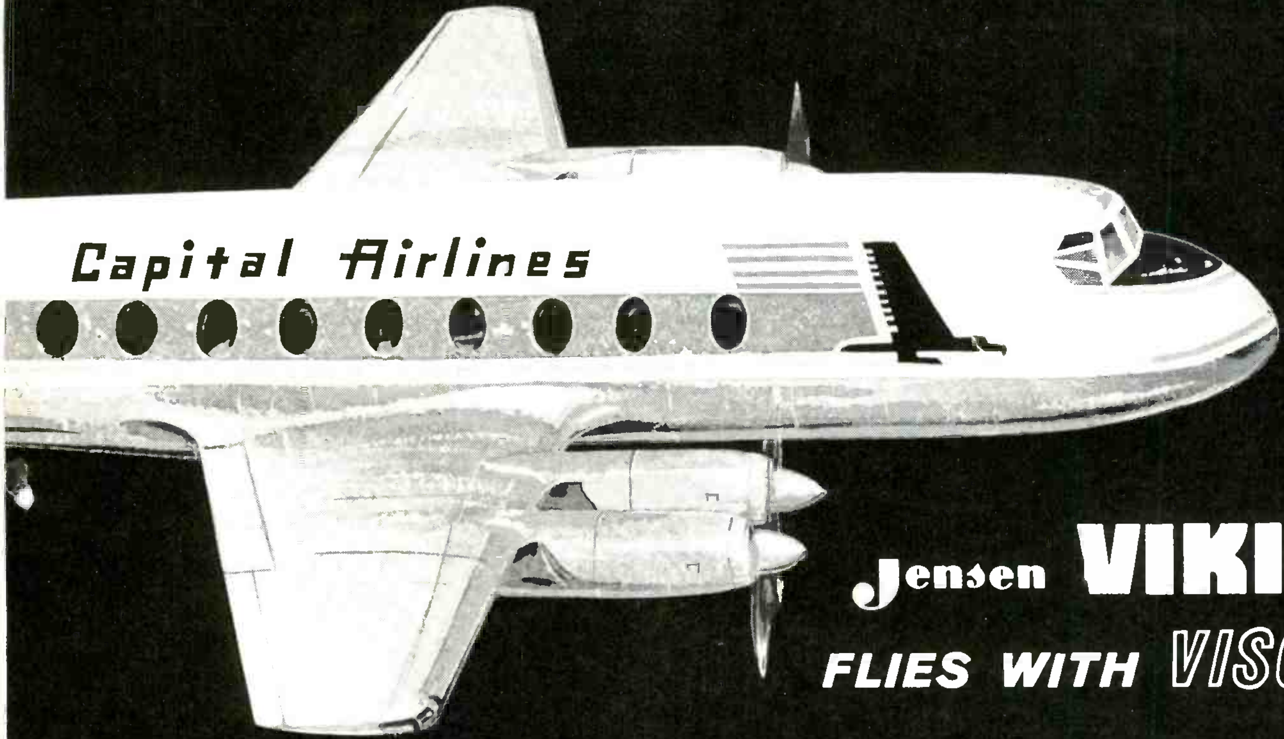
Vert. Hold con.
Vert. Int. network
V25, V26
Check 0.0047 $\mu f$ cap. connected to pin 3 of V25

### NO HOR. OR VERT. SYNC.—PIX SIGNAL OK

V13, V14, V15, V16
Check 0.047 $\mu f$ cap. connected to pin 7 of V13

### NO HOR. SYNC.—VERT. SYNC. OK

Hor. Hold and Freq. con.
V13, V18, V19
Check 600 $\mu\mu f$ cap. connected to pin 4 of V18

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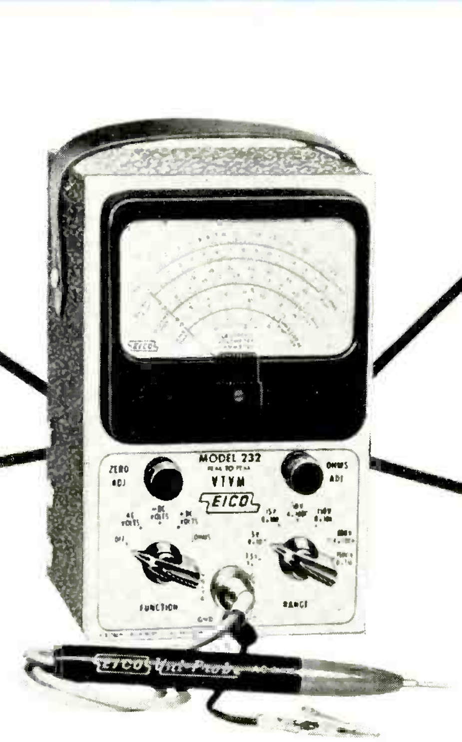
# peak to peak VTVM





by **Harry C. Ashley**
**and Philip Portnoy**
*Chief Engineers, EICO Mfg. Corp.*


Expressly designed for TV servicing, the EICO Model 232 (249) peak-to-peak *vtvm* features a full-wave, high frequency rectifier circuit that responds to and measures the peak-to-peak voltage value of complex and sine waveforms even when *dc* is present. It also reads the *rms* voltage of sine waves (on a separate scale), *dc* voltage values, and resistance values. For consistently high accuracy, there are seven non-skip ranges on all functions to provide a uniform 3 to 1 scale ratio between adjacent ranges.

All *rms* scales are in black with full-scale values of 1.5, 5, 15, 50, 500, and 1500 volts. All peak-to-peak scales are in red with full-scale values 4, 14, 42, 140, 420, 1400, and 4200 volts. When the instrument is set at the 1.5 volt range, the *rms* or p-p scales on the lowest arc (designated as LOW-AC) are read; on higher ranges, the scales on the two center arcs are read. It should be noted that the fixed ratio of 2.83 to 1 between corresponding peak-to-peak and *rms* scales is derived from the relationship between the peak-to-peak and *rms* values of a sine wave. Therefore, while peak-to-peak readings are valid regardless of whether the waveform is complex or sine, *rms* readings are valid only for sine waves. Note also that the time delay between the instant the leads are removed from the source being measured and the instant the meter pointer returns to zero is normal and is the result of circuit constants selected to permit accurate measurement of recurrent pulses with low repetition rates.

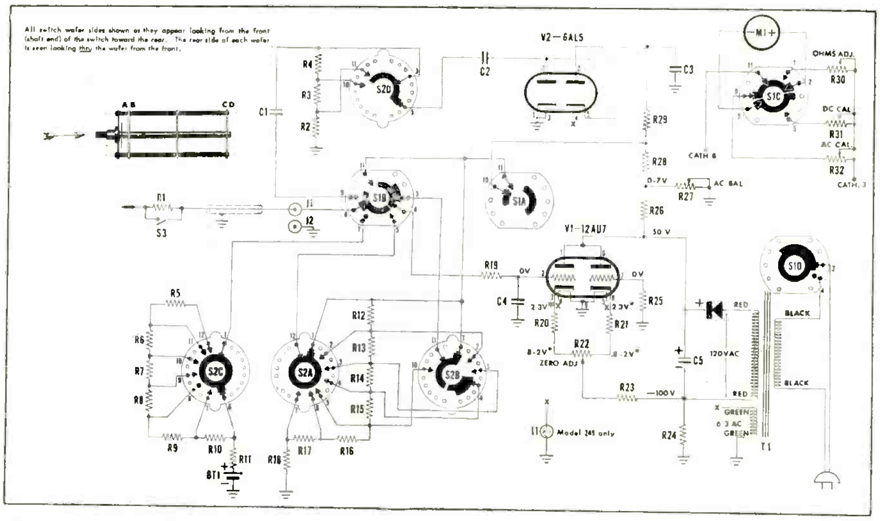



Fig. 1—Complete circuit diagram of EICO Model 232 (249) peak-to-peak VTVM.

| Sym. | Description | Sym. | Description |
|---|---|---|---|
| BT1 | battery, 1 1/2V | R14 | res., 700KΩ, 1/2W, 1% |
| C1 | cap., .1mf - 1000V | R15 | res., 200K, 1/2W, 1% |
| C2,C3 | cap., .025mf - 400V | R16 | res., 70KΩ, 1/2W, 1% |
| C4 | cap., .003mf - 400V | R17 | res., 20KΩ, 1/2W, 1% |
| C5 | cap., elec. 10mf - 150V | R18 | res., 10KΩ, 1/2W, 1% |
| CR1 | rect., 35 ma | R19 | res., 3.3MΩ, 1/2W |
| I1* | bulb, #47 | R20,21 | res., 680Ω, 1/2W |
| M1 | meter, 400ua | R22,30 | pot., 2KΩ, linear |
| R1 | res., 1MΩ, 1/2W | R23 | res., 47K, 1/2W |
| R2 | res., 150KΩ, 1/2W, 1% | R24 | res., 68K, 1/2W |
| R3 | res., 325KΩ, 1/2W, 1% | R25 | res., 4.7MΩ, 1/2W |
| R4 | res., 900KΩ, 1W, 1% | R26 | res., 33K, 1/2W |
| R5 | res., 9MΩ, 1/2W, 1% | R27 | pot., 10KΩ, linear |
| R6 | res., 900KΩ, 1/2W, 1% | R28 | res., 82MΩ, 1/2W |
| R7 | res., 90KΩ, 1/2W, 1% | R29 | res., 18MΩ, 1/2W |
| R8 | res., 9KΩ, 1/2W, 1% | R31,32 | pot., 2KΩ, linear |
| R9 | res., 900Ω, 1/2W, 1% | S1 | switch, function |
| R10 | res., 90Ω, 1/2W, 1% | S2 | switch, range |
| R11 | res., 9.7Ω, 1/2W, 1% | V1 | tube, 12AU7 |
| R12 | res., 7MΩ, 1W, 1% | V2 | tube, 6AL5 |
| R13 | res., 2MΩ, 1/2W, 1% | | |

* Model 249 only

Rotors on all switch wafers shown in extreme counter-clockwise position.

FUNCTION SWITCH S1

| Position | Setting |
|---|---|
| 1 | OFF |
| 2 | AC VOLTS |
| 3 | -DC VOLTS |
| 4 | +DC VOLTS |
| 5 | OHMS |

RANGE SWITCH S2

| Position | Setting |
|---|---|
| 1 | 1.5V, R X 1 |
| 2 | 5V, R X 10 |
| 3 | 15V, R X 100 |
| 4 | 50V, R X 1000 |
| 5 | 150V, R X 10K |
| 6 | 500V, R X 100K |
| 7 | 1500V, R X 1M |

Fig. 2—Parts list of VTVM

## Operation

The central circuit in the operation of this instrument is a vacuum-tube bridge circuit using a 12AU7 twin-triode. When the bridge is balanced, the voltages at the two cathodes will be equal and the meter connected across them will read zero.

**DC Voltmeter Operation:** Referring to *Fig. 1,* when a positive *dc* voltage is applied, a fraction (depending on the range setting) is taken from the range voltage divider (*R12-R18*) and applied to the grid of V1a. This causes the current through V1a to increase and consequently, the cathode voltage of V1a to increase. Concurrently the voltage on the arm of R22 tends to increase,

[*Continued on page* 58]

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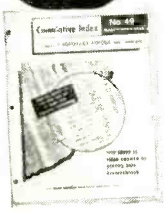

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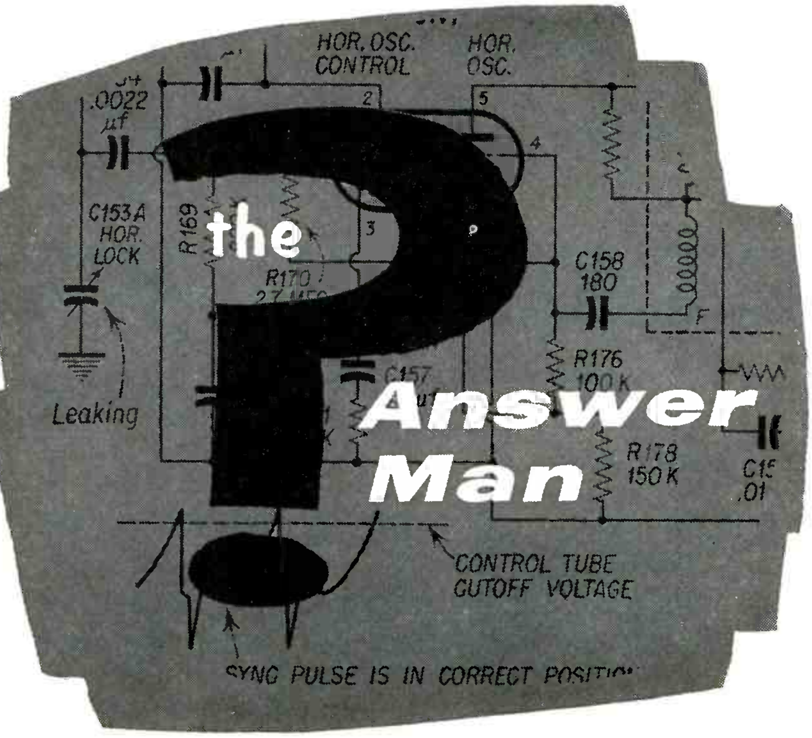



**by Bob Dargan**

**Do you have a vexing problem on the repair of some radio or TV set? If so, send it in to the Answer Man, care of this magazine. All inquiries acknowledged and answered.**

***Note: Only communications with Radio-TV Service Firm letterheads will be considered and answered. Please indicate make, model, and chassis number cf receiver.***

*Dear Mr. Answerman:*

I have a Cascode Standard Coil Tuner in a TV receiver in which I have had to replace the 6BQ7 *rf* amplifier tube very frequently. In fact, I have had to put a new one in three times in the past week and I wonder if you can give me some indication as to what is killing these tubes. I use name brand tubes, not seconds or cheap ones.

*L. C.*
*Montreal, Canada*

Most probably, the B plus feed resistor to the *rf* stage, 1500 ohms, has burned and the resistance is much less than this value. This results frequently when a 6BQ7 tube shorts and the damage to the resistor is generally such that the resistor is reduced to a much lower resistance in many instances. On the other hand, it can also burn open, but in this case it is easily located as faulty as it provides no B plus to the *rf* stage.

If the resistor has burned and become lower in value, the additional B plus voltage applied to the plates of the 6BQ7 tube will cause it to become weak after a short period of operation. What most TV servicemen do is replace the weak tube with a new one. However, after another abnormally short period the tube fails again. This can occur in almost any tuner that employs the 6BQ7, 6BZ7 variety of *rf* amplifier tube. Since both triodes are connected in series, the cathode of the upper triode is connected to the plate of the lower triode (See *Fig. 1*) and the output

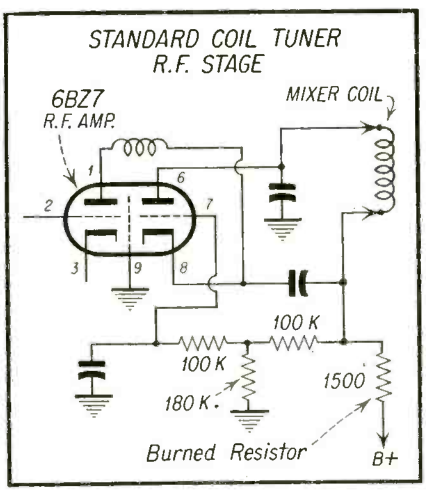



**Fig. 1—Short between pin 8 and internal shield overheats 1.5K.**

triode will have at least 110 volts potential applied to the cathode. The tube frequently breaks down between this cathode and filament or between this cathode and the shield, pin 9. As pointed out, this difficulty can occur in any cascode tuner, not just the Standard Coil Tuner. When the resistor is replaced it is suggested that a resistor with a dissipation rating of one watt be used instead of the ½ watt value generally found. It is certainly advisable in those receivers where repeated failure of the *rf* amplifier has occurred to examine the resistor or even replace it with a one watt size. Of course, this hinges upon the available space for the resistor.

*Dear Sir:*

Some years ago, I think I read in your pages of a case in New York City, where the owner of a small radio took it to a shop for test. He called for it later, didn't want the work done, and refused to pay the fee for testing. As I remember, he used every legal procedure available to obtain the set, and I believe it was carried to a high court, which ruled that the technician, or shop, was entitled to collect, but, that he should notify the customer of his intentions to charge for testing.

It made an impression on me to the extent that I had a line printed on my claim checks as follows: A FEE WILL BE CHARGED FOR TESTING AND DIAGNOSIS.

Now, a parallel case has arisen here.

A customer brought in a radio for test. She didn't want to spend more than $3.50 for repairs. Our test showed a defective filter, and we substituted a new one to make sure. As the job would run over $3.50, we waited for her to call, before going ahead. When she came in to get it, she decided not to have it done, and wanted to take the set, refusing to pay the $1.00 testing charge. Her husband, an accountant, came in later and demanded it, threatening to go to the police. As they had established no credit with me, I refused to let them have the radio until the charge was paid.

Today, I am served with a summons to Small Claims Court, to pay $7.50, plus costs.

What can I do?

This is a small town and we have no servicemen's organization here.

*J. M.*
*Chico, Calif.*

We believe that in all instances where the customer was advised that a fee for labor will be charged for any work done, the laborer, artisan or mechanic is entitled to an artisan's or mechanic's Lien.

We are positive that the Justice of

the Peace or the Judge in the Small Claims Court of Chico, California will sustain your position that you do not have to return the set until you are paid for your labor; to wit; the $1.00 for testing. This is a general and recognized principle of law and we are so advised by our lawyers. It is our lawyer's opinion that this matter will be dismissed and you will be able to retain possession until your fees are paid.

*Dear Mr. Answerman:*

Why does the vertical sync pulse of a composite video signal stand up higher than the horizontal sync pulse as seen on my scope when I know that the tops of the vertical pulses are supposed to be even with the tops of the horizontal pulses?

*L. S.*
*New York City*

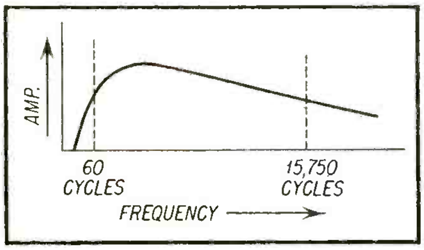



Fig. 2—Frequency response of vertical amplifier on some scopes.

This is because of the frequency response of the vertical amplifiers of your oscilloscope. A typical oscilloscope reresponse is shown in *Fig.* 2. The vertical amplifiers have a greater output for the 60 cycle vertical pulses than

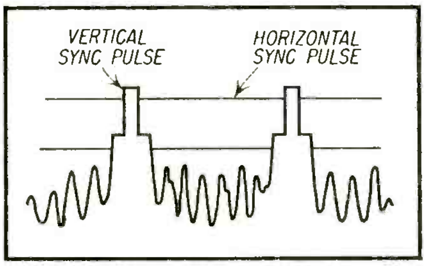



Fig. 3—Presentation of composite video on scope with poor response.

the 15,750 cycle pulses because of this drop off in vertical amplifier gain at the higher frequencies. Therefore, they present the vertical sync pulse as greater in amplitude than the horizontal as shown in *Fig.* 3.

*Dear Answerman:*

I have a 19R20 Zenith chassis that exhibits a little hiss or background noise in the audio. I have tried the buzz control but this is no help. Is there any-

[*Continued on page* 56]

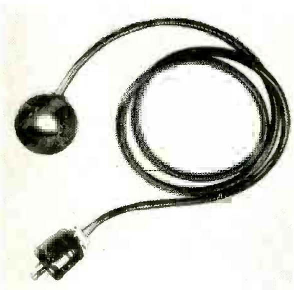
# NEW products

## for better sales and service

### ETI Tester

Electronic Test Instrument Corp. 13224 Livernois Avenue, Detroit, Michigan, announces the availability of the VITAMETER. This instrument is designed to maintain, improve and vitalize the operation of a Cathode Ray Tube.

Reactivation of the cathode of a picture tube is accomplished by a dynamic sweep between cathode and grid thus removing gas ions and stale emitting material from the surface of the cathode.



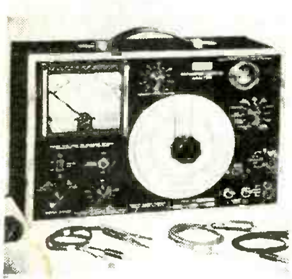
### Superex CRT Tester

Superex Electronics Corporation, 4-6 Radford Place, Yonkers, N.Y. has recently announced an addition to its line of a CRT Rejuvenator-Tester for all servicemen who own a tube tester. The unit will test and rejuvenate any picture tube 10" to 30" electrostatic or magnet focus without the necessity of the removal of the tube from the chassis or cabinet. The unit is supplied with settings and full instructions for its use.

### Kay-Townes Antenna

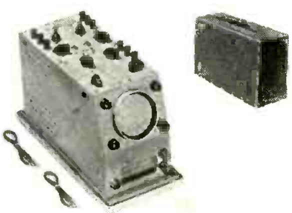
Many months ago Kay-Townes engineers anticipating this condition started experiments on a completely new design of antenna. It was engineered to select signals from practically a pin point, and thus eliminate any co-channel interference from sides or rear.

Tests on all bands have shown up to a 100-1 ratio. Arrays are available to correct most interference problems.



### Pyramid Analyzer

A new capacitor-resistor analyzer, model CRA-1, is now in production at the Pyramid Electric Co., 1445 Hudson Blvd., N. Bergen, N. J. The unit is designed with a built-in quick-check stage that permits the technician to test a suspected capacitor, while in the circuit, without disconnecting the capacitor. Tests may be performed for shorts, opens and intermittants, tests for capacitance, resistance, power factor, leakage current and insulation resistance.



### Hickok Portable 'Scope

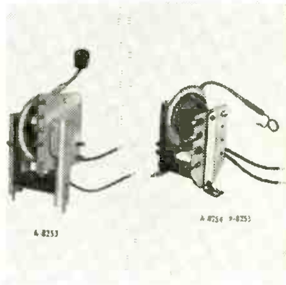
Availability of a new lightweight 3" portable oscilloscope is announced by the Hickok Electrical Instrument Company. This 'scope features a new 6-section unitized circuit construction for minimum interaction between amplifiers and sweeps, as well as provides for replaceable circuit sections as individual units. Slightly larger than a normal sized telephone, the Model 385 provides a new high in dependable accuracy.


### Self Service Tube Tester

The American Scientific Development Co., 334-336 S. Main St., Ft. Atkinson, Wisc., has developed a self-service tester which saves the serviceman's valuable time and capijudge for himself the condition of that the customer be allowed to judge for himself the condition of his tubes, and to set up the tester himself, thus relieving him of any suspicions he may have about the counter salesman.

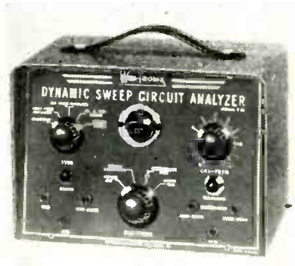
### Stancor Flybacks

Three new Admiral exact replacement flybacks have been added to the Stancor line, Chicago Standard Transformer Corporation, Addison and Elston, Chicago 18., Ill. They are A-8253, A-8254, and A-8255, replacing Admiral parts 79D48-1, 79C60-1, and 79C60-2 respectively. These flybacks are exact electrical and physical duplicates of the units they are designed to replace.



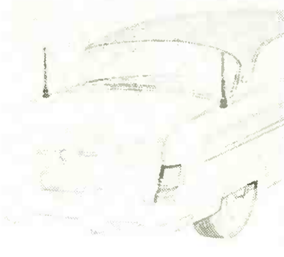
### Win-Tronix Analyzer

A new T.V. test instrument for color or monocrome, designed to troubleshoot horizontal and vertical deflection circuits. Manufactured by Winston Electronics, Inc., 4312 Main Street, Philadelphia 27, Pa., the Model 820 Dynamic Sweep Circuit Analyzer provides 60 cycles vertical sawtooth, 15 KC horizontal sawtooth and deflection transformer drive for both vertical and horizontal sweep circuit troubleshooting by speedy signal substitution.




### Snyder Rear-Deck Antennas

A rear-deck dual auto antenna which provides the driver with maximum vision through its rear deck position, is being marketed by Snyder Mfg. Co., of Philadelphia. The two three-section staffs are 13½ inches high when collapsed, and 27 inches high when extended. They are easily mounted on the rear fenders and are adjustable to 180°. They are available in the swivel or the ball and socket type.



### R.C.P. Modified Tube Checker

Radio City Products, Inc. Tube Checker—Modified Model 322 P Portable Tube Tester to provide for testing the new series tubes, announced by Walter Jablon. The unit includes the addition of a special power transformer and switch to insure correct testing conditions for series tube, CR Tubes including color as well as a reactivator for black and white tubes. All other current electronic tubes can be tested on Model 327 P.

# TRADE LITERATURE

• • •

## New Books

Audio Amplifier Manual (Howard W. Sams and Co., Inc.) 352 pages, $3.95.
The fifth of the Audio Amplifier Series, the complete Photofact treatment includes data on 37 audio amplifiers, 12 preamplifiers and 14 AM-FM tuners. The data on each device is complete with copyrighted adjustment and maintenance data, parts lists, Standard Notation Schematics and all other information necessary for the service on the equipment.

Picture Book of TV Troubles, *by Rider Laboratories Staff* (John F. Rider Publisher, Inc.) 5½ x 8½, 96 pages, $1.80.
This publication makes the diagnosis of troubles in the vertical and horizontal sweep and deflection circuits of television receivers a very simple matter. Every type of sweep and deflection circuit is shown schematically; then the results of defects in the components of these circuits are illustrated by picture tube patterns, and resultant incorrect waveforms, as well as the correct waveform.

Bigger Profits in TV, *by Ray A. Snyder and Donald B. Shaw* (Howard W. Sams and Co., Inc.) 132 pages, $1.50.
The practical guide toward better business records, customer relations and increased profits in TV Servicing will prove helpful to every shop owner. It is written in simple and direct form with many sample problems and examples of accounting procedures, business records, shop tickets and labor costs. The many excellent technicians whose business difficulties come from lack of attention to business methods will be helped immeasurably by this work.

"Basic Electronics" (John F. Rider Publisher, Inc.)
The use of over 800 pictures throughout the 560 pages in this series represents a completely revolutionary method of subject presentation. Every page covers one complete idea; on that same page, at least one big "show-how" illustration explains that idea. Anyone with an understanding of DC and AC electricity and electrical circuits can effectively use this course. The five-volume "Basic Electronics" course covers: Diodes, power supplies, amplifiers, oscillators, transmitters and receivers. The set retails for $9.00 and is available at parts jobbers and bookstores.

Tape Recorder Manual (John F. Rider Publisher, Inc.) 8½" x 11", 312 pages, $4.50.
In addition to the complete electronic information, this volume contains complete mechanical details in the form of step-by-step adjustment information, exploded views of the assembly, and service guide to both electrical and mechanical troubles. The manual is cross-indexed for easy reference to manufacturer, trade name and model numbers.

"How To Install TV Antennas," *by Samuel L. Marshall* (John F. Rider Publisher, Inc.) 5½" x 8½", 128 pages, $2.50.
Devoted wholly to the practical aspects of this activity, it deals with every facet of the installation as related to VHF and UHF antennas. The subject matter covers from the simplest installation of a television antenna to the pouring of a concrete base for a tower; calculating the kind of mast required to accept different amounts of ice and wind loading; the steps necessary in the raising of a tall mast, etc.

Color TV Dictionary, *by J. Richard Johnson* (John F. Rider Publisher, Inc.)
The basis of the book are the terms which originated in the National TV Systems Committee (NTSC) and which formed the basis

of present color TV. The dictionary defines more than 263 names and terms and contains 45 illustrations. 70 pages. Price: $1.25.

"Obtaining and Interpreting Test Scope Traces," *by John F. Rider* (John F. Rider Publisher, Inc.) 5½" x 8½", $2.40.
A 192-page book containing more than 1000 waveforms; almost every illustration (exclusive of test set-up schematics) is an actual photograph, taken of waveforms right off the test scope screen. It is a treatment which explains the make-up of waveforms of all kinds in practical easy-to-understand language, and shows numerous examples of each type of distortion. Most important of all, it explains the reasons for the distortion seen in the waveform.

Rider Television Manual, Vol. 14. (John F. Rider Publisher, Inc.)
In order to present properly the true output of the receiver manufacturers, Rider Manuals include all the schematics, chassis views, circuit descriptions, voltage data, alignment information, and other data which apply to all the production runs of each receiver, including color receivers. Volume 14 contains the equivalent of more than 2,300 (8½" x 11") pages, loose-leaf bound with Fabrikoid covers, and sells for $24.00.

Sonics, *by Theodor F. Hueter and Richard H. Bolt* (John Wiley and Sons, Inc.) 6 x 9¼, 456 pages, $10.00.
A sound, useful, easy-to-read presentation of the principles and practices of the rapidly expanding field of *sonics*. Techniques and devices ranging from a few cycles per second to hundreds of megacycles per second are covered. Material is drawn from the fields of physics, engineering, and electronics. The reader is given a clear and authoritative account of: fundamental physics of vibration and sound, design principles of electroacoustic and fluid-dynamic transducers, choice of sonic variables for systems engineering, and special techniques for testing and processing. All information is given in a framework of basic physics, so that common features of seemingly unrelated techniques are made apparent.

National Electrical Code Handbook, *by Arthur L. Abbott, revised by Charles L. Smith* (McGraw-Hill Publishing Co.) $7.50.
The handbook explains the NEC rules in brief, easy-to-understand language. It gives the general plan, scope, and intent of the Code requirements, and discusses them in simple fashion to aid electrical contractors, electricians and others in making and planning electrical installations that are in conformity with the National Electrical Code.

Radio-Television Service Pricing Guide (Oerlich Publications) $2.95.
The "Guide" shows price and description of all the flat rate services such as: service calls, pick-up and delivery, pix tube replacements, alignment estimates, etc., and is supplied with extra flat rate sheets that do not show price so that the dealer can type in his own prices and substitute pages if desired. It also contains the standard rate system showing average time periods for each specific defect so that the entire service job may be priced. The "Guide" also contains ten pages for pricing merchandise such as radio, TV and appliances, and is bound in a loose leaf binder for easy page removal or addition.

Transistor Audio Amplifiers, *by Richard F. Shea* (John Wiley and Sons, Inc.) 6 x 9¼, 219 pages, $6.50.
A short, lucid volume which should enable the audio engineer to design practically audio amplifier for which transistors can be used componentially. The inclusion of all specifications and specific design data enables you to take a commercial transistor specification, and knowing the requirements of your overall design, develop the necessary circuit of your amplifier.

TV Service Timesavers, *by Milton S. Kiver* (Howard W. Sams and Co., Inc.) 124 pages, 5½" x 8½", $1.50.
Prepared in 5 sections entitled *general servicing timesavers, sectional servicing timesavers, test instruments and alignment, timesaver tips on servicing tools,* and *odds and ends for quicker servicing*, this handy reference summarizes

many service techniques found profitable from actual experience. A total of 97 photographs and drawings are used to illustrate the 51 "Timesaver Tips," a few of which are: "Causes and Cures for the Narrow Picture"; "Tuner Sensitivity—How to Increase It"; "Vertical Retrace Blanking"; "Checking Horizontal Output Transformers"; "Touch-up Alignment"; "Remedy to a Corona Problem."

**Basic Electricity (Howard W. Sams and Co., Inc.) 264 Pages, 8½" x 11", $5.00.**
This book presents the Student *and* Instructor with a practical approach to beginning studies in the intriguing and complex field of Electricity. The text material is laid out in 35 logical and easily understood lessons. Each lesson is profusely illustrated and explained. Many questions and problems are presented to aid the student in grasping the fundamental laws and relationships which will guide him throughout his further studies.

## CIRC. ANALYSIS

*[from page 36]*

*Fig. 1*. The series nature of this circuit can be seen clearly from this diagram. The encircled resistors are not actually resistors, but they represent the effective resistance values of the tubes involved. Thus, *R-V204* is the effective resistance between the plate and cathode of V204, the audio output tube. Looked at in this way, the entire arrangement is nothing more or less than an elaborate voltage divider across the power supply output.

Starting with 265 volts at the power supply, we go through *R502* which

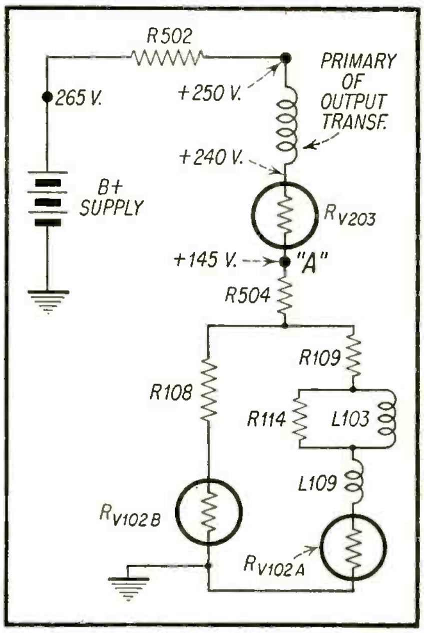



**Fig. 3—Simplified equivalent circuit corresponding to Fig. 1. Note RV203 shown as equivalent resistance.**

produces a 15 volt drop, then through the primary of the output transformer which produces a 10 volt drop resulting in a voltage between the plate of V204 and ground of 240 volts. The tube resistance itself (*R-V204*) then causes a 95 volt drop, resulting in 145 volts appearing at its cathode. It is from this point, "A" of *Fig*. 3, that the various circuits shown in *Fig*. 2, receive B+.

It is apparent, that if V204, the sound output tube fails, the effect is the same as if the resistor R-V204 opened, thus depriving all the circuits shown in *Fig*. 2 of B+ voltage. Since the *rf* mixer and oscillator receive plate voltage from this point, they would become inoperative in the event of such a failure. An open primary in the output transformer, or an open *R502* would have the same effect. This then results in the misleading symptoms of raster but no sound or picture, as previously mentioned.

In the particular model discussed here, an additional clue would be that the raster would be dimmer than normal, since the screen grid of the horizontal output tube would also lose its voltage. (See *Fig*. 2). The Admiral 19K1 chassis, which uses a somewhat similar arrangement, does not tie the horizontal output tube into the same line so that the brightness of the raster is not affected.

### Voltage Regulating Action

In *Fig*. 4 it will be seen that the control grid of the audio output tube is kept at a fixed bias of 130 volts through the voltage divider action of *R214* and *R215 which are connected from the* ground to the 250 volt point on the supply line. The grid is connected to the junction of these two resistors through R216. If the current through the tube should change because of tube variations, *agc* fluctuations, etc., the voltage at the cathode of audio output tube would also change. This is true because a change in current through the tube means that the value of "R" in *Fig. 4*, which represents the effective resistance of all the circuits tied to the cathode changes resulting in redistribution of voltage between the audio output tube and the remainder of the circuit.

Suppose the change is such that the cathode voltage increases. Since the grid is held fixed at +130v, the bias would become more negative. This in turn

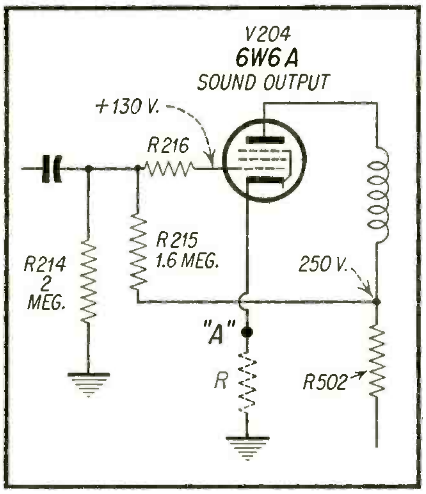



Fig. 4—Partial schematic illustrating voltage regulator action of the audio output tube.

would reduce the current through the tube (by increasing its effective resistance). The reduced current then tends to drop the cathode voltage back to its normal value. In this manner then, V204 acts as a series regulator, tending to maintain the voltage at its cathode at a constant level of 145 volts.

## TRADE FLASHES

*[from page 10]*

***ed by scientists of the Radio Corporation of America. The new radio, employing nine transistors in place of electron tubes, is equal in performance to standard car radios, the RCA scientists said. Emphasizing its low power consumption, they pointed out that more than half the small amount of current required by the radio is used to light the two small pilot lights that illuminate its dial.***

*[Continued on next page]*

A new idea in phonograph cartridge packaging has been introduced by Electro-Voice, Inc., Buchanan, Mich. Each E-V replacement phono-cartridge is now sealed-in-plastic in a unique "Blister-Pak." Full identification interchangeability chart and instructions are printed on the package.

**Mr. Charles Weyl, president of International Resistance Company, Mr. William I. Elliott, president of Hycor Companies, and Mr. Kenneth T. Eckardt, president of the Hycor Sales Company, announce the acquisition of the Hycor Companies of California and Puerto Rico, by the International Resistance Company. Management of the Hycor Companies will continue operations independently.**


Astron Corp. of N.J. is offering a metal "Swing Bin" which contains 90 capacitors of 18 different values, with a maximum of 5 of each type. It has clear plastic construction for easy visual stock control; attaches on the wall or under bench, and each of 6 bins swing out 180° for easy access.

*Production of radio and television receivers in February increased from the output rate of both January and the same month a year ago, the Radio-Electronics-Television Manufacturers Association reported. During February, 702,-514 television receivers were produced. This compares with 654,582 sets manufactured in January and 426,933 units turned out in February 1954. The radio production in February totaled 1,089,724 units, compared with 1,068,-*

*146 receivers produced in January. During February 1954, radio set production had totaled 769,232.*

**A new brand featuring the well-known letters "CBS" for its radio and Television tubes and semiconductor products has just been unveiled by CBS-Hytron, a Division of Columbia Broadcasting System, Inc. Charles F. Stromeyer, President of CBS-Hytron, said: "We have changed our brand name from CBS-Hytron to CBS because we wish to take full sales advantage of the nationally recognized and respected letters CBS . . ."**

Guests at the cocktail party given by the Pyramid Electric Co. of N.J. during the I.R.E. show listen to Service Dealer publisher Sandy Cowan (second from left) recount one of his many anecdotes. Left to right: Art Cerf, Pyramid representative; Mr. Cowan; Mrs. Jack Poff, wife of Pyramid's sales manager; Bob Elliot, jobber sales manager of Erie Resistor Corp.; and Richard Kaiser.

Free portable batteries and advertising aids are the rewards for dealers and servicemen participating in Philco's nationwide "Rocket to Profit" promotion, one of the most flexible programs in parts and accessories history, according to General Manager James J. Shallow, Philco Accessory Division. Based on the theme that 87 per cent of all portable battery sales are produced by six "best seller" models, the promotion enables Philco Dealers and Servicemen to earn free quantities of "best sellers" with their regular purchase of these six most popular style batteries.

## ASSOCIATIONS

*[from page 26]*

Radio Servicemen's Associations passed the following resolution.

RESOLUTION: Resolved that Glenn McDaniels, President of R.E.T.M.A. and Wm. H. Parkinson, Chairman of R.E.T.M.A. Committee on technical education furnish satisfactory proof to the Federation that licensing of technicians would increase cost of service to the consumer, as stated before various legislative bodies.

### Television Service Association of Connecticut, Inc.

Held their 1st Annual Meeting on Feb. 20th. Chapters represented were from Hartford, New Britain, Waterbury, Meriden, and Manchester. Guests from Middletown, New Haven, Portland, and Haddam were also present. In my humble opinion the "Minutes and Proceedings" of this first meeting is one of the finest compilations of "Association" material ever to be collated in 10 pages. I would suggest other associations to write for copies of this brochure as a shining guide to what could be done by a wide awake group.

### Radio & Television Servicemen's Assn. of Pittsburgh, Penna.

B. A. Bregenzer, Editor of the R&TSA Video Scope, official organ of the above association, says, in part, on the subject of manufacturers setting up their own service companies:

"In our humble opinion, the task of supplementing the independent service profession with captive service will not be a profitable one for the general public, as no large operators ever can compete with the smaller independent on even terms and make a profit. So we think that the independent TV service profession must sell their customers on personalized ethical service at prices comensurate with an honest profit. Thus by lending that personal touch, coupled with the know how to give the best possible service, we think we can weather the storm."

### Western N.Y. Electronics Guild

In a release by the above Guild licensing is opposed on the grounds that: 1. The present laws are sufficient to prevent malpractices and fraud; 2. It would be better to set up a local investigating committee to study charges of malfeasance practices, etc.; 3. It would impose an undue burden on part-time technicians and one-man shops and stifle competition.

## ANSWER MAN

*[from page 47]*

thing that may be tried before I remove the chassis and perform a complete alignment. I have made normal checks such as tube substitutions, etc.

*H.S.*
*Albany, N. Y.*

The hiss that you are experiencing is undoubtedly due to a slight misadjustment of the quadrature coil in the 6BN6 Gated Beam Detector circuit shown in *Fig. 4*. This coil may easily be touched up by tuning it for the clearest sound with minimum hiss or buzz without employing alignment equipment.

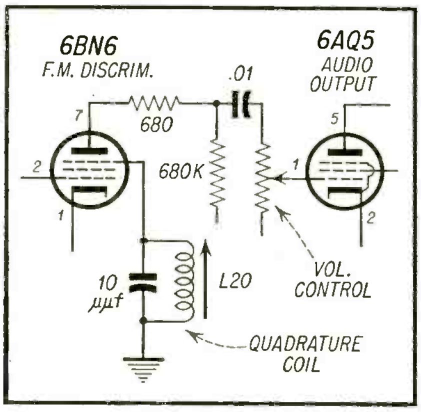



Fig. 4—Partial schematic of 6BN6 Gated Beam Detector.

## SQUARE WAVE GENERATOR

*[from page 16]*

indicate poor high frequency response of the amplifier. Poor high frequency response makes itself evident as poor detail in the picture.

*Figure 12* is a characteristic waveform which is associated with ringing in high frequency peaking coils. This may be caused, for example, by open damping resistors across peaking coils such as *R1* and *R2* in *Fig. 1*. The effect on the picture is to produce a series of closely spaced, alternate black and white "shadows", directly to the right of objects which have sharp changes of shading.

When the cause of trouble has been localized to the video amplifier by any of the above or similar checks, conventional methods may then be used to pinpoint the source of trouble.

### Square Wave Checking of High Fidelity Audio Amplifiers

All that has been said in the preceding portion of this article (except where direct reference is made to TV circuits) applies equally well to the checking of high fidelity audio amplifiers by means of the square wave technique. With increased skill and experience in the use of the genrator, the technician can discover in short order whether the frequency response, phase distortion, and transient response are within acceptable limits.

### Adjusting Horizontal and Vertical Linearity With the Square Wave Generator

While the square wave generator is not primarily designed for this purpose, it can be used to solve what is sometimes an annoying problem. In the home, or in the shop it is often necessary to adjust both horizontal and vertical linearity controls. In most cases, the station pattern is not on the air, and the adjustment is not too easily made. By setting the square wave generator to a frequency of 250 *kc* and feeding the signal into the grid of the video amplifier, 16 vertical pairs of black and white lines will be produced on the screen. The horizontal linearity and the width controls are then adjusted to space these lines equally, or as close as possible to equality.

In a similar way, if the generator is set for a multiple of 60 *cps*, horizontal pairs of black and white lines will be produced. At 1200 *cps*, for example, 20 pairs of horizontal lines would be produced. The vertical linearity and vertical size controls are then adjusted for equal spacing of these lines.

To facilitate this type of adjustment in the home, an adapter plug may be inserted into the socket of the video amplifier tube, and connections made to the readily available terminals on this adapter. The video amplifier tube, of course, is placed in the adapter socket during this operation.

### Sine Wave Applications

Most square wave generators have the facilities to provide sine waves over the same frequency range as that provided for square waves. This of course adds to the versatility of the instrument and greatly extends its usefulness. By using this feature, we have in effect another instrument, namely, an audio

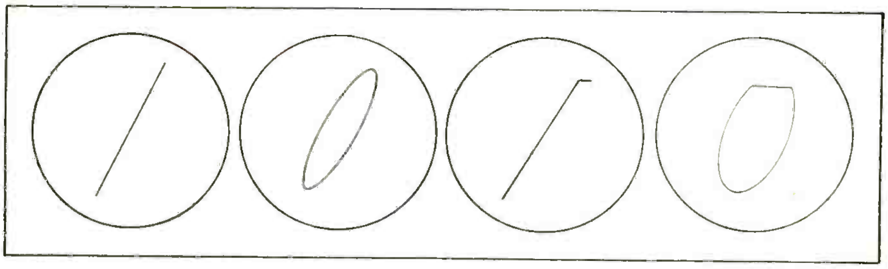


Fig. 13 — Various scope traces observed under different conditions of phase shift.

signal generator having a range well beyond the highest audio frequencies. As such it finds its greatest usefulness for such procedures as:

1. Determining accurate point by point frequency response curves for audio amplifiers.
2. Determining the extent of phase shift at any particular frequency. *Fig. 14* shows some scope tracers observed under different conditions of phase shift.
3. Determining the undistorted power output of an audio amplifier.
4. Observing and tracing the cause of distortion.

## PEAK-TO-PEAK VTVM

*[from page 44]*

which since it tends to make the cathode of V1b more positive, causes a decrease in the plate current and hence in the cathode voltage of V1b. This push-pull action permits a large value of cathode resistance with negligible degeneration and, consequently, greatly increased stability of operation. The meter circuit is connected across the two cathodes and the difference in potential across the meter causes current to flow through the meter from the cathode of V1a to the cathode of V1b.

**AC Voltage Measurements:** The applied voltage is first rectified by the twin-diode V2, which serves as a full-wave peak-to-peak rectifier. The operation of this circuit is as follows: On the positive swing of the *ac* signal, diode V2a conducts and a negative *dc* voltage equal to the positive peak value builds up on the plate-connected side of C2. As the *ac* signal voltage swings negative, diode V2a ceases to conduct (and so prevents any discharge of C2) while diode V2b begins to conduct. The negative *dc* voltage on C2 is added in series to the signal voltage on the negative swing and is applied to the cathode of V2b. As a result, a negative *dc* voltage equal to the sum of the positive and negative peaks of the positive and negative peaks of the *ac* signal voltage is built up on the plate-connected side of C3 through conduction of diode V2b and is maintained because of the relatively long time constants of the circuit. To offset the contact potential within V1, an exactly adjusted positive voltage is taken from the junction of R26 and R27 and applied to the V1 rectifier circuit through isolating resistor R28. The peak-to-peak voltage across C3 is attenuated by R29 before application to the range voltage divider and thereafter the operation is similar to *dc* voltage measurement.

**Ohmmeter Operation:** The applied resistance determines the current through the battery and the section of the ohms range network (*R5-R11*) selected by the range switch. With nothing connected across the input terminals, no current is drawn, and consequently there is no voltage drop across the ohms network. As a result, the entire battery voltage is applied to the grid of V1-a. Potentiometer *R30* in the meter circuit is adjusted to produce full-scale deflection (infinity reading) in this condition. A short across the input terminals produces a voltage drop in the ohms range network equal and opposite to the battery voltage and effectively places the grid of V1a at ground potential for a zero reading. Intermediate values of resistance produce voltage drops exceeded by the battery voltage and the difference in voltage is applied to the grid of V1a. This voltage causes an intermediate deflection on the meter which has an ohms scale calibrated to read the applied resistance.

## WORKBENCH

*[from page 35]*

probe (or stick) was then pressed against each component in the oscillator circuit. This is what is known as a vibration check. If the microphonic whistle is diminished by the pressure of the probe on the component then we have found the vibrating component. Resoldering of the component, replacement, or just the addition of solder on the component's pigtails can cure the trouble.

After pressing many components on the oscillator circuit with no results, they were next lightly tapped. Tapping produces momentary vibration and frequency modulation which results in a "pinging sound" from the speaker. The component producing the strongest "pinging sound" is the trouble maker. The loudest "pinging sound" was heard when the fine tuning condenser, *C110* was tapped. Moreover, by pressing the plastic probe against the lead (or buss) connected to *C110,* the microphonic whistle completely disappeared. It was noted upon examination that this lead was very close to ground. The lead was then moved away from ground and then resoldered at both ends. This of course detuned the oscillator. Therefore, each station, as this was a standard cascode tuner, was retuned by adjusting the oscillator slug. The volume control was then turned up to maximum and no microphonic whistle could now be heard on any station.

It may be interesting to describe how this microphonic whistle occurs. First the sound waves from the speaker set up mechanical vibrations in one or more of the wires, components or tube elements in the *rf* oscillator circuit. This mechanical vibration produces slight variations in inductance and capacity of the oscillator circuit which causes corresponding frequency modulation of the *rf* oscillator signal. This produces corresponding frequency modulation of the

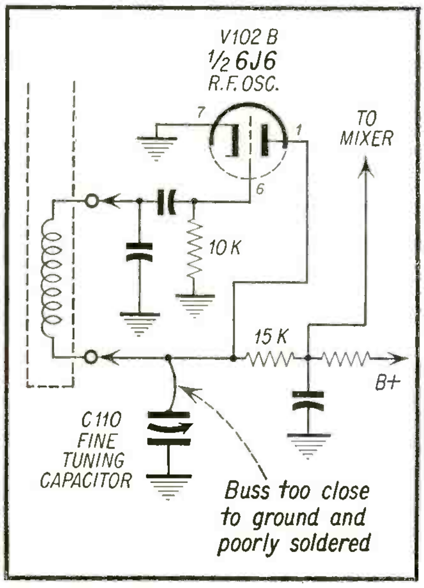



Fig. 2—Partial schematic of *rf* stage showing point of trouble.

sound *if* signal which is detected in the sound discriminator, and which produces audio frequency in its output. This is amplified in the audio amplifier and produces speaker cone motion. The speaker cone motion produces sound waves which tend to increase the vibrations in one or more of the wires, components or tube elements in the *rf* oscillator. The action is then repeated with reinforcement on each cycle. The net result is an audible whistle.

## ANTENNAS

*[from page 30]*

The reason that the transmission line is taken off the common harness termination point rather than the main dipole is due to transmit time considerations. If the harnesses from the two small dipoles were transposed and terminated at the main dipole the phase of the small dipole components would be changed in proportion to the length of the harness. Three equal lengths are used for this reason. It is interesting to note, however, that the transmission line could be taken off the main dipole if all harnesses were run straight. The individual harnesses happen to be ¼ wavelength long, so a phase change of 90 degrees would occur from the small dipoles to the present take off point and an additional 90 degrees from this point to the large dipole or the desired 180 degrees. The placement of the dipoles or phasing elements can be physically changed but the basic electrical operating principle is exactly the same.

This same principle was employed in the popular JFD Superjet and earlier antenna types.

## COLOR

*[from page 33]*

From these values we can easily prove that G and B are both zero. Thus:

$$G = Y - (G\text{-}Y) = .3 - .3 = 0$$
$$B = Y - (B\text{-}Y) = .3 - .3 = 0$$

which is what we set out to prove.

*Figure* 8 illustrates a partial schematic of the system around the 2-triode demodulator under discussion. The economy of potentiometers required for this type of demodulator is evident when we realize that this type of demodulator requires some five to seven tube envelopes less than previous designs. This economy of parts has the remarkable additional feature that the phasing and relative amplitude of the color signals produced is free from areas of drift and instability; it also has a minimum of adjustable elements (tuned coils and potentiometers), and is practically independent of variations of demodulator tube characteristics.

## P. A.

[from page 24]

systems which in addition to the necessary speakers, amplifiers, microphones, automatic time switch and automatic tape playing mechanisms, incorporate additional tape recording and tape playing mechanisms. In this way the store manager can record on a standard seven inch reel of tape, the store specials, advertisements and store promotions for the week, leaving a minimum of 10 seconds of space between commercials. The main music reel is then recorded with intervals of 10 second breaks. With a sound operated relay the music reel shuts off and a standard tape playing mechanism plays one commercial. When the commercial is terminated the relay reverts and the music reel is brought into play. The frequency of commercials can be controlled by merely putting the necessary spaces in the recorded music. The 7 inch reel with the one minute commercial on it is also recorded at three and three-quarter inches per second. As can be seen, it is very simple to record enough commercials for at least two days.

When the tape has been fully played it is merely rewound, put back in operation and needs no further attention for two more days. The most important part of this system is that the same unit can be used, with the use of the store microphone, to record the commercials. This enables the store manager to change the commercials as often as he sees fit.

## 600 MA TUBES

[from page 8]

*ma* tube is that of providing a controlled warm-up time of about 10 seconds. This reduces to nil any possible unbalance or improper voltage distribution across the filament line during the starting period. It means that in 10 seconds the filament for all the tubes are at their constant operating value. Every 600 *ma* type tube will warm up in exactly the same time as every other one.

Of course, this does not mean that the receiver will be in operation in 10 seconds inasmuch as it takes a somewhat longer time to transfer the heat from the filament to the cathode material for adequate election emission. In certain cases, such as damper tubes, it can take as long as 35 to 75 seconds before the receiver comes up to normal operation and high voltage is provided to develop the raster.

As is indicated in Table 1, the new 600 *ma* tubes have prototypes that correspond physically and electrically with each other except for filament voltages, current ratings, and warm-up time characteristics.

With the 600 *ma* series string tube the negative temperature coefficient resistor will not be necessary to absorb voltage surges since the resistance in the whole series line will increase at a constant rate for all tubes. Therefore, an inexpensive resistor can be employed to furnish any additional voltage drop necessary to provide the proper voltage distribution across the whole series circuit. In fact, tube manufacturers suggest that these series filament resistors have a positive temperature coefficient.

### Typical Receivers

Two chassis employing the 600 *ma* filament circuit are shown in *Fig.* 2 and 3. These new receivers are a far cry from the series filament types produced by the TV industry in the past. The Admiral chassis 17XP3 is shown in *Fig.* 2 and in this diagram it can be noted that each filament terminal connects to the next and that all the tubes are in series with a voltage dropping resistor of 47 ohms, 20 watts. This circuit will do every bit as good a job as the power transformer type.

*Figure* 3 shows the Zenith series filament system. Here, the feature of providing accessible filament test points shown as J, K and L in *Fig.* 3. This permits rapid servicing of the series string circuit without getting under the chassis. The most tubes that will be found in any portion of the line is five. Five tubes are the greatest number that need be removed from the chassis for test purposes of ascertaining which tube filament is open.

A point of interest to the serviceman concerning the Zenith chassis is that all tubes except the 6SN7GTA horizontal oscillator tube may be substituted for while the receiver is hot and in operation. This is brought about only because the replacement of the horizontal oscillator tube with one that is cold that will not immediately provide the horizontal output with a signal from this cold tube. This lack of drive at the

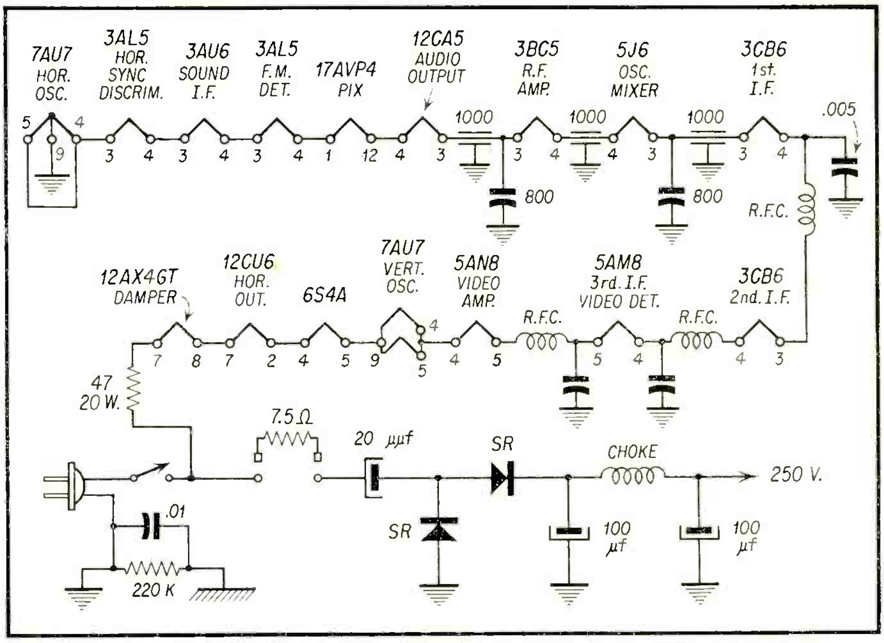



Fig. 2—Admiral chassis 17XP3 B plus and filament circuit.

grid of the horizontal output tube and therefore lack of grid bias during a period that may be as long as 20 seconds will permit too much plate current to flow through the horizontal output tube. The excessive plate current will generally open the high voltage fuse. *To prevent this, remove the high voltage fuse and permit the 6SN7GTA tube to warm up for about 30 seconds.* The fuse can then be inserted without danger of it popping due to this cause. At the time of replacement of the high voltage fuse

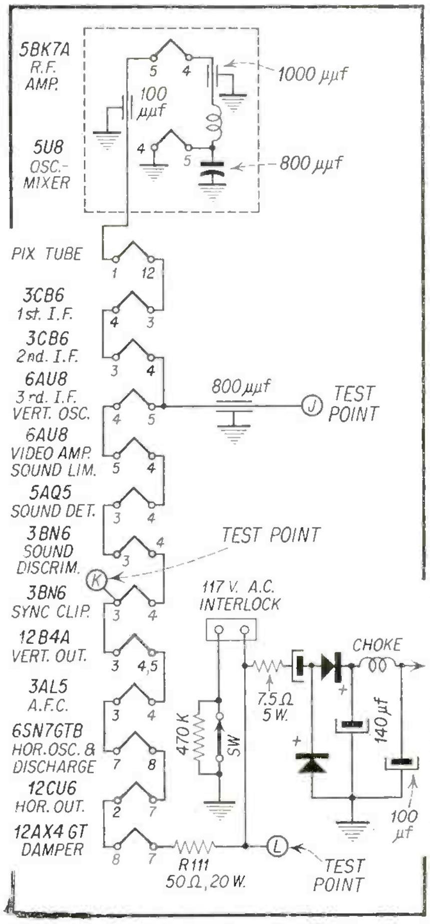



Fig. 3—Partial schematic of Zenith chassis 16T20 showing B plus and filament circuit. Notice use of test points for purposes of easy servicing on the part of the service technician.

it is recommended that the receiver be momentarily switched off.

### Replacement Tubes

A point concerning the purchase of tubes must be made in closing. Care must be exercised for the present in buying tubes as replacements for the new receivers. As an example, there are three possible tubes that can be obtained in ordering the 6SN7 variety. Only the 6SN7GTB has the close tolerance, controlled warm-up filament. The same applies to the 12B4 type. Only the 12B4A should be used in the series filament as the other does not heat up properly for a series filament line.

## Advertising Index

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**(72 pages in this issue, including complete TV Service Sheets)**

**RADIO-TELEVISION SERVICE DEALER**
**COMPLETE TV SERVICE INFORMATION SHEETS**

# STROMBERG-CARLSON

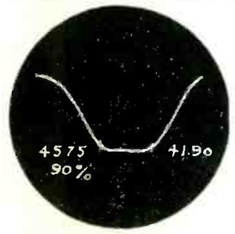
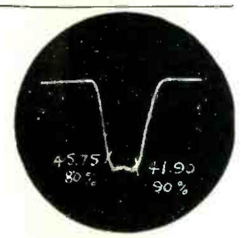
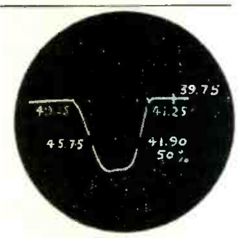
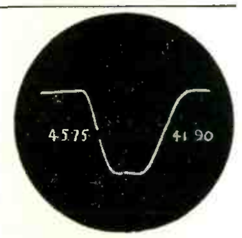
## 625 SERIES

*An exclusive service of Cowan Publishing Corp. by special arrangement with John F. Rider, Publisher*

### ALIGNMENT PROCEDURE

Apply A.G.C. bias of approximately—2 V to A.G.C. Line (across C-202). Maintain the output level of the sweep generator such that the second detector output is 2 volts peak to peak. Scope Cal. 1-V per inch.

**NOTE—USE A NON-METALLIC ALIGNING TOOL AND LIGHT PRESSURE ON ALL SLUGS.**

| Signal Generator Connection | Oscilloscope or VTVM Connection | Adjustments | |
|---|---|---|---|
| 1. Output of 40mc. Sweep Generator to grid of 3rd I.F. Tube, pin 1 of 6CB6 V-12 thru 100 MMF isolating capacitor. | Input of scope to grid of Video Amplifier, pin 2 of 6U8 V-13 thru 47K ohm isolating resistor. | 1. Adjust top and bottom of T-11 for marker positions as shown on curve Figure 1. |   FIG. 1 |
| 2. Output of 40mc. Sweep Generator to grid of 2nd I.F. Tube, pin 1 of 6CB6 V-11 thru 100 MMF isolating capacitor. | Same as Step #1. | 1. Adjust top and bottom of T-10 for marker positions as shown on curve Figure 2. |   FIG. 2 |
| 3. Output of 40mc. Sweep Generator to grid of 1st I.F. Tube, pin 1 of 6CB6 V-10 thru 100 MMF isolating capacitor. | Same as Step #1. | 1. Adjust top of T-9 for marker position of 47.25mc. 2. Adjust bottom of T-9 for marker positions at 41.25mc. 3. Adjust bottom of T-6 for marker position at 39.75mc. 4. Adjust bottom of T-7 and T-8 to produce curve as shown on Figure 3. |   FIG. 3 |
| 4. Raise converter tube shield from ground and connect output of 40mc. sweep generator to the shield. | Same as Step #1. | 1. Adjust top of T-6 and L-4 on tuner (L-14 on standard coil tuner) assembly to produce a curve as shown on Figure 4. |   FIG. 4 |
| 5. Connect a 400 cycle modulated 4.5mc. signal to the junction of Video detector M-13 and C-130. Adjust generator output to a level to indicate 1.5 Volts on VTVM. | Connect 2-100 resistors in series from plate of ratio detector pin 2 of V-18, 6T8 to ground. Connect VTVM from junction of the 2-100K resistors to ground. | 1. Adjust L-21, T-15 and bottom slug of T-16 for maximum indication. | |
| 6. Same as Step #5. | Connect — VTVM ground lead to the junction of the 2-100K resistors (see 5 above). Connect VTVM D.C. lead to the junction of C-183 and R-182. | 1. Adjust the secondary (Top slug) of T-16 for zero volts between the positive and negative excursions. (Increase Generator output for good deflection). | |

### Alternate Trap Alignment

**IF THIS METHOD IS USED, IT SHOULD BE PERFORMED BEFORE THE I.F. CURVE ALIGNMENT**

| Signal Generator Connection | Oscilloscope or VTVM Connection | Adjustments |
|---|---|---|
| 1. Connect a modulated (400 cycle) 39.75mc. signal to grid, pin 1 of the 1st video I.F. Tube—V-10. | Same as Step #1. | 1. Adjust bottom of T-6 for minimum response on scope. |
| 2. Connect a modulated (400 cycle) 41.25mc. signal to the grid, pin 1 of 1st video I.F. Tube 6CB6—V-10. | Same as Step #1. | 1. Adjust bottom of T-9 for minimum response on scope. |
| 3. Connect a modulated (400 cycle) 47.25mc. signal to grid, pin 1 of 1st video I.F. Tube 6CB6—V-10. | Same as Step #1. | 1. Adjust top of T-9 for minimum response on scope. |

### PARTS LIST

#### COILS

| Circuit Symbol | S-C Part No. | Description |
|---|---|---|
| L-1 | 171271 | Matching Coil |
| L-2 | 171272 | 44Mc Input from UHF Tuner |
| L-3 | 171273 | Neutralizing Coil |
| L-4 | 171274 | VHF Tuner I.F. Output Adjust |
| L-5 | 171275 | Filament Choke |
| L-6 | | |
| L-7 | | |
| L-8 | | |
| L-9 | | |
| L-10 | 171800 | Antenna Input |
| L-11 | 171801 | UHF Tuning |
| L-12 | 171802 | UHF Tuning |
| L-13 | 171803 | Filament Choke |
| L-14 | 171804 | Filament Choke |
| L-15 | 171805 | Crystal Pickup Loop |
| L-16 | 171806 | Crystal Diode Load |
| L-17 | 171807 | 44Mc I.F. Adjust |
| L-18 | 171808 | Oscillator Coupling Loop |
| L-19 | | |
| L-20 | 114747 | 40Mc Rejection |
| L-21 | 114400 | 1st Audio I.F. |
| L-22 | 114748 | Peaking Coil |
| L-23 | | |
| L-24 | 114749 | Peaking Coil |
| L-25 | 114750 | Peaking Coil |
| L-26 | 114751 | Peaking Coil |
| L-27 | 114415 | 4.5Mc Trap |
| L-28 | 114132 | Horizontal Oscillator |
| L-29 | 114125 | Horizontal Linearity |
| L-30 | 114129 | Horizontal Size |
| L-31 | 161030 | Filter Choke |
| L-32 | 114746 | Deflection Yoke |
| L-33 | 114693 | 2.2 uh Choke |
| L-34 | | |
| L-35 | | |
| L-101 | See T-6 | 39.75Mc Trap |
| L-102 | See T-9 | 41.25Mc Trap |
| L-103 | See T-9 | 47.25Mc Trap |
| L-104 | | |
| L-201 | 171292 | VHF Grid Adjust |
| L-202 thru L-213 | 171809 thru 171820 | VHF Grid Coils |
| L-301 | 171293 | VHF RF Plate Adjust |
| L-302 thru L-315 | 171484 thru 171497 | VHF RF Plate Coils |
| L-401 | 171294 | VHF Mixer Grid Adjust |
| L-402 thru L-415 | 171584 thru 171597 | VHF Mixer Grid Coils |
| L-501 | 171295 | VHF Oscillator Adjust |
| L-502 thru L-508 | 171253 thru 171259 | VHF Oscillator Coils |
| L-509 | 171296 | VHF Low Channel Osc. Adjust |
| L-510 thru L-513 | 171260 thru 171263 | VHF Osc. Coil |

#### TRANSFORMERS

| Circuit Symbol | S-C Part No. | Description |
|---|---|---|
| T-1 | 171276 | VHF Antenna Input |
| T-2 | | |
| T-3 | | |
| T-4 | | |
| T-5 | | |
| T-6 | 171246 | Converter Secondary and 39.75Mc Trap Coil |
| T-7 | 171247 | 1st Video I.F. Output |
| T-8 | 171248 | 2nd Video I.F. Input |
| T-9 | 171249 | 41.25 and 47.25Mc Trap |
| T-10 | 171250 | 3rd Video I.F. |
| T-11 | 171251 | 4th Video I.F. |
| T-12 | | |
| T-13 | | |
| T-14 | | |
| T-15 | 114401 | 2nd Audio I.F. |
| T-16 | 114375 | Ratio Detector |
| T-17 | See M-8 | Audio Output |
| T-18 | 161254 | Vertical Blocking |
| T-19 | 161266 | Vertical Output |
| T-20 | 161045 | Horizontal Output |
| T-22 | 114127 | Sawtooth Transformer |
| T-21 | 161444 | Power Transformer |
| T-23 | | |

#### MISCELLANEOUS

| Circuit Symbol | S-C Part No. | Description |
|---|---|---|
| M-1 | 128200 | Circuit Network |
| M-2 | 128003 | Fuse, ¼ Amp. |
| M-3 | 158037 | Slide Switch |
| M-4 | 128007 | Fuse, 5 Amp. |
| M-5 | | |
| M-6 | 34421 | Phono Jack |
| M-7 | 128203 | I.F. Strip |
| M-8 | 155734 | Speaker Assembly |
| M-9 | | |
| M-10 | | |
| M-11 | 164023 | VHF Tuning Unit |
| M-12 | 164024 | UHF Tuning Unit |
| M-13 | 162157 | 1N64 Crystal Diode |
| M-14 | 171252 | K-3 (Kemtron) Crystal Diode |

#### RESISTORS

| Circuit Symbol | S-C Part No. | Resistance | Watt | Tol. |
|---|---|---|---|---|
| R-1 | 28172 | 15K ohms | ½ W | 10% |
| R-2 | 28154 | 470 ohms | ½ W | 10% |
| R-3 | 171297 | 1 Megohm | ½ W | 5% |
| R-4 | 149315 | 750K ohms | ½ W | 5% |
| R-5 | 28165 | 3.9K ohms | ½ W | 10% |
| R-6 | 28158 | 1K ohms | ½ W | 10% |

# STROMBERG-CARLSON

## 625 SERIES

*An exclusive service of Cowan Publishing Corp. by special arrangement with John F. Rider, Publisher*

| Circuit Symbol | S-C Part No. | Resistance | Watt | Tol. |
|---|---|---|---|---|
| R-7 | 28183 | 220K ohms | ½ W | 10% |
| R-8 | 28158 | 1K ohms | ½ W | 10% |
| R-9 | 28162 | 2.2K ohms | ½ W | 10% |
| R-10 | 28172 | 15K ohms | ½ W | 10% |
| R-11 | 28150 | 220 ohms | ½ W | 10% |
| R-12 | 28166 | 4.7K ohms | ½ W | 10% |
| R-13 | 28158 | 1K ohms | ½ W | 10% |
| R-14 | | | | |
| R-15 | | | | |
| R-16 | | | | |
| R-17 | | | | |
| R-18 | | | | |
| R-19 | | | | |
| R-20 | 149282 | 4.7 ohms | 1 W | 10% |
| R-30 | 28172 | 15K ohms | ½ W | 10% |
| R-31 | 149048 | 2.2K ohms | 2 W | 10% |
| R-32 | | | | |
| R-33-39 | | | | |
| R-40-49 | | | | |
| R-100 | 28170 | 10K ohms | ½ W | 10% |
| R-101 | 28142 | 47 ohms | ½ W | 10% |
| R-102 | 149103 | 2.2K ohms | ½ W | 20% |
| R-103 | 28159 | 1.2K ohms | ½ W | 10% |
| R-104 | 149103 | 2.2K ohms | ½ W | 20% |
| R-105 | 171238 | 24K ohms | ½ W | 5% |
| R-106 | | | | |
| R-110 | 149384 | 22K ohms | ½ W | 10% |
| R-111 | 28142 | 47 ohms | ½ W | 10% |
| R-112 | 28159 | 1.2K ohms | ½ W | 10% |
| R-113 | | | | |
| R-120 | 28170 | 10K ohms | ½ W | 10% |
| R-121 | 28145 | 82 ohms | ½ W | 10% |
| R-122 | 28159 | 1.2K ohms | ½ W | 10% |
| R-123 | | | | |
| R-130 | 28164 | 3.3K ohms | ½ W | 10% |
| R-131 | 28162 | 2.2K ohms | ½ W | 10% |
| R-132 | 28162 | 2.2K ohms | ½ W | 10% |
| R-133 | 149404 | 33K ohms | 1 W | 10% |
| R-134 | 149012 | 33K ohms | 2 W | 10% |
| R-135 | 149119 | 1 Megohm | ½ W | 20% |
| R-136 | 149121 | 2.2 Megohms | ½ W | 20% |
| R-137 | 28175 | 33K ohms | ½ W | 10% |
| R-138 | 28179 | 68K ohms | ½ W | 10% |
| R-139 | | | | |
| R-140 | 149117 | 470K ohms | ½ W | 20% |
| R-141 | 145140 | 1K-100K ohms | Dual Pot. | |
| R-142 | 149134 | 220 ohms | 1 W | 20% |
| R-143 | 149094 | 68 ohms | ½ W | 20% |
| R-144 | 149411 | 2K ohms | 7 W | 10% |
| R-145 | 149075 | 680 ohms | 2 W | 20% |
| R-146 | 149109 | 22K ohms | ½ W | 20% |
| R-147 | | | | |
| R-148 | | | | |
| R-149 | | | | |
| R-150 | 149119 | 1 Megohm | ½ W | 20% |
| R-151 | 28185 | 330K ohms | ½ W | 10% |
| R-152 | 149107 | 10K ohms | ½ W | 20% |
| R-153 | | | | |
| R-160 | 149094 | 68 ohms | ½ W | 20% |
| R-161 | 149093 | 47 ohms | ½ W | 10% |
| R-162 | 28173 | 18K ohms | ½ W | 10% |
| R-163 | 149120 | 1.5 Megohms | ½ W | 20% |
| R-164 | 28173 | 18K ohms | ½ W | 10% |
| R-165 | | | | |
| R-170 | 149108 | 15K ohms | ½ W | 20% |
| R-171 | 149142 | 4.7K ohms | 1 W | 20% |
| R-172 | 149097 | 220 ohms | ½ W | 20% |
| R-173 | | | | |
| R-180 | 149111 | 47K ohms | ½ W | 20% |
| R-181 | 149097 | 220 ohms | ½ W | 20% |
| R-182 | 28173 | 18K ohms | ½ W | 10% |
| R-183 | 145148 | 250K-500K ohms | Dual Pot. | |
| R-184 | 149125 | 10 Megohms | ½ W | 20% |
| R-185 | 149117 | 470K ohms | ½ W | 20% |
| R-186 | | | | |
| R-190 | 149117 | 470K ohms | ½ W | 20% |
| R-191 | 149014 | 270 ohms | 2 W | 10% |
| R-192 | 149094 | 68 ohms | ½ W | 20% |
| R-193 | 149420 | 1250 ohms | 5 W | 10% |
| R-194 | 149075 | 680 ohms | 2 W | 20% |
| R-200 | 149384 | 22K ohms | ½ W | 10% |
| R-201 | 28189 | 680K ohms | ½ W | 10% |
| R-202 | | | | |
| R-203 | 149113 | 100K ohms | ½ W | 20% |
| R-204 | 149403 | 27K ohms | 1 W | 10% |
| R-205 | 28187 | 470K ohms | ½ W | 10% |
| R-206 | 149111 | 47K ohms | ½ W | 20% |
| R-207 | 28186 | 390K ohms | ½ W | 10% |
| R-208 | 149115 | 220K ohms | ½ W | 20% |
| R-209 | | | | |
| R-210 | 149114 | 150K ohms | ½ W | 20% |
| R-211 | 28185 | 330K ohms | ½ W | 10% |
| R-212 | 149121 | 2.2 Megohms | ½ W | 20% |
| R-213 | 28162 | 2.2K ohms | ½ W | 10% |
| R-214 | 28158 | 1K ohms | ½ W | 10% |
| R-215 | 28162 | 2.2K ohms | ½ W | 10% |
| R-216 | 149114 | 150K ohms | ½ W | 20% |
| R-220 | 149113 | 100K ohms | ½ W | 20% |
| R-221 | See M-1 | 22K ohms | | |
| R-222 | See M-1 | 8200 ohms | | |
| R-223 | See M-1 | 8200 ohms | | |
| R-224 | 28190 | 820K ohms | ½ W | 10% |
| R-225 | 145146 | 1 Megohm<br>50K ohms | Dual Pot. | |
| R-226 | 149107 | 10K ohms | ½ W | 20% |
| R-227 | 28191 | 1 Megohm | ½ W | 10% |
| R-228 | 145100 | 6 Megohms | Pot. | |
| R-229 | 28167 | 5.6K ohms | ½ W | 10% |
| R-230 | 149121 | 2.2 Megohms | ½ W | 20% |
| R-231 | 149039 | 390 ohms | 2 W | 10% |
| R-232 | 145149 | 1000 ohms | Pot. | |
| R-233 | 149075 | 680 ohms | 2 W | 20% |
| R-234 | | | | |
| R-240 | 149385 | 100K ohms | ½ W | 10% |
| R-241 | 149385 | 100K ohms | ½ W | 10% |
| R-242 | 149117 | 470K ohms | ½ W | 20% |
| R-243 | | | | |
| R-250 | 149123 | 4.7 Megohms | ½ W | 20% |
| R-251 | 28189 | 680K ohms | ½ W | 10% |
| R-252 | 149387 | 1.5K ohms | ½ W | 5% |
| R-253 | 149184 | 5.6K ohms | 1 W | 10% |
| R-254 | 149386 | 150K ohms | ½ W | 10% |
| R-255 | 145150 | 40K ohms | Pot. | |
| R-256 | 28177 | 47K ohms | ½ W | 10% |
| R-257 | 28170 | 10K ohms | ½ W | 10% |
| R-258 | 149103 | 2.2K ohms | ½ W | 20% |
| R-259 | 149434 | 250 ohms | 10 W | 10% |
| R-260 | 149111 | 47K ohms | ½ W | 20% |
| R-261 | 145147 | 500K ohms | Pot. | |
| R-262 | 149094 | 68 ohms | ½ W | 20% |
| R-263 | 149017 | 68 ohms | 2 W | 10% |
| R-264 | 149017 | 68 ohms | 2 W | 10% |
| R-265 | 149094 | 68 ohms | ½ W | 20% |
| R-266 | 149051 | 4.7K ohms | 2 W | 10% |
| R-267 | 149051 | 4.7K ohms | 2 W | 10% |
| R-268 | | | | |
| R-269 | | | | |
| R-270 | 149051 | 4.7K ohms | 2 W | 10% |
| R-271 | 149051 | 4.7K ohms | 2 W | 10% |
| R-272 | 149430 | 5.6 ohms | 1 W | 10% |
| R-273 | 149115 | 220K ohms | ½ W | 20% |
| R-274 | 149115 | 220K ohms | ½ W | 20% |
| R-275 | 149115 | 220K ohms | ½ W | 20% |
| R-276 | 28155 | 560 ohms | ½ W | 10% |
| R-277 | 28155 | 560 ohms | ½ W | 10% |
| R-278 | 149101 | 1K ohms | ½ W | 20% |
| R-279 | | | | |
| R-280 | 149435 | 1 ohm | ½ W | 20% |
| R-281 | | | | |
| R-290 | 149433 | 2.2K ohms | 25 W | 10% |
| R-291 | 149113 | 100K ohms | ½ W | 20% |
| R-292 | | | | |
| R-300 | | | | |
| R-301 | 149078 | 2.2K ohms | 2 W | 20% |
| R-302 | 149078 | 2.2K ohms | 2 W | 20% |
| R-303 | 149069 | 68 ohms | 2 W | 20% |
| R-304 | 149069 | 68 ohms | 2 W | 20% |

### CAPACITORS

| Circuit Symbol | S-C Part No. | Capacity | Type | Voltage |
|---|---|---|---|---|
| C-1 | 171298 | 800 MMF | Disc Ceramic | |
| C-2 | 171299 | 22 MMF | Ceramic | |
| C-3 | 110402 | 47 MMF | Ceramic | |
| C-4 | 171300 | 3.9 MMF | Ceramic | |
| C-5 | 171233 | 1000 MMF | Disc Ceramic | |
| C-6 | 171301 | 1000 MMF | Ceramic | |
| C-7 | 171498 | 470 MMF | Disc Ceramic | |
| C-8 | 171499 | .33 MMF | Ceramic | |
| C-9 | 171500 | .39 MMF | Ceramic | |
| C-10 | 171501 | 2 MMF | Ceramic | |
| C-11 | 110402 | 47 MMF | Ceramic | |
| C-12 | 171599 | .75 MMF | Ceramic | |
| C-13 | 171298 | 800 MMF | Disc Ceramic | |
| C-14 | 171264 | 10 MMF | Ceramic | |
| C-15 | 171265 | 1.5 MMF | Ceramic | |
| C-16 | 171233 | 1000 MMF | Disc Ceramic | |
| C-17 | 171266 | 1.6 MMF | Ceramic | |
| C-18 | 171233 | 1000 MMF | Disc Ceramic | |
| C-19 | 171264 | 10 MMF | Ceramic | |
| C-20 | 171267 | 1.5 MMF | Ceramic | |
| C-21 | 171268 | Fine Tuning | | |
| C-22 | 171269 | 82 MMF | Ceramic | |
| C-23 | 171233 | 1000 MMF | Disc Ceramic | |
| C-24 | 171270 | 7.5 MMF | Ceramic | |
| C-25 | 171298 | 800 MMF | Disc Ceramic | |
| C-26 | 171298 | 800 MMF | Disc Ceramic | |
| C-27 | | | | |
| C-30 | 171285 | | Trimmer | |
| C-31 | 171285 | | Trimmer | |
| C-32 | 171598 | .68 MMF | Ceramic | |
| C-33 | 171233 | 1000 MMF | Disc Ceramic | |
| C-34 | 171265 | 1.5 MMF | Ceramic | |
| C-35 | 171286 | | Trimmer | |
| C-36 | 171233 | 1000 MMF | Disc Ceramic | |
| C-37 | 171287 | 22 MMF | Ceramic | |
| C-38 | 171288 | 82 MMF | Disc Ceramic | |
| C-39 | 171289 | Variable—RF Tuning | | |
| C-40 | 171290 | Variable—RF Tuning | | |
| C-41 | 171291 | Variable—Osc. Tuning | | |
| C-100 | 171239 | 8.2 MMF | Ceramic | |
| C-101 | 171240 | 1500 MMF | Ceramic | |
| C-102 | 171240 | 1500 MMF | Ceramic | |
| C-103 | 171241 | 470 MMF | Ceramic | |
| C-104 | 171240 | 1500 MMF | Ceramic | |
| C-105 | 171241 | 470 MMF | Ceramic | |
| C-106 | 171240 | 1500 MMF | Ceramic | |
| C-107 | 171242 | 12 MMF | Ceramic | |
| C-108 | 171243 | 5 MMF | Ceramic | |
| C-109 | | | | |
| C-110 | 171240 | 1500 MMF | Ceramic | |
| C-111 | 171240 | 1500 MMF | Ceramic | |
| C-112 | 171241 | 470 MMF | Ceramic | |
| C-113 | | | | |
| C-120 | 171240 | 1500 MMF | Ceramic | |
| C-121 | 171244 | 680 MMF | Ceramic | |
| C-122 | 171240 | 1500 MMF | Ceramic | |
| C-123 | 171245 | 4 MMF | Ceramic | |
| C-124 | | | | |
| C-129 | 110824 | .001 MF | Ceramic | 450 |
| C-130 | 110598 | 5 MMF | Ceramic | 350 |
| C-131 | 110598 | 5 MMF | Ceramic | 350 |
| C-132 | 110586 | .005 MF | Disc Ceramic | 450 |
| C-133 | | | | |
| C-134 | 110722 | .047 MF | Tubular | 400 |
| C-135 | 110460 | 100 MMF | Ceramic | 500 |
| C-136 | | | | |
| C-140 | 110724 | .1 MF | Tubular | 400 |
| C-141 | | | | |
| C-142 | 110672 | .01 MF | Disc Ceramic | 450 |
| C-144 | | | | |
| C-150 | 110724 | .1 MF | Tubular | 400 |
| C-151 | 110459 | 68 MMF (See L27) | Ceramic | 500 |
| C-152 | 110743 | .1 MF | Tubular | 600 |
| C-153 | 110724 | .1 MF | Tubular | 400 |
| C-154 | | | | |
| C-160 | 110586 | .005 MF | Disc Ceramic | 450 |
| C-161 | 110586 | .005 MF | Disc Ceramic | 450 |
| C-162 | 110703 | .047 MF | Tubular | 200 |
| C-163 | | | | |
| C-170 | 110486 | 33 MMF | Ceramic | 400 |
| C-171 | 110672 | .01 MF | Disc Ceramic | 450 |
| C-172 | | | | |
| C-180 | 111093 | 5 MF | Electrolytic | 50 |
| C-181 | 110586 | .005 MF | Disc Ceramic | 450 |
| C-182 | 110465 | 680 MMF | Ceramic | 350 |
| C-183 | 110715 | .0033 MF | Tubular | 400 |
| C-184 | 110718 | .01 MF | Tubular | 400 |
| C-185 | 110586 | .005 MF | Disc Ceramic | 450 |
| C-186 | 110735 | .0047 MF | Tubular | 600 |
| C-187 | | | | |
| C-190 | 110737 | .01 MF | Tubular | 600 |
| C-191 | 110737 | .01 MF | Tubular | 600 |
| C-192 | | | | |
| C-200 | 110707 | .22 MF | Tubular | 200 |
| C-201 | 110533 | .47 MF | Tubular | 200 |
| C-202 | 110823 | 1 MF | Tubular | 100 |
| C-203 | 110586 | .005 MF | Disc Ceramic | 450 |
| C-204 | | | | |
| C-210 | 110705 | .1 MF | Tubular | 200 |
| C-211 | 110718 | .01 MF | Tubular | 400 |
| C-212 | | | | |
| C-220 | See M-1 | .0022 MF | | |
| C-221 | See M-1 | .0047 MF | | |
| C-222 | See M-1 | .0047 MF | | |
| C-223 | 110718 | .01 MF | Tubular | 400 |
| C-224 | 110745 | .22 MF | Tubular | 600 |
| C-225 | 110560 | .068 MF | Tubular | 600 |
| C-226 | 110557 | .022 MF | Tubular | 600 |
| C-227 | | | | |
| C-230 | 110561 | .1 MF | Tubular | 600 |
| C-231 | 110561 | .1 MF | Tubular | 600 |
| C-232 | | | | |
| C-233 | 111105 | 20 MF | Electrolytic | 450 |
| C-240 | 110534 | .001 MF | Tubular | 400 |
| C-241 | 110534 | .001 MF | Tubular | 400 |
| C-242 | 110716 | .0047 MF | Tubular | 400 |
| C-243 | | | | |
| C-250 | 110722 | .047 MF | Tubular | 400 |
| C-251 | 110309 | 3900 MMF | Mica | 500 |
| C-252 | 110262 | 390 MMF | Mica | 500 |
| C-253 | 110291 | 100 MMF | Mica | 500 |
| C-254 | 110260 | 270 MMF | Mica | 500 |
| C-255 | 110262 | 390 MMF | Mica | 500 |
| C-256 | | | | |
| C-260 | 110737 | .01 MF | Tubular | 600 |
| C-261 | 111093 | 5 MF | Electrolytic | 50 |
| C-262 | 110548 | .22 MF | Tubular | 400 |
| C-263 | | | | |
| C-270 | 110722 | .047 MF | Tubular | 400 |
| C-271 | 110722 | .047 MF | Tubular | 400 |
| C-272 | 110743 | .1 MF | Tubular | 600 |
| C-273 | 110562 | .001 MF | Tubular | 1KV |
| C-274 | 110548 | .22 MF | Tubular | 400 |
| C-275 | 110825 | 180 MMF | Ceramic | 3KV |
| C-276 | 110311 | 120 MMF | Mica | 1.5KV |
| C-277 | 110291 | 100 MMF | Mica | 500 |
| C-278 | | | | |
| C-279 | 110718 | .01 MF | Tubular | 400 |
| C-280 | 110820 | 500 MMF | Ceramic | 30KV |
| C-281 | | | | |
| C-290 | 111095 | 40-40 MF | Electrolytic | 450 |
| C-291 | 111104 | 40-20-10 MF<br>100 MF | Electrolytic<br>Electrolytic | 450<br>50 |
| C-292 | 110568 | .01 MF | Tubular | 1KV |
| C-293 | 110568 | .01 MF | Tubular | 1KV |
| C-294 | 111104 | 40-20-10 MF<br>100 MF | Electrolytic<br>Electrolytic | 450<br>50 |
| C-295 | | | | |

# STROMBERG-CARLSON

## 625 SERIES

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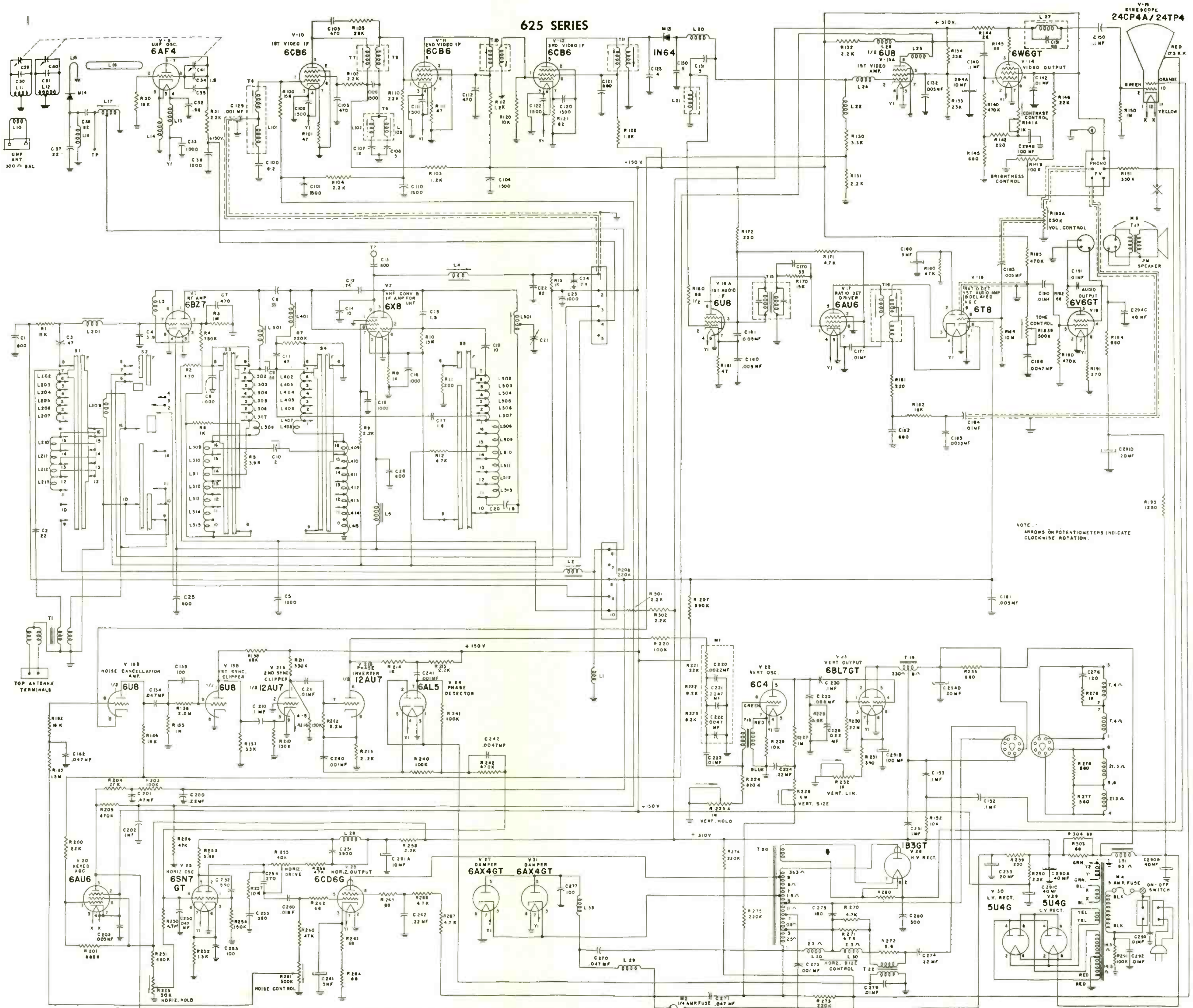

# STROMBERG-CARLSON
## 625 SERIES

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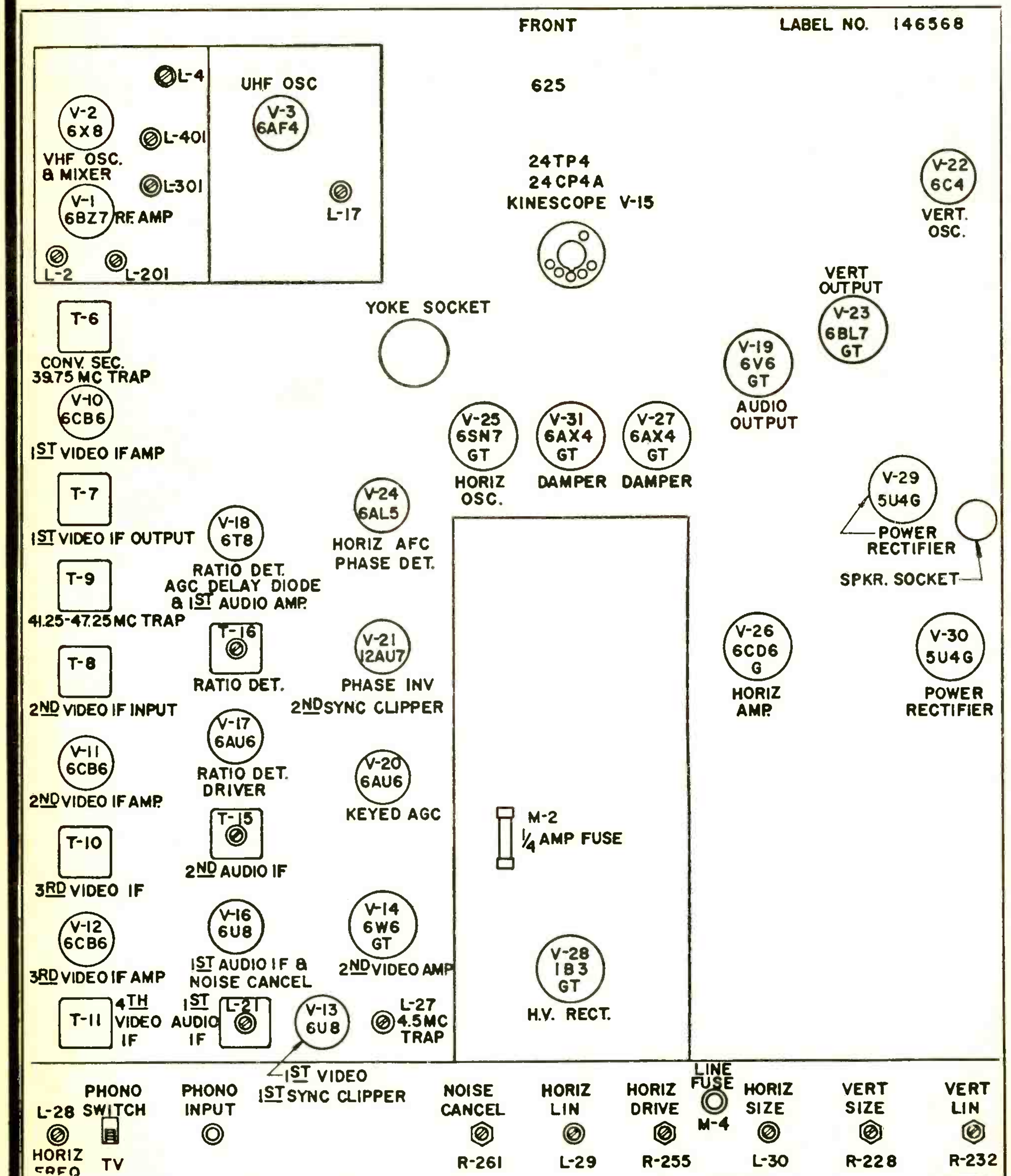



## TUBE VOLTAGE CHART

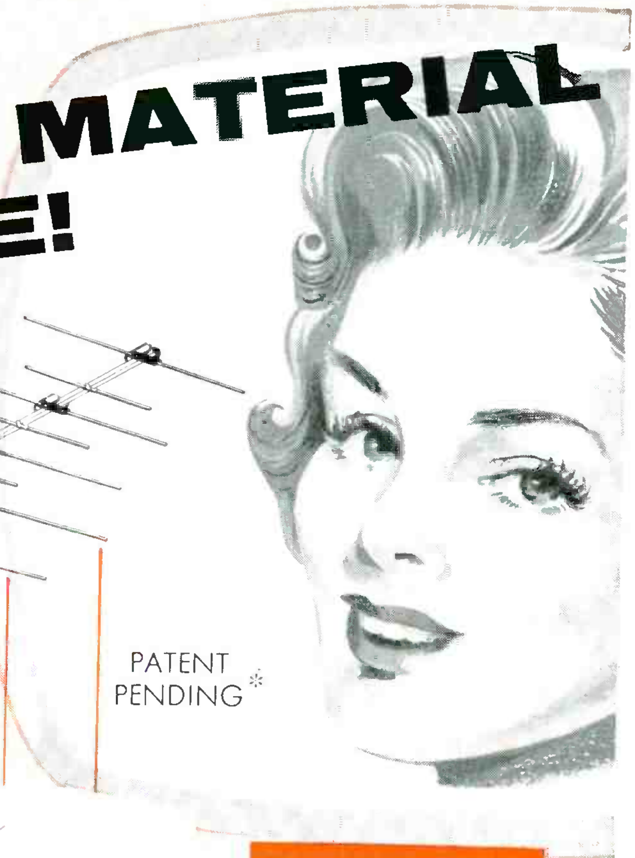
1. Measurements are made at 117 Volts line using vacuum tube voltmeter. All voltages are D.C. and are positive with respect to chassis ground except where noted.
2. Contrast and brightness controls set at minimum, antenna disconnected.

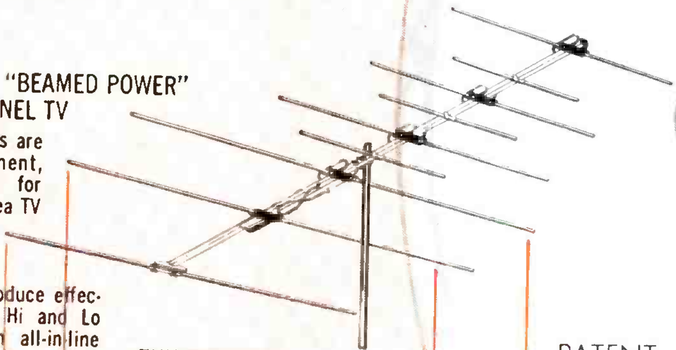
| | | | PIN 1 | PIN 2 | PIN 3 | PIN 4 | PIN 5 | PIN 6 | PIN 7 | PIN 8 | PIN 9 | PIN 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| V-10 | 6CB6 | 1st VIDEO I.F. | .0 | .65 | AC 6.3 | AC 6.3 | 97 | 90 | Gnd. | | | |
| V-11 | 6CB6 | 2nd VIDEO I.F. | .0 | .65 | AC 6.3 | AC 6.3 | 95 | 96 | Gnd. | | | |
| V-12 | 6CB6 | 3rd VIDEO I.F. | .0 | .9 | AC 6.3 | AC 6.3 | 97 | 99 | Gnd. | | | |
| V-13 | 6U8 | 1st VIDEO AMP. & 1st SYNC. CLIPPER | 32 | —.25 | 86 | AC 6.3 | Gnd. | 92 | Gnd. | Gnd. | —1.8 | |
| V-14 | 6W6 | 2nd VIDEO AMP. | 8.2 | AC 6.3 | 265 | 112 | 7.8 | 425 | Gnd. | 23 | | |
| V-16 | 6U8 | 1st AUDIO I.F. & NOISE CANCEL | 91 | .0 | 110 | Gnd. | AC 6.3 | 106 | .6 | —.1 | —.7 | |
| V-17 | 6AU6 | RATIO DET. DRIVER | —.46 | Gnd. | Gnd. | AC 6.3 | 75 | 83 | Gnd. | | | |
| V-18 | 6T8 | RATIO DET. | —.43 | —1.65 | —.58 | Gnd. | AC 6.3 | .0 | Gnd. | .13 | 47 | |
| V-19 | 6V6 | AUDIO OUTPUT | NC | Gnd. | 225 | 245 | .0 | NC | AC 6.3 | 13 | | |
| V-20 | 6AU6 | KEYED A.G.C. | 97 | 112 | 110 | 112 | 2.4 | 300 | 112 | | | |
| V-21 | 12AU7 | PHASE INV. & 2nd SYNC. CLIPPER | 38 | Gnd. | 6.0 | AC 6.3 | AC 6.3 | 91 | 10 | 15 | Gnd. | |
| V-22 | 6C4 | VERT. OSC. | NC | NC | Gnd. | AC 6.3 | 180 | —43 | .0 | | | |
| V-23 | 6BL7 | VERT. OUTPUT | .0 | 278 | 18 | 0 | 278 | 18 | AC 6.3 | Gnd. | | |
| V-24 | 6AL5 | PHASE DET. | .0 | .0 | Gnd. | AC 6.3 | 12 | NC | —5.7 | | | |
| V-25 | 6SN7 | HORIZ. OSC. | —15 | 190 | 13 | 4.8 | 290 | 13 | AC 6.3 | Gnd. | | |
| V-26 | 6CD6 | HORIZ. OUTPUT | NC | Gnd. | 20 | 135 | 7.2 | 7.2 | AC 6.3 | 135 | | |
| V-27 | 6AX4 | DAMPER | NC | NC | 565 | NC | 255 | 255 | AC 6.3 | Gnd. | | |
| V-29 | 5U4 | L.V. RECTIFIER | NC | 335 | NC | Plate | NC | Plate | NC | 335 | | |
| V-30 | 5U4 | L.V. RECTIFIER | NC | 335 | NC | Plate | NC | Plate | NC | 335 | | |
| V-31 | 6AX4 | DAMPER | NC | NC | 565 | NC | 255 | NC | AC 6.3 | Gnd. | | |
| | | DEFLECTION SOCKET | NC | NC | NC | 600 | 560 | Gnd. | 290 | 290 | | |
| TUNER TERMINAL STRIP VOLTAGES: | | | | | | | | | | | | |
| | | V.H.F. TUNER (V.H.F. POS.) | 110 | 113 | AC 6.3 | —1.0 | .0 | .0 | 0 | —.5 | .0 | 225 |
| | | UHF POSITION | 110 | 112 | AC 6.3 | 110 | .0 | .0 | AC 6.3 | —.5 | .0 | 225 |

| | | | PIN 1 | PIN 2 | PIN 10 | PIN 11 | PIN 12 |
|---|---|---|---|---|---|---|---|
| V 15 | 24CP4A | KINESCOPE | Gnd. | .0 | 440 | 94 | AC 6.3 |

AGAIN *telrex* OFFERS MORE BECAUSE...

# THERE IS A MATERIAL DIFFERENCE!



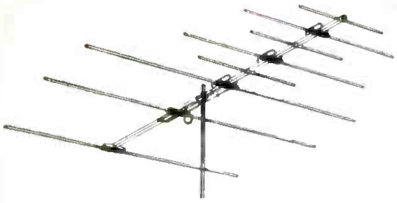


NEW "THUNDER BIRD" "BEAMED POWER" ARRAYS FOR ALL-CHANNEL TV

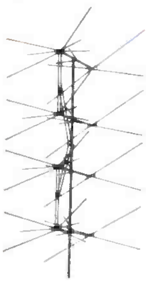
"THUNDER BIRD" Antennas are loop phased, multi-element, "Beamed Power" Arrays for fringe and "sub-fringe" area TV reception. Element functions are duplexed by means of variable impedance phasing loops to produce effective high gain Yagis for Hi and Lo channel VHF Bands in an all-in-line array which actually produces superior gain and directivity — element for element — than equivalent separate units.

THUNDERBIRD MODEL T120

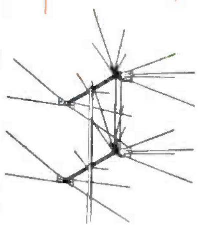
PATENT PENDING*



MODEL T110 THUNDERBIRD



"8X-TV"—the Finest Fringe Area All-Channel Array ever Produced



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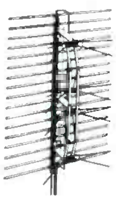

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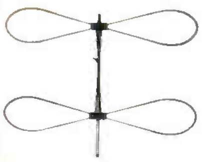

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