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Electronic TUBES

Techni-talk

on AM, FM, TV Servicing

NEW

300 AND 450 MA SERIES-STRING TUBES

Many of the latest model TV receivers will use series-string tubes. Some of these receivers will use 300-ma type tubes, some will use 450 ma type tubes and others will use 600-ma type tubes. Regardless of the current required by the tube heaters they will all have controlled warm-up time if used in a series-string circuit.

Receivers with their heaters connected in series have been manufactured for quite a few years and most service technicians are familiar with this type circuit. Prior to 1954 some tubes designed for parallel connected heaters were used in series-string circuits. When used in series-string circuits, some of these tubes did not perform as well as when used in parallel heater circuits. In 1954 it was decided that in view of the trend to lower price receivers a line of tubes should be developed specifically for series-string operation.

It was found that tubes had to be improved in two ways for series-string operation. First, the heater-cathode voltage rating had to be increased because the full a-c line voltage in addition to any applied d-c voltage might be present between these two tube elements. Second, each tube in a series-string circuit had to warm-up at practically the same time. This was necessary in order to prevent any high voltage surges across any particular tube heater.

Both of these improvements were made in a line of tubes first introduced by General Electric and known as the "600 Series" receiving tubes. The heaters used in these tubes as well as all General Electric picture tubes are so designed that all tubes warm-up within a certain specified time interval. High voltage surges across any tube heater are eliminated and voltage limiting devices are not required.

The development of the "600 Series" receiving tube made possible lower cost TV receivers and initiated the "swing" to portable receivers by a number of TV manufacturers. The service technician has benefited from this in two ways. First, due to lower priced receivers, more people have purchased a second set. Since two receivers require more service than one, more potential service business is now and will continue to be available. Second, portable TV receivers can be brought into the service shop. This type of business should be encouraged since many more receivers can be serviced in a day if travel time can be eliminated. There will also be more profit in this type of service because all of the expenses necessary for home servicing will be reduced. These expenses include gas, oil, depreciation on vehicle, insurance, repairs, etc. The service technician should, therefore, welcome these latest advances made by the tube industry.

The "600 Series" tubes have been used in many series-string type receivers with excellent results. It has been found, however, that since the voltage across all of the tube heaters used in series-string receivers seldom equaled the line voltage, some additional component was required to provide proper heater voltages. One method was a tapped transformer such as used on the General Electric "N" line of receivers shown in Fig. 1. This tap provides about 90 volts at 600 ma.

Another method commonly used is a wire wound resistor such as used in the General Electric "M" chassis shown in Fig. 2. Notice that R-401 is a 40-watt resistor which dissipates a considerable amount of heat. This heat presents a problem to both the manufacturer and the purchaser. The manufacturer must make provision for proper ventilation and the purchaser must pay for the unwanted heat. Since the cathode in each tube requires a specific amount of heat (supplied by the heater) for proper operation, the only significant heat reduction would be to either eliminate the voltage dropping resistor or reduce the current flow through this resistor. This is precisely what was accomplished by the development of the "300 Series" and "150 Series" tubes with controlled warm-up time.

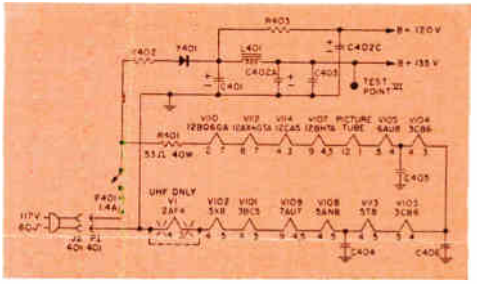


Fig. 2. Series-heater circuit with resistor used in General Electric "M" line of receivers.

An up-to-date list of all tubes with controlled warm-up time and their prototypes is shown in the chart on pages 2 and 5. It will be noted that some types such as the 6AU6-A and 6CB6A are listed as "300 Series" tubes. Since their prototypes, the 6AU6 and 6CB6, are also 300-ma type, the only difference between the "300 Series" and their prototypes is in the controlled warm-up time characteristic of the heater.

It will also be noticed that there are several versions of a single tube type such as the 7AU7, 9AU7 and the 12AU7, with the 7AU7 listed in both the "300 Series" and "600 Series" columns. The only difference between the 7AU7, 9AU7 and the 12AU7 is the heater voltage and current. Since the 7AU7 has a center-tapped controlled warm-up time heater, it can be used as either a "300 Series" or a "600 Series," depending on the way the heater is connected.

Since the only difference between the new tubes and their prototypes is in the heater, many of these tubes can be tested if the proper heater voltage tap is available. All *other* tube tester settings for the prototype can then be used.

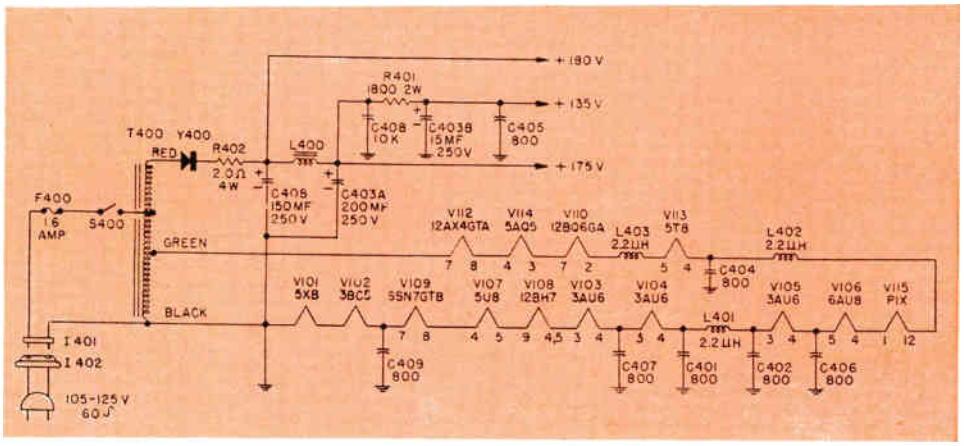


Fig. 1. Transformer-type supply for series-heater circuit used in General Electric "N" line of receivers.

Series-String Receiving Tube Wall Chart

★300 Series		★450 Series		★600 Series		PROTOTYPE			
TYPE	HEATER VOLTS	TYPE	HEATER VOLTS	TYPE	HEATER VOLTS	TYPE	HEATER VOLTS	AMPS.	DESCRIPTION
		3AF4-A	3.2	2AF4 and A	2.35	6AF4 and A	6.3	.225	Triode-UHF Oscillator
		3BN4	2.8	2BN4	2.1	6BN4	6.3	.2	Triode-RF Amplifier
				3AL5	3.15	6AL5	6.3	.3	Twin Diode
						12AL5	12.6	.15	Twin Diode
						6AU6	6.3	.3	Pentode
6AU6-A	6.3			3AU6	3.15	12AU6	12.6	.15	Pentode
				3AV6	3.15	6AV6	6.3	.3	Duplex-Diode Triode
						12AV6	12.6	.15	Duplex-Diode Triode
						6BA6	6.3	.3	Pentode
				3BA6	3.15	12BA6	12.6	.15	Pentode
		4BC5	4.2	3BC5	3.15	6BC5	6.3	.3	Pentode
				3BE6	3.15	6BE6	6.3	.3	Heptode
						12BE6	12.6	.15	Heptode
		4BN6	4.2	3BN6	3.15	6BN6	6.3	.3	Gated-Beam Discriminator
		4BU8	4.2	3BU8	3.15	6BU8	6.3	.3	Twin Pentode
				3BY6	3.15	6BY6	6.3	.3	Heptode
				3BZ6	3.15	6BZ6	6.3	.3	Pentode
6CB6-A	6.3	4CB6	4.2	3CB6	3.15	6CB6	6.3	.3	Pentode
6CE5	6.3			3CE5	3.15	None			Improved (High Gm) version of 6BC5
				3CF6	3.15	6CF6	6.3	.3	Pentode
				3CS6	3.15	6CS6	6.3	.3	Heptode
				3DT6	3.15	6DT6	6.3	.3	Pentode
				4BC8	4.2	6BC8	6.3	.4	Twin Triode
		5BQ7-A	5.6	4BQ7-A	4.2	6BQ7-A	6.3	.4	Twin Triode
		5BZ7	5.6	4BZ7	4.2	6BZ7	6.3	.4	Twin Triode
				5AM8	4.7	6AM8	6.3	.45	Diode-Pentode
				5AN8	4.7	6AN8	6.3	.45	Triode-Pentode
		6AQ5-A	6.3	5AQ5	4.7	6AQ5	6.3	.45	Beam Pentode
				5AT8	4.7	6AT8	6.3	.45	Triode-Pentode
				5AV8	4.7	None			Triode-Pentode
				5B8	4.7	None			Triode-Pentode
				5BE8	4.7	None			Triode-Pentode
		6BK7-B	6.3	5BK7-A	4.7	6BK7-A	6.3	.45	Twin Triode
		6BR8-A	6.3	5BR8	4.7	6BR8	6.3	.45	Triode Pentode
		6CG8-A	6.3	5CG8	4.7	None			Triode Pentode
		6CL8	6.3	5CL8	4.7	None			Triode-Tetrode
		6CM8	6.3	5CM8	4.7	None			Triode-Pentode
		6J6-A	6.3	5J6	4.7	6J6	6.3	.45	Twin Triode
						19J6	18.9	.15	Twin Triode
		6T8-A	6.3	5T8	4.7	6T8	6.3	.45	Triple Diode-Triode
						19T8	18.9	.15	Triple Diode-Triode
9U8-A	9.45	6U8-A	6.3	5U8	4.7	6U8	6.3	.45	Triode-Pentode

				5V6-GT	4.7	6V6-GT	6.3	.45	Beam Pentode
		6X8-A	6.3	5X8	4.7	6X8	6.3	.45	Triode-Pentode
		8AU8	8.4	6AU8	6.3	None			Triode-Pentode
				6AW8 and A	6.3	None			Triode-Pentode
6AX7	6.3			6AX7	*3.15	12AX7	12.6	.15	Twin Triode
				6BA8 and A	6.3	None			Triode-Pentode
		8BH8	8.4	6BH8	6.3	None			Triode-Pentode
				6BV8	6.3	None			Duplex-Diode-Triode
		8CG7	8.4	6CG7	6.3	None			Twin Triode
		8CM7	8.4	6CM7	6.3	None			Dissimilar Double Triode
		8CN7	*4.2	6CN7	6.3	None			Duplex-Diode Triode
				6S4-A	6.3	6S4	6.3	.6	Triode
						6SN7-GT	6.3	.6	Twin Triode
				6SN7-GTB	6.3	6SN7-GTA	6.3	.6	Twin Triode
7AU7	7.0	9AU7	*4.7	7AU7	*3.5	12AU7	*6.3	.3	Twin Triode
10C8	10.5					None			Triode-Pentode
		17AV5-GA	16.8	12AV5-GA	12.6	6AV5-GA	6.3	1.2	Beam Pentode
						25AV5-GA	25.0	.3	Beam Pentode
		17AX4-GT	16.8	12AX4-GTA	12.6	6AX4-GT	6.3	1.2	Diode (Damper)
						25AX4-GT	25.0	.3	Diode (Damper)
				12B4-A	*6.3	12B4	*6.3	.6	Triode
				12BH7-A	*6.3	12BH7	*6.3	.6	Twin Triode
				12BK5	12.6	6BK5	6.3	1.2	Beam Pentode
						25BK5	25.0	.3	Beam Pentode
						6BQ6-GT	6.3	1.2	Pentode
				12BQ6-GA and GTA	12.6	6BQ6-GA	6.3	1.2	Pentode
						25BQ6-GT	25.0	.3	Pentode
						25BQ6-GA	25.0	.3	Pentode
				12BY7-A	*6.3	12BY7	*6.3	.6	Pentode
		17C5	16.8	12C5	12.6	25C5	25.0	.3	Beam Pentode
						50C5	50.0	.15	Beam Pentode
				12CA5	12.6	6CA5	6.3	1.2	Beam Pentode
						25CA5	25.0	.3	Beam Pentode
12CT8	12.6					None			Triode-Pentode
				12CU6	12.6	6CU6	6.3	1.2	Pentode
						25CU6	25.0	.3	Pentode
				12D4	12.6	None			Diode (Damper)
		17DQ6	16.8	12DQ6 and A	12.6	6DQ6	6.3	1.2	Pentode
						25DQ6	25.0	.3	Pentode
				12L6-GT	12.6	25L6-GT	25.0	.3	Beam Pentode
						50L6-GT	50.0	.15	Beam Pentode
				12W6-GT	12.6	6W6-GT	6.3	1.2	Beam Pentode
17H3	17.5					None			Diode (Damper)
18A5	18.5					None			Beam Pentode
				19AU4-GTA	18.9	6AU4-GTA	6.3	1.8	Diode (Damper)
				25CD6-GA and GB	25.0	6CD6-G	6.3	2.5	Beam Pentode
						6CD6-GA	6.3	2.5	Beam Pentode

★With controlled heater warm-up time. * With heaters parallel connected.

BENCH NOTES

Contributions to this column are solicited. For each question, short-cut or chronic-trouble note selected for publication, you will receive $10.00 worth of electronic tubes. In the event of duplicate or similar items, selection will be made by the editor and his decision will be final. The Company shall have the right without obligation beyond the above to publish and use any suggestion submitted to this column. Send contributions to The Editor, Techni-talk, Tube Department, General Electric Company, Schenectady 5, New York.

USE FOR SPRAY BOTTLES

Most servicemen will agree, a dirty picture tube face can obscure the clarity of an otherwise electrically perfect set. So rather than bother the customer for rags and cleaning agents, I pack along a small quantity of facial tissue, and glass cleaner. A handy non-spill container for the glass cleaner is the new squeeze type bottle with a spray spout. The one I use once contained a well known brand of deodorant. Luckily most of these containers are reusable because the tops can be pryed up for refilling.

Needless to say, your customer will appreciate the sparkling appearance of a freshly cleaned screen, and will surely brand you a thorough workman.

Dan W. Damron
5531 W. 79th
Oak Lawn, Ill.

SLIPPING DIAL CORD

Here is an idea I thought might help some other service man. How much time has a busy service man spent trying to repair a radio dial cord that continues to slip at certain places? Dial cord dressing doesn't ordinarily cure this problem. I think I have found a simple cure that really works. Take a small three-cornered file and rough up the shaft and the cord won't slip any more.

Bert Taylor, Jr.
B&L Radio & Television Sales & Service
840 Ferris Street, N. W.
Grand Rapids, Michigan

NEW USE FOR G-E TUBE PULLER

I would like to pass on two service hints which I use and find most practical.

I use a G-E rubber tube puller with the large end slipped over the suction tube of my vacuum cleaner and a 4-ft. length of small rubber tubing inserted into the small end and held with a rubber band. The small tube is used for chassis cleaning in relatively inaccessible spots and does a good job.

I have assembled a 5-ft. jumper cord with a male interlock plug on one end and a female receptacle on the other end. This is used to connect the back panel or the H.V. cage cover to the chassis of the set.

This device saves the search for the wall receptacle, the occasional need for an extension cord, the possibility of disconnecting a clock or floor lamp and of disturbing drapes, tables, etc.

A. J. Fister
3006 Washington St.
St. Louis 14, Mo.

Editor's Note: The jumper cord described above is available as Catalog Number ETR-1090 from General Electric Tube Distributors.

HORIZONTAL TROUBLE

This information refers to all RCA sets using the Syncroguide system in the horizontal oscillator. Many cases of intermittent loss of horizontal oscillator frequency can be caused by trouble in the .01 mfd. condenser across the wave form coil of the horizontal oscillator transformer. Most of the troublesome condensers are those using the white casing.

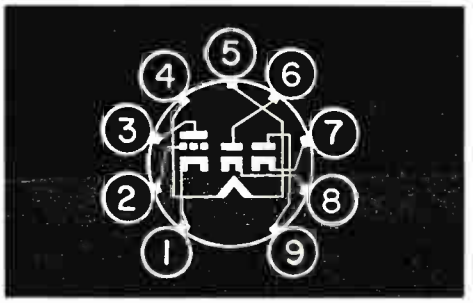
The correct fix is to replace the condenser with a high-grade unit of .01 mfd. capacity at 600 volts and then adjust the wave form with an oscilloscope for proper wave shape as shown in the manufacturer's service notes.

Ralph Hunter
Hunter's Radio Center
450 Main St.
Catskill, N. Y.

What's new!

6BV8
DUPLEX-DIODE TRIODE

The 6BV8 is a miniature duplex-diode medium-mu triode in which separate cathode and plate connections are provided for each diode section. The tube is intended primarily for service as a combined synchronous detector and chrominance amplifier in color television receivers. The high perveance characteristic of the triode section adapts the tube particularly to this service. It is also suitable for use as a combined FM detector and audio-frequency voltage amplifier.



Heater Voltage, AC or DC	6.3 Volts
Heater Current	0.6 Amperes
Heater Warm-up Time	11 Seconds

AVERAGE CHARACTERISTICS

Plate Voltage	75	200 Volts
Grid Voltage	0	... Volts
Cathode-Bias Resistor		330 Ohms
Amplification Factor		33
Plate Resistance, approximate		5900 Ohms
Transconductance		5600 Micromhos
Plate Current	14	11 Milliamperes
Grid Voltage, approximate Ib = 100 Microamperes		−11 Volts
Average Diode Current, Each Diode With 5.0 Volts DC Applied		23 Milliamperes

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