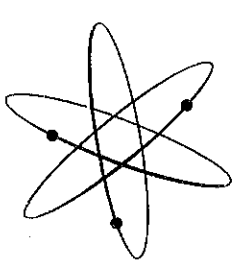
PRICE $1.00

HEATHKIT®
ASSEMBLY MANUAL



FUNCTION GENERATOR

MODEL ES-600

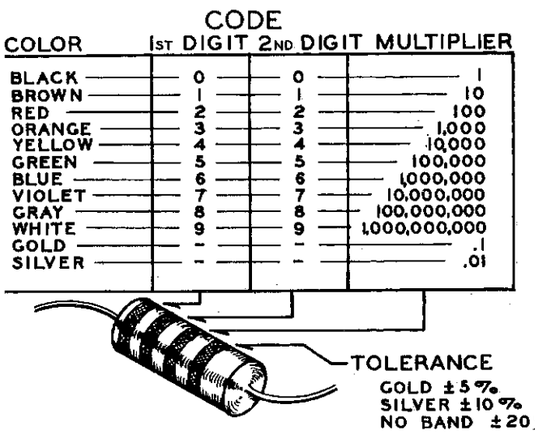
RESISTOR AND CAPACITOR COLOR CODES

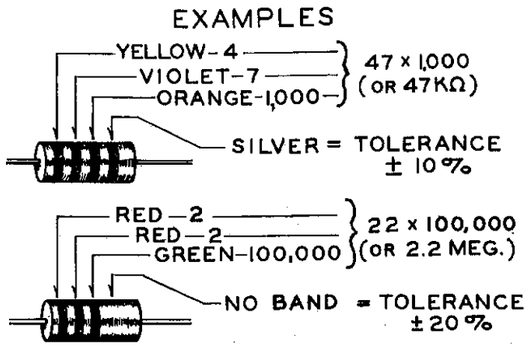
RESISTORS

ıe colored bands around the body of a color coded resistor rep-sent its value in ohms. These colored bands are grouped ıward one end of the resistor body. Starting with this end the resistor, the first band represents the first digit of ı resistance value; the second band represents the second ;it; the third band represents the number by which the first o digits are multiplied. A fourth band of gold or silver rep-sents a tolerance of ±5% or ±10% respectively. The absence a fourth band indicates a tolerance of ±20%.

The physical size of a composition resistor is related to its wattage rating. Size increases progressively as the wattage rating is increased. The diameters of 1/2 watt, 1 watt and 2 watt resistors are approximately 1/8", 1/4" and 5/16", respectively.

The color code chart and examples which follow provide the information required to identify color coded resistors.

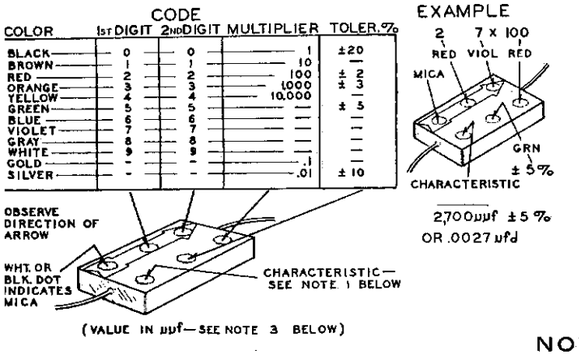




CAPACITORS

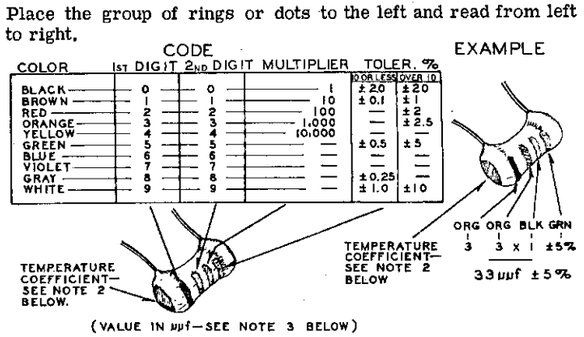
ıerally, only mica and tubular ceramic capacitors, used modern equipment, are color coded. The color codes differ mewhat among capacitor manufacturers, however the codes shown below apply to practically all of the mica and tubular ceramic capacitors that are in common use. These codes comply with EIA (Electronics Industries Association) Standards.

MICA



TUBULAR CERAMIC

Place the group of rings or dots to the left and read from left to right.



NOTES:

The characteristic of a mica capacitor is the temper-ure coefficient, drift capacitance and insulation resistance. ıis information is not usually needed to identify a capacitor ıt, if desired, it can be obtained by referring to EIA Stand-:d, RS-153 (a Standard of Electronic Industries Association.)

The temperature coefficient of a capacitor is the predict-ıle change in capacitance with temperature change and is expressed in parts per million per degree centigrade. Refer to EIA Standard, RS-198 (a Standard of Electronic Industries Association.)

3. The farad is the basic unit of capacitance, however capacitor values are generally expressed in terms of μfd (microfarad, .000001 farad) and μμf (micro-micro-farad, .000001 μfd); therefore, 1,000 μμf = .001 μfd, 1,000,000 μμf = 1μfd.

USING A PLASTIC NUT STARTER

plastic nut starter offers a convenient method starting the most used sizes: 3/16" and 1/4" -48 and 6-32). When the correct end is pushed own over a nut, the pliable tool conforms to the ıape of the nut and the nut is gently held while it being picked up and started on the screw. The ıol should only be used to start the nut.

FUNCTION GENERATOR

MODEL ES-600

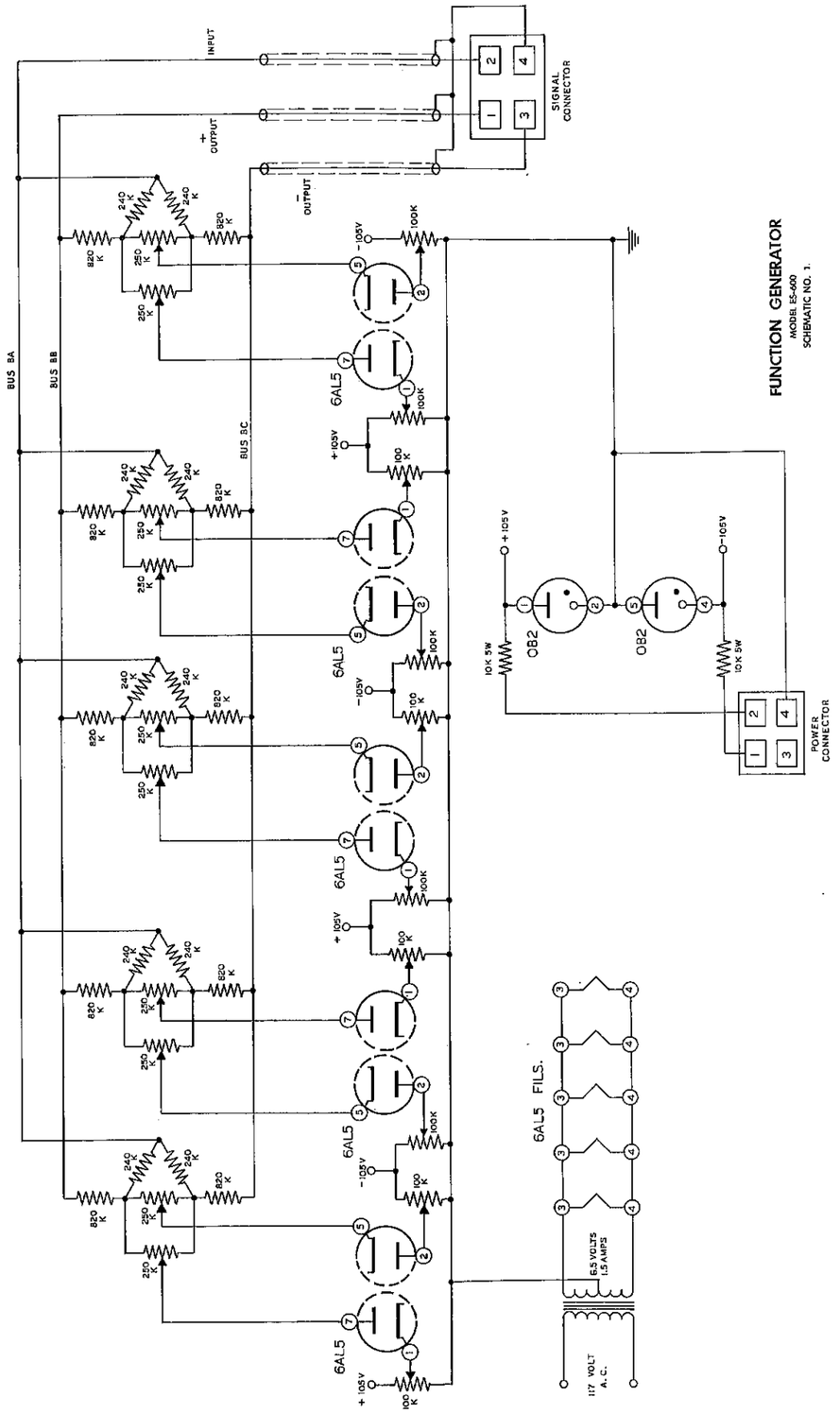
TO BE USED WITH THE

HEATH ELECTRONIC ANALOG COMPUTER

SPECIFICATIONS

Power Requirements:	+250 volts at 16 ma. -250 volts at 16 ma. 117 volts A. C. at 100 ma.
Input:	A voltage which varies with respect to time.
Output:	Approximation of any function by straight line segments.
Tubes:	Two OB2: Five 6AL5.
Dimensions:	9 1/2" wide, 6 1/2" high, 5" deep.
Net Weight:	6 1/2 pounds.
Shipping Weight:	8 pounds.

11/24/61

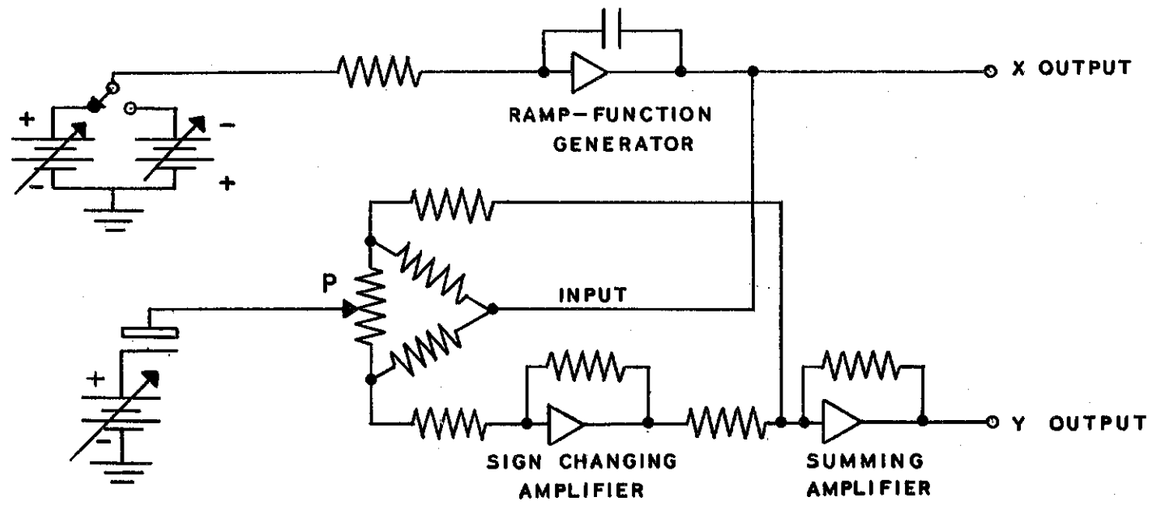


INTRODUCTION

The Heath ES-600 Function Generator is designed to be used with the Heath Analog Computer, but is capable of being used with any analog computer as long as the power requirements are met.

This unit approximates curves or functions by straight line segments. The unit has a total of ten segments, five in the plus X direction and five in the minus X direction. The break voltage and slope of the segments are set by controls on the front panel.

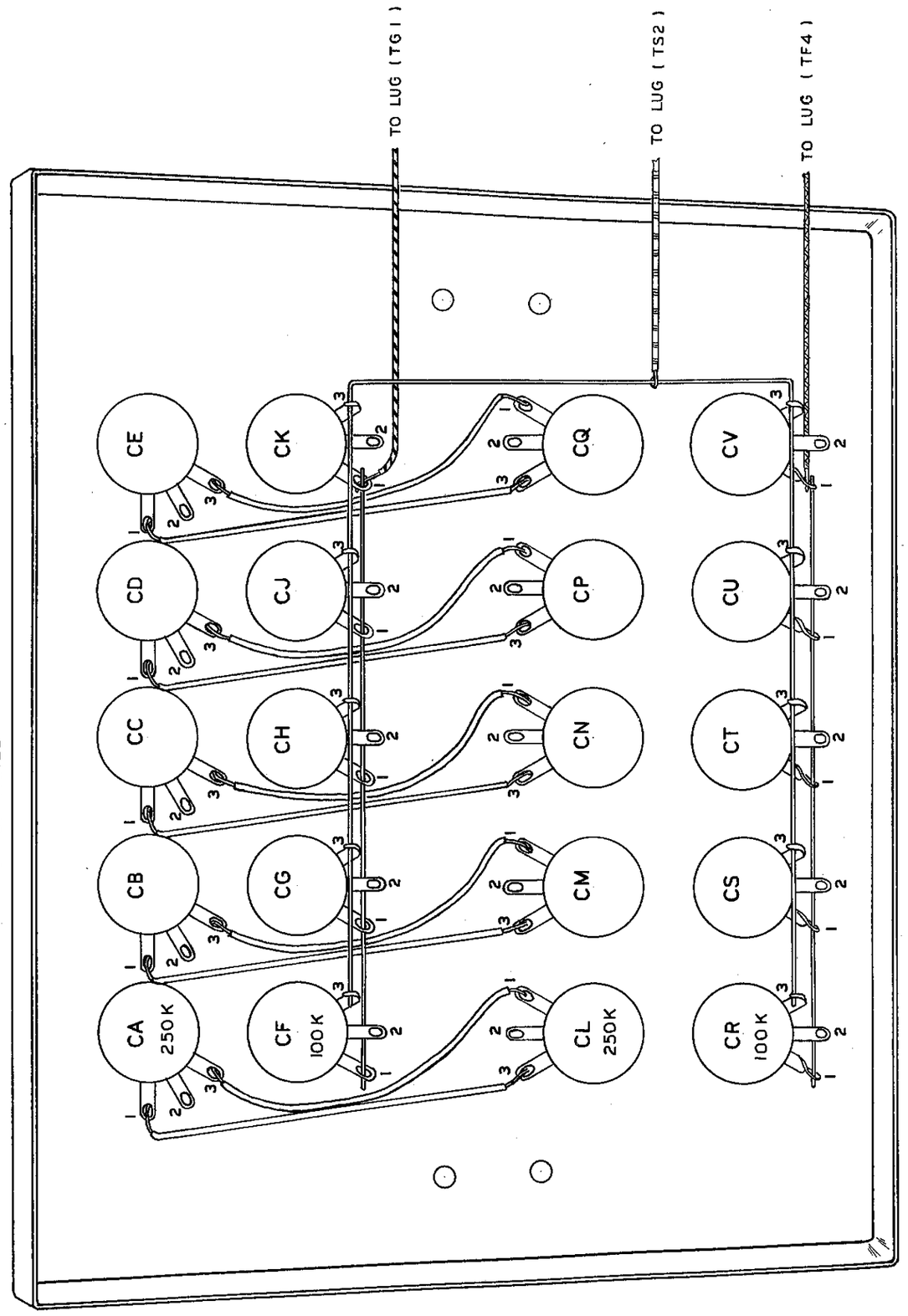
Each line segment is generated by a modified bridge circuit. Schematic 2 shows a simplified version of this circuit. A ramp function or voltage is fed into one arm of the bridge while the opposite arm is connected to a biased diode. The other two arms of the bridge combine to form the output. The voltage appearing at one of these arms is fed through a sign changing amplifier and then summed with the voltage appearing at the opposite arm. If the arm of potentiometer P (the slope control) is set in the center the bridge will be balanced and the output of the summing amplifier will be zero. If on the other hand potentiometer P is adjusted one way or the other from center the bridge will be unbalanced and the summing amplifier output will vary linearly with respect to the input in either a positive or negative (Y) direction depending upon which side of center potentiometer P is set.



MODEL ES-600
SCHEMATIC NO. 2

The break voltage or value of X at which a straight line segment will begin is set by biasing the diode to the particular voltage level or value of X desired.

The ramp-function generator has either a positive or negative input which, because of the 180° phase shift in the amplifier, gives a respective minus or plus X output.



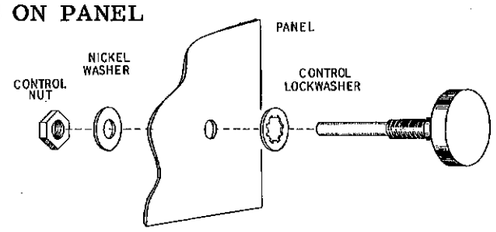
PICTORIAL 1

MOUNTING OF PARTS ON PANEL

( ) Select the front panel and orient as shown in Pictorial 1.

( ) Mount 250 KΩ controls at CA through CE and CL through CQ. Use lockwashers, flat washers and nuts as shown in Figure 1. Orient lugs as shown in Pictorial 1. Make sure no shorts exist. Bend the lugs as shown.

( ) In the same manner mount 100 KΩ controls at CF through CK and CR and CV.



HOW TO MOUNT CONTROLS & SWITCHES.

Figure 1

PROPER SOLDERING PROCEDURE

High quality solder of the proper grade is most important. There are several different brands of solder on the market, each clearly marked "Rosin Core Radio Solder." Such solders consist of an alloy of tin and lead, usually in the proportion of 50:50. Minor variations exist in the mixture such as 40:60, 45:55, etc. with the first figure indicating the tin content. Radio solders are formed with one or more tubular holes through the center. These holes are filled with a rosin compound which acts as a flux or cleaning agent during the soldering operation.

NO SEPARATE FLUX OR PASTE OF ANY KIND SHOULD BE USED. We specifically caution against the use of so-called "non-corrosive" pastes. Such compounds, although not corrosive at room temperatures, will form residues when heated. The residue is deposited on surrounding surfaces and attracts moisture. The resulting compound is not only corrosive but actually destroys the insulation value of non-conductors. Dust and dirt will tend to accumulate on these "bridges" and eventually will create erratic or degraded performance of the instrument.

NOTE: ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE INSTRUMENTS IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. WHEN IN DOUBT ABOUT SOLDER, IT IS RECOMMENDED THAT A NEW ROLL PLAINLY MARKED "ROSIN CORE RADIO SOLDER" BE PURCHASED.

If terminals are bright and clean and wires free of wax, frayed insulation and other foreign substances, no difficulty will be experienced in soldering. Crimp or otherwise secure the wire (or wires) to the terminal, so a good joint is made without relying on solder for physical strength. To make a good solder joint, the clean tip of the soldering iron should be placed against the joint to be soldered so that the terminal is heated sufficiently to melt solder. The solder is then placed against both the terminal and the tip of the iron and will immediately flow out over the joint. Use only enough solder to cover wires at the junction; it is not necessary to fill the entire hole in the terminal with solder. Excess solder may flow into tube socket contacts, ruining the socket, or it may creep into switch contacts and destroy their spring action. Position the work so that gravity tends to keep the solder where you want it.

WIRING INSTRUCTIONS

The abbreviation (NS) is used to indicate that other connections will be made to that terminal later and the connection should not be soldered yet. When the last connection has been made to a terminal, the abbreviation (S) is inserted indicating that the connection should be soldered.

Leads on resistors, capacitors and transformers are generally much longer than they need to be to make the indicated connections. In these cases, the excess lead should be cut off when the part is added to the chassis. This will result in a much neater wiring job.

Each component part has been given a letter code designation. In addition, each terminal has been assigned a number. For example, when the instructions call for a connection to be made to TA5 it is to be understood that the connection is to be made to pin 5 on socket TA.

( ) Connect a 3" length of hookup wire from CA3 (NS) to CL1 (S). See Pictorial 1.

( ) Connect a 3" length of hookup wire from CB3 (NS) to CM1 (S).

( ) Connect a 3" length of hookup wire from CC3 (NS) to CN1 (S).

( ) Connect a 3" length of hookup wire from CD3 (NS) to CP1 (S).

( ) Connect a 3" length of hookup wire from CE3 (NS) to CQ1 (S).

( ) Connect a 3 1/2" length of hookup wire from CA1 (NS) to CL3 (S).

( ) Connect a 3 1/2" length of hookup wire from CB1 (NS) to CM3 (S).

( ) Connect a 3 1/2" length of hookup wire from CC1 (NS) to CN3 (S).

( ) Connect a 3 1/2" length of hookup wire from CD1 (NS) to CP3 (S).

( ) Connect a 3 1/2" length of hookup wire from CE1 (NS) to CQ3 (S).

( ) Bend and twist lug 1 on controls CF through CK and CR through CV down so that a piece of bus wire may be passed through them. See Figure 2.

( ) Bend and twist lug 3 on controls CF through CK and CR through CV up so that a piece of bus wire may be passed through them. See Figure 2.

NOTE: In the steps that follow the use of bus wire is called for. Before cutting and using, the bus wire should be prepared by clamping one end of the wire in a vise and pulling on the other end with a pair of pliers until the wire stretches. This will remove the kinks from the wire resulting in a neater wiring job.

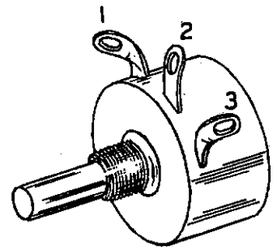


Figure 2

( ) Using a 5 3/4" length of bus wire connect together lugs CF1 (S), CG1 (S), CH1 (S), CJ1 (S) and CK1 (NS). See Pictorial 1.

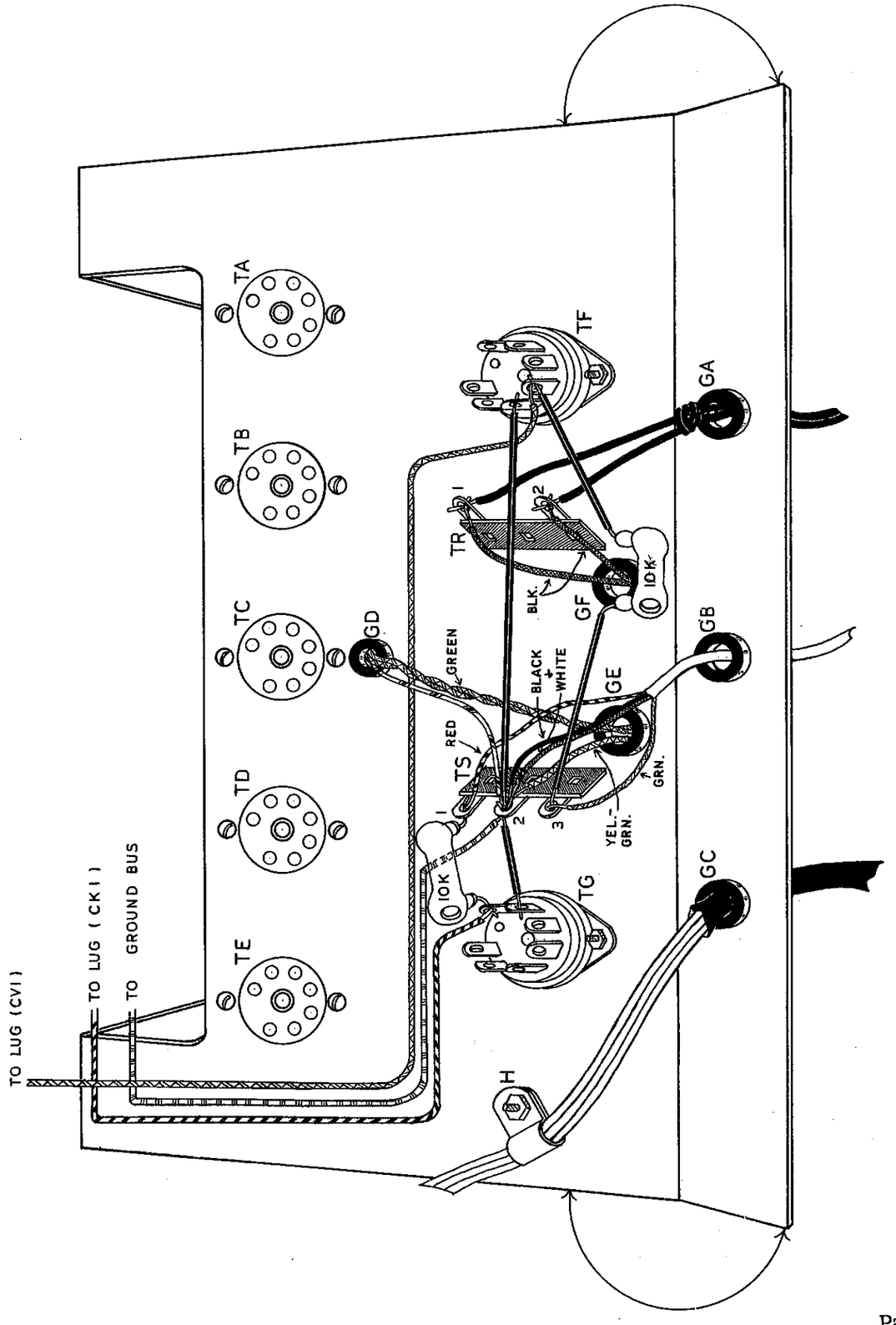
( ) Using a 5 3/4" length of bus wire connect together lugs CR1 (S), CS1 (S), CT1 (S), CU1 (S) and CV1 (NS).

( ) Using a 15 1/4" length of bus wire connect together lug 3 on controls CF through CK and CR through CV. Solder all lugs.

( ) Now check lug 2 on controls CF through CK and CR through CV. Make sure these lugs are not touching any of the bus wires.

( ) Set the front panel aside and select the chassis.

( ) Mount 7-pin miniature tube sockets at TF and TG. These two sockets mount on the under side of the chassis as shown in Pictorial 2. Use 3-48 hardware. Observe the location of the blank space on the socket.



PICTORIAL 2

( ) Mount 7-pin miniature tube sockets at TA, TB, TC, TD and TE. These five sockets mount on the top of the chassis as shown in Pictorial 3. Use 3-48 hardware. Observe the location of the blank space on the socket.

( ) Mount three 5/16" grommets in holes GD, GE and GF.

( ) Mount two 3/8" grommets in holes GA and GB.

( ) Mount a 1/2" grommet in hole GC.

( ) Locate the power transformer on the top of the chassis, placing its leads through grommets GE and GF. Using 6-32 hardware secure the transformer to the top of the chassis, at the same time securing, on the underside of the chassis, a 2-lug terminal strip at TR and a 3-lug terminal strip at TS. Orient as shown in Pictorial 2.

( ) Using a 6 1/4" length of bus wire connect together lugs TA3 (S), TB3 (S), TC3 (NS), TD3 (S) and TE3 (S). Use sleeving between all lugs. See Pictorial 3. Twist the lugs so the bus wire will insert easily.

( ) Using a 6 1/4" length of bus wire connect together lugs TA4 (S), TB4 (S), TC4 (NS), TD4 (S) and TE4 (S). Use sleeving between all lugs. Bend and twist the lugs down so the bus wire will insert easily.

( ) Using a 6 1/4" length of bus wire, connect together lugs TA6 (S), TB6 (S), TC6 (NS), TD6 (S) and TE6 (S). Use sleeving between all lugs. It may be necessary to bend the #1 pins down slightly so the bus will clear.

( ) Connect one end of a piece of hookup wire to lug TC6 (S). Run the other end of this lead through grommet GD and connect to lug TS2 (NS).

( ) Twist together the two green transformer leads and place them through grommet GD. Connect one lead to lug TC3 (S) and the other lead to lug TC4 (S). See Pictorials 2 and 3.

( ) Connect the green-yellow transformer lead to lug TS2 (NS).

( ) Connect one black transformer lead to lug TR1 (NS) and the other to lug TR2 (NS).

( ) Using a 4 1/4" length of bus wire connect together lugs TG2 (S), TS2 (NS) and TF5 (S). Use sleeving between the lugs.

( ) Connect one end of an 8 1/4" length of hookup wire to lug TS2 (NS). Leave the other end free.

( ) Connect one end of a 13 1/4" length of hookup wire to lug TF4 (NS). Leave the other end free.

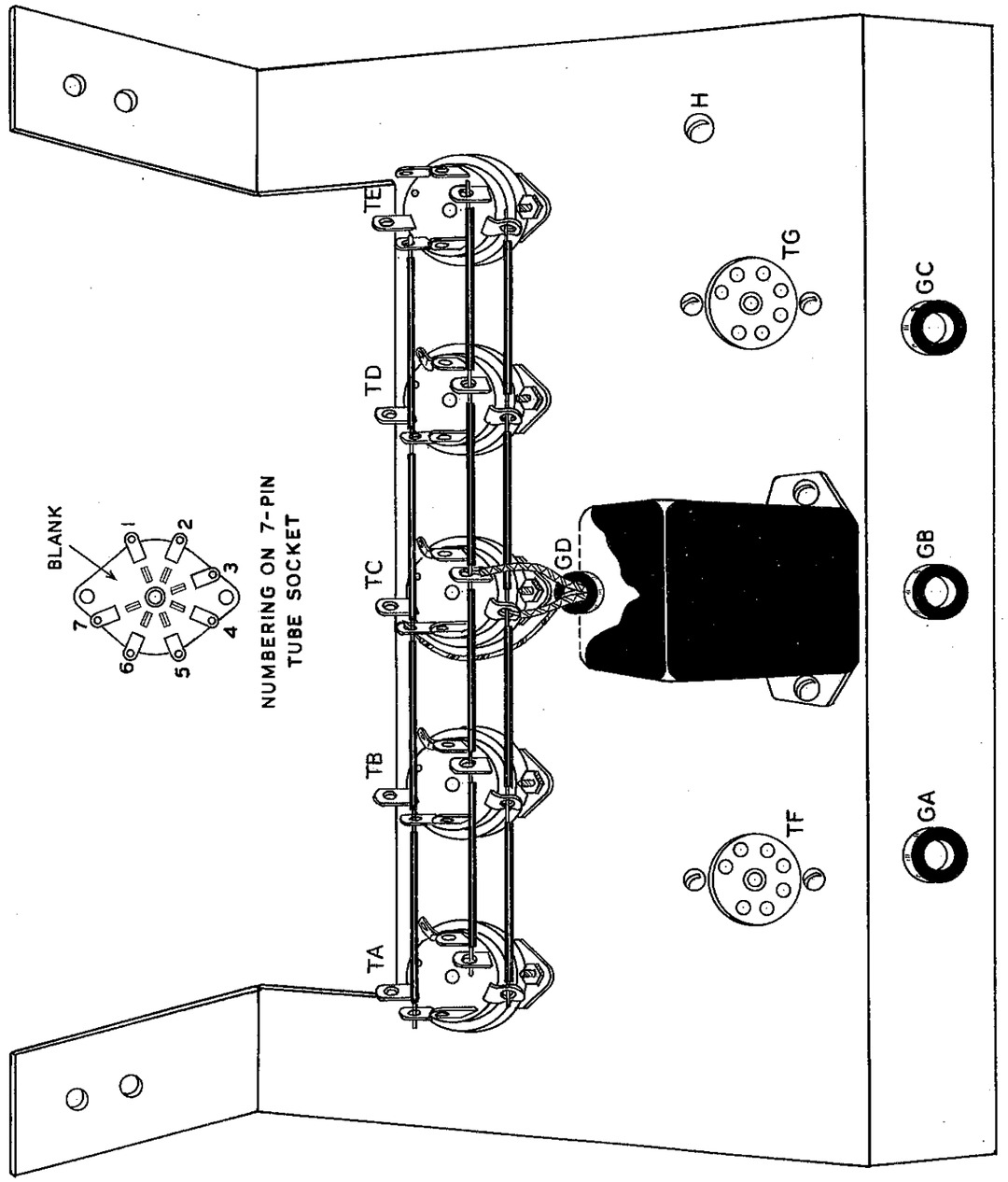
( ) Connect one end of a 9" length of hookup wire to lug TG1 (NS). Leave the other end free.

( ) Connect a 10 KΩ 10 watt resistor from lug TG1 (S) to lug TS1 (NS). Place as shown in Pictorial 2.

( ) Connect a 10 KΩ 10 watt resistor from lug TF4 (S) to lug TS3 (NS). Use sleeving on both leads and place as shown in Pictorial 2.

( ) Mount the front panel to the chassis. Use 6-32 hardware and secure two 3-lug vertical terminal strips under the nuts and lockwashers on the screws nearer the top of the panel. See Pictorial 4.

( ) Connect the lead from lug TG1 to lug CK1 (S). See Pictorials 1 and 2.



PICTORIAL 3

( ) Connect the lead from lug TF4 to lug CV1 (S). See Pictorials 1 and 2.

( ) Connect the lead from TS2 to the ground bus between lugs CK3 and CV3. Solder the connection. See Pictorials 1 and 2.

NOTE: Dress the following leads neatly along the front panel: See Pictorial 4.

( ) Connect a 5" length of hookup wire from CR2 (S) to TA2 (S).

( ) Connect a 4 1/4" length of hookup wire from CL2 (S) to TA5 (S).

( ) Connect a 4 1/2" length of hookup wire from CF2 (S) to TA1 (S).

( ) Connect a 5 1/2" length of hookup wire from CA2 (S) to TA7 (S).

( ) Connect a 5" length of hookup wire from CS2 (S) to TB2 (S).

( ) Connect a 4 1/4" length of hookup wire from CM2 (S) to TB5 (S).

( ) Connect a 4 1/2" length of hookup wire from CG2 (S) to TB1 (S).

( ) Connect a 5 1/2" length of hookup wire from CB2 (S) to TB7 (S).

( ) Connect a 5" length of hookup wire from CT2 (S) to TC2 (S).

( ) Connect a 4 1/4" length of hookup wire from CN2 (S) to TC5 (S).

( ) Connect a 4 1/2" length of hookup wire from CH2 (S) to TC1 (S).

( ) Connect a 5 1/2" length of hookup wire from CC2 (S) to TC7 (S).

( ) Connect a 5 1/2" length of hookup wire from CU2 (S) to TD2 (S).

( ) Connect a 4 3/4" length of hookup wire from CP2 (S) to TD5 (S).

( ) Connect a 5" length of hookup wire from CJ2 (S) to TD1 (S).

( ) Connect a 6" length of hookup wire from CD2 (S) to TD7 (S).

( ) Connect a 5 1/2" length of hookup wire from CV2 (S) to TE2 (S).

( ) Connect a 4 3/4" length of hookup wire from CQ2 (S) to TE5 (S).

( ) Connect a 5" length of hookup wire from CK2 (S) to TE1 (S).

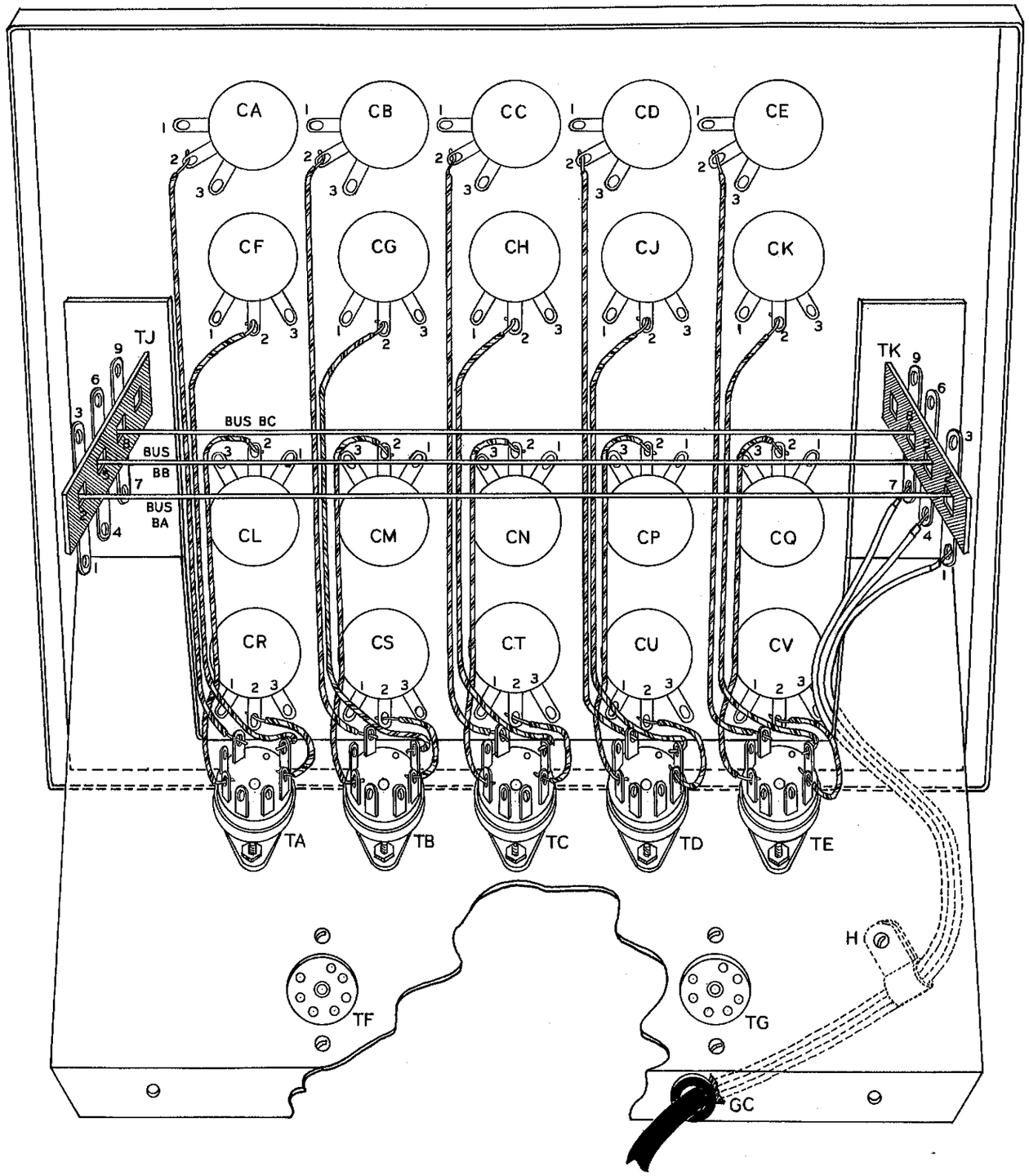
( ) Connect a 6" length of hookup wire from CE2 (S) to TE7 (S).

( ) Cut three 7 5/8" lengths of bus wire.

( ) Connect one from lug TJ8 (S) to lug TK8 (S). This bus will be referred to as bus BC. See Pictorial 5.

( ) Connect another from lug TJ5 (S) to lug TK5 (S). This bus will be referred to as bus BB.

( ) Connect the last from lug TJ2 (S) to lug TK2 (S). This bus will be referred to as bus BA.



PICTORIAL 4

NOTE: In the following connections place the resistor bodies as shown in Figure 3 and Pictorial 5. Also make right angle bends in resistor leads as shown.

( ) Connect an 820 KΩ resistor from lug CE3 (NS) to bus BB (S).

( ) Connect a 240 KΩ resistor from lug CE3 (S) to bus BA (S).

( ) Connect an 820 KΩ resistor from lug CE1 (NS) to bus BC (S).

( ) Connect a 240 KΩ resistor from lug CE1 (S) to bus BA (S).

( ) Connect an 820 KΩ resistor from lug CD3 (NS) to bus BB (S).

( ) Connect a 240 KΩ resistor from lug CD3 (S) to bus BA (S).

( ) Connect an 820 KΩ resistor from lug CD1 (NS) to bus BC (S).

( ) Connect a 240 KΩ resistor from lug CD1 (S) to bus BA (S).

( ) Connect an 820 KΩ resistor from lug CC3 (NS) to bus BB (S).

( ) Connect a 240 KΩ resistor from lug CC3 (S) to bus BA (S).

( ) Connect an 820 KΩ resistor from lug CC1 (NS) to bus BC (S).

( ) Connect a 240 KΩ resistor from lug CC1 (S) to bus BA (S).

( ) Connect an 820 KΩ resistor from lug CB3 (NS) to bus BB (S).

( ) Connect a 240 KΩ resistor from lug CB3 (S) to bus BA (S).

( ) Connect an 820 KΩ resistor from lug CB1 (NS) to bus BC (S).

( ) Connect a 240 KΩ resistor from lug CB1 (S) to bus BA (S).

( ) Connect an 820 KΩ resistor from lug CA3 (NS) to bus BB (S).

( ) Connect a 240 KΩ resistor from lug CA3 (S) to bus BA (S).

( ) Connect an 820 KΩ resistor from lug CA1 (NS) to bus BC (S).

( ) Connect a 240 KΩ resistor from lug CA1 (S) to bus BA (S).

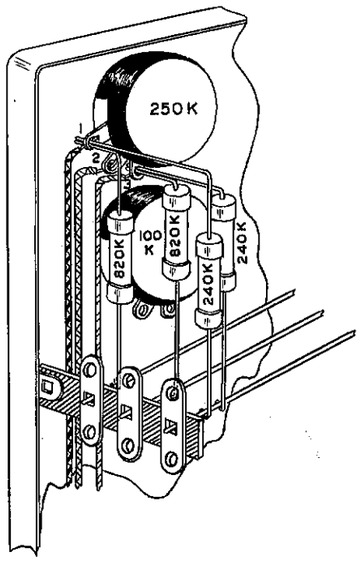


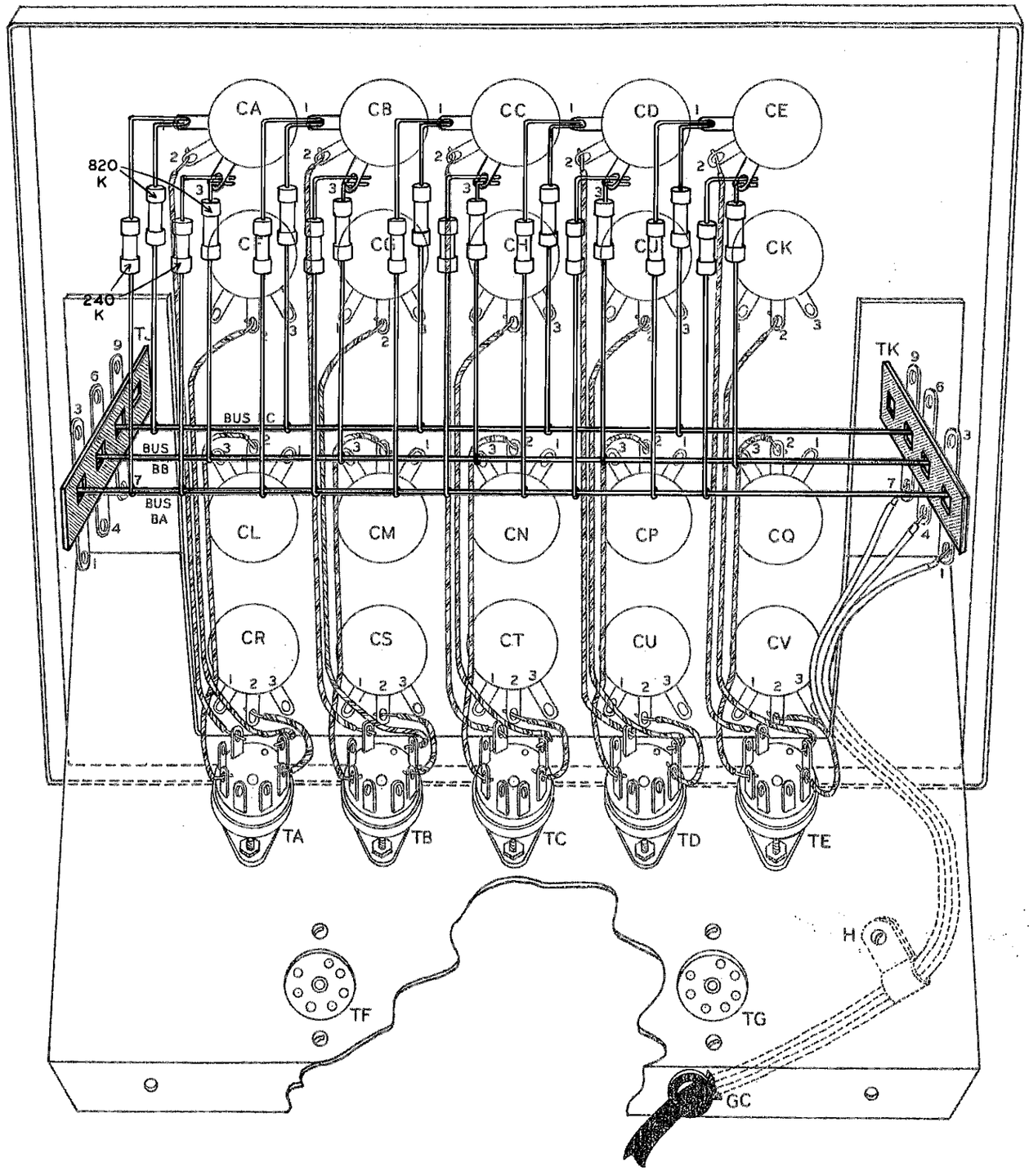
Figure 3

( ) Pass the line cord through grommet GA. Tie a knot in the cord for strain relief. Connect one lead to lug TR1 (S) and the other lead to lug TR2 (S). See Pictorial 2.

( ) Prepare one end of the 4-conductor cable by removing 1 1/2" of the outer plastic jacket and stripping 1/4" of insulation from each lead.

( ) Place this end of the cable through grommet GB and connect the red lead to TS1 (S), the green lead to TS3 (S) and the white and black leads to TS2 (S).

( ) Cut three 5' lengths of single conductor shielded cable and prepare one end of each by removing 1/2" of both the outer plastic jacket and the shield. Strip 1/4" of insulation from the inner conductor and tin the lead.



PICTORIAL 5

( ) Slip this end of the three cables through grommet GC and up through the chassis. Connect one to lug TK7 (S), one to TK4 (S), and the last to TK1 (S). See Pictorials 2 and 4.

( ) Using a plastic cable clamp and 6-32 hardware secure these three cables at location H. See Pictorial 2.

( ) Prepare the free end of the 4-conductor cable by removing 3/4" of the outer plastic jacket and stripping 1/4" of insulation from each lead.

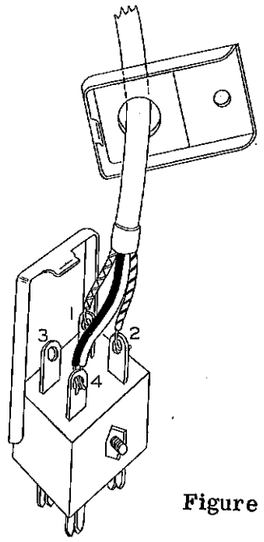


Figure 4

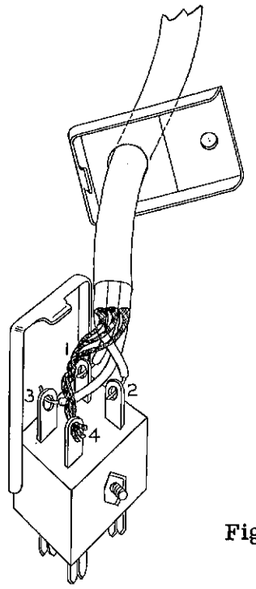


Figure 5

( ) Select one of the male varicon plugs and connect the red lead to lug 2 (S), the green lead to lug 1 (S) and the white and black leads to lug 4 (S). Assemble the varicon as shown in Figures 4 and 6. Don't forget the side cover.

( ) Prepare the free ends of the three single conductor shielded cables by removing 3/4" of the outer plastic jacket and separating the shield from the leads.

( ) Over these three cables slip the length of large plastic sleeving. Remove any excess.

( ) Select the other male varicon plug and connect the cable from TK1 to lug 2 (S), connect the cable from TK4 to lug 1 (S), connect the cable from TK7 to lug 3 (S) and connect the three shields to lug 4 (S). Assemble the varicon as shown in Figures 5 and 6. If an ohmmeter is available it will greatly aid in finding the proper cable ends.

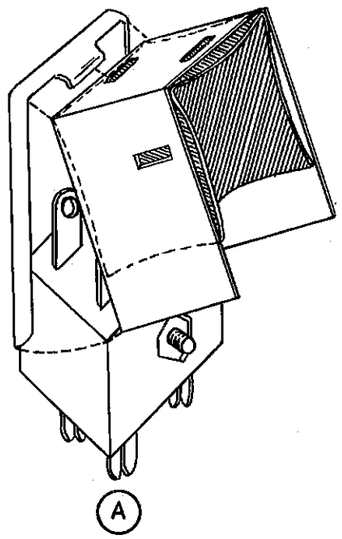
( ) Install gray knobs on controls CA through CE and CL through CQ.

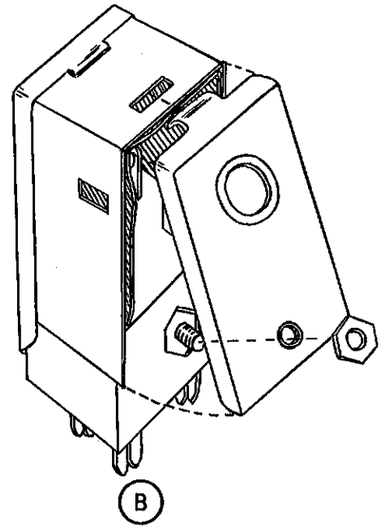
( ) Install red knobs on controls CF through CK and CR through CV.

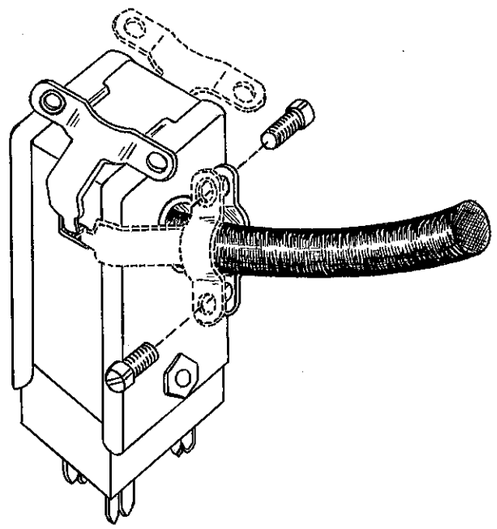
( ) Insert 6AL5 tubes in sockets TA through TE.

( ) Insert OB2 tubes in sockets TF and TG.

IMPORTANT WARNING: Miniature tubes can be easily damaged when plugging them into their sockets. Therefore, use extreme care when installing them. We do not guarantee or replace miniature tubes broken during installation.







CONNECTOR ASSEMBLY

Figure 6

The ES-600 Function Generator is now ready to be tested. For operation of this unit refer to the Operational Manual for the Heath Electronic Analog Computer. Connect the line cord to a 105-125 volt 60 cycle AC outlet only. DO NOT PLUG INTO A DC OUTLET AS DAMAGE TO THE TRANSFORMER WILL RESULT.

( ) Attach the handle to the top of the cabinet by means of the two 10-24 machine screws.

( ) Place the four rubber feet in the holes provided in the bottom of the cabinet.

( ) The function generator may now be placed in the cabinet. Pass the cables through the holes provided for them in the rear of the cabinet and secure the chassis to the cabinet by means of the two sheet metal screws.

This completes the assembly of your Heathkit Function Generator, model ES-600.

IN CASE OF DIFFICULTY

1. Recheck the wiring. Most cases of difficulty result from improper wiring. Often having a friend check the wiring will reveal a mistake consistently overlooked.

2. Check the tubes.

3. Check the voltages against those shown in the chart below. The readings should check within 10%. These voltages are measured with a Heath VTVM with an input impedance of 11 megohms. Other types of voltmeters may give slightly different readings, depending upon their input impedance. If the voltages differ considerably from the chart, check the associated circuits carefully.

TERMINAL STRIP OR SOCKET	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7
TA	+105	-105	3.0 AC	3.0 AC	x		x
TB	+105	-105	3.0 AC	3.0 AC	x		x
TC	+105	-105	3.0 AC	3.0 AC	x		x
TD	+105	-105	3.0 AC	3.0 AC	x		x
TE	+105	-105	3.0 AC	3.0 AC	x		x
TS	+250	0	-250				
TF	0	-105		-105	0		-105
TG	+105	0		0	+105		0

All controls are set in the extreme counterclockwise position.

x - Readings should be slightly less than the input signal.

All voltages are DC unless otherwise indicated.

All voltages measured with respect to ground.

REPLACEMENTS

Material supplied with Heathkits has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally improper instrument operation can be traced to a faulty tube or component. Should inspection reveal the necessity for replacement, write to the Heath Company and supply all of the following information.

A. Thoroughly identify the part in question by using the part number and description found in the manual parts list.
B. Identify the type and model number of kit in which it is used.
C. Mention date of purchase.
D. Describe the nature of defect or reason for requesting replacement.

The Heath Company will promptly supply the necessary replacement. Please do not return the original component until specifically requested to do so. Do not dismantle the component in question as this will void the guarantee. If tubes are to be returned, pack them carefully to prevent breakage in shipment as broken tubes are not eligible for replacement. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

SERVICE

In event continued operational difficulties of the completed Generator are experienced, the Heath Company is willing to offer its full cooperation to assist you in obtaining the specified performance level in your instrument. You may contact the Technical Consultation Department by mail, or you may return your Generator for inspection or repair by our Factory Service Department for a minimal service fee, plus the price of any additional material. In some areas, Local Service is available through authorized Heathkit Service Centers. Although you may find charges for local service somewhat higher than for factory service, the amount of increase is usually offset by the transportation charges you will pay if you elect to return your kit to the Heath Company. THESE SERVICE POLICIES APPLY ONLY TO COMPLETED INSTRUMENTS CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Instruments that are not entirely completed or instruments that are modified in design will not be accepted for repair. Instruments showing evidence of acid core solder or paste fluxes will be returned NOT repaired.

For information regarding possible modifications of Heathkits, it is suggested that you refer to any one or more of the many publications that are available on all phases of electronics. They can be obtained at or through your local library, as well as at most electronic equipment stores. Although the Heath Company sincerely welcomes all comments and suggestions, it would be impossible to design, test, evaluate and assume responsibility for proposed circuit changes for specific purposes. Therefore, such modifications must be made at the discretion of the kit builder according to information which will be much more readily available from some local source.

SHIPPING INSTRUCTIONS

Before returning a unit for service, be sure that all parts are securely mounted. Attach a tag to the instrument giving name, address and trouble experienced. Pack in a rugged container, preferably wood, using at least three inches of shredded newspaper or excelsior on all sides. DO NOT SHIP IN THE ORIGINAL KIT CARTON AS THIS CARTON IS NOT CONSIDERED ADEQUATE FOR SAFE SHIPMENT OF THE COMPLETED INSTRUMENT. Ship by prepaid express; note that a carrier cannot be held responsible for damage in transit, if in HIS OPINION, the article is inadequately packed for shipment. Your instrument will be returned by express collect.

SPECIFICATION CHANGES

All prices are subject to change without notice. The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

PARTS LIST

PART No.	PARTS Per Kit	DESCRIPTION
Resistors and controls		
2-34A	10	240 K 1 watt 1%
2-35A	10	820 K 1 watt 1%
3-7J	2	10 K 10 watt 10%
10-55	10	100 K linear
10-54	10	250 K linear
Wire		
89-1	1	Line cord
340-3	1	length bus wire
343-4	1	length shielded wire
344-1	1	length hookup wire
347-7	1	length 4-conductor cable
Sockets and terminal strips		
431-2	1	2 lug terminal strip
431-4	2	3 lug terminal strip (vertical)
431-10	1	3 lug terminal strip
432-12	2	4-pin male connector
434-34	7	7-pin miniature socket
Hardware		
250-2	14	3-48 machine screw
250-8	2	#6 sheet metal screw
250-9	7	6-32 machine screw
250-83	2	10-24 machine screw
252-1	14	3-48 nut
252-3	7	6-32 nut
252-7	20	Control nut
253-10	20	Control flat washer
254-1	7	#6 lockwasher
254-4	20	Control lockwasher

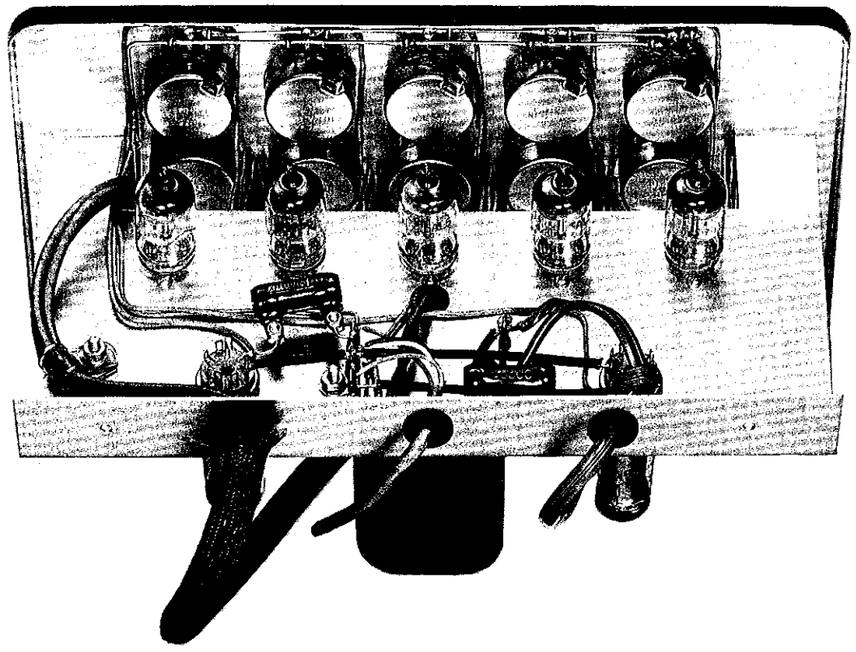
PART No.	PARTS Per Kit	DESCRIPTION
Tubes		
411-40	5	6AL5
411-46	2	OB2
Miscellaneous		
54-42	1	Power transformer
73-1	2	Grommet 3/8"
73-3	1	Grommet 1/2"
73-4	3	Grommet 5/16"
90-55	1	Cabinet
200-M115	1	Chassis
203-107F147	1	Front panel
207-4	1	Plastic cable clamp
211-4	1	Handle
261-1	4	Rubber feet
346-1	1	length sleeving (small)
346-10	1	length sleeving (large)
462-30	10	Gray knob
462-40	10	Red knob
595-150	1	Instruction manual

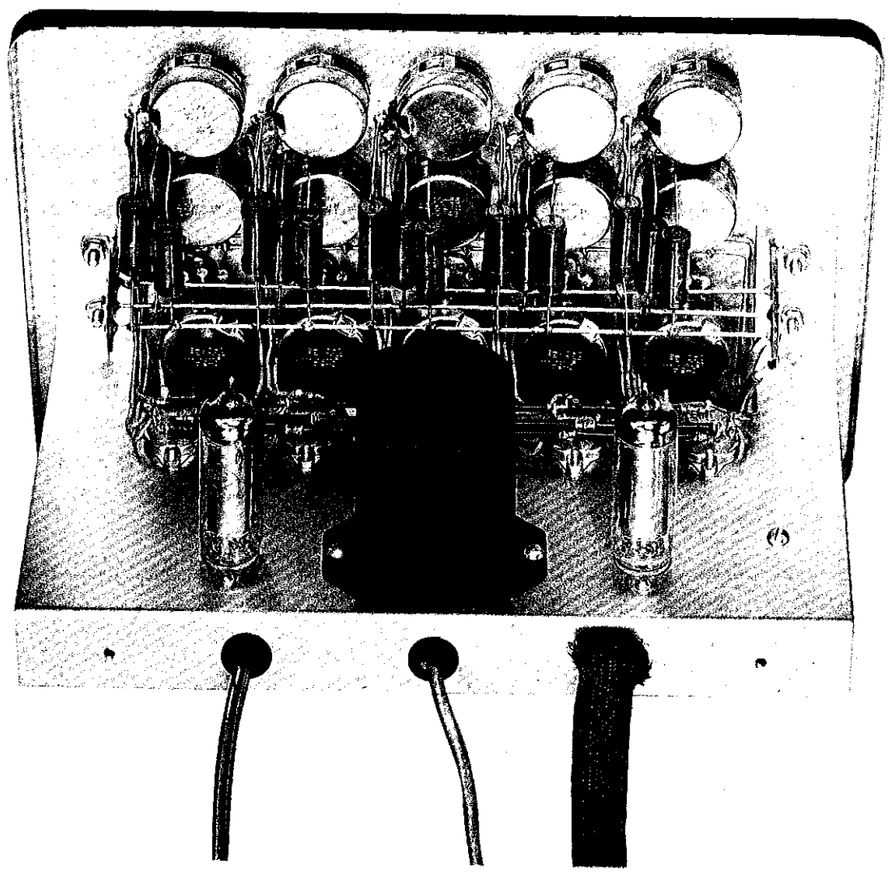
WARRANTY

Heath Company warrants that for a period of three months from the date of shipment, all Heathkit parts shall be free of defects in materials and workmanship under normal use and service and that in fulfillment of any breach of such warranty, Heath Company shall replace such defective parts upon the return of the same to its factory. The foregoing warranty shall apply only to the original buyer, and is and shall be in lieu of all other warranties, whether express or implied and of all other obligations or liabilities on the part of Heath Company and in no event shall Heath Company be liable for any anticipated profits, consequential damages, loss of time or other losses incurred by the buyer in connection with the purchase, assembly or operation of Heathkits or components thereof. No replacement shall be made of parts damaged by the buyer in the course of handling or assembling Heathkit equipment.

NOTE: The foregoing warranty is completely void and we will not replace, repair or service instruments or parts thereof in which acid core solder or paste fluxes have been used.

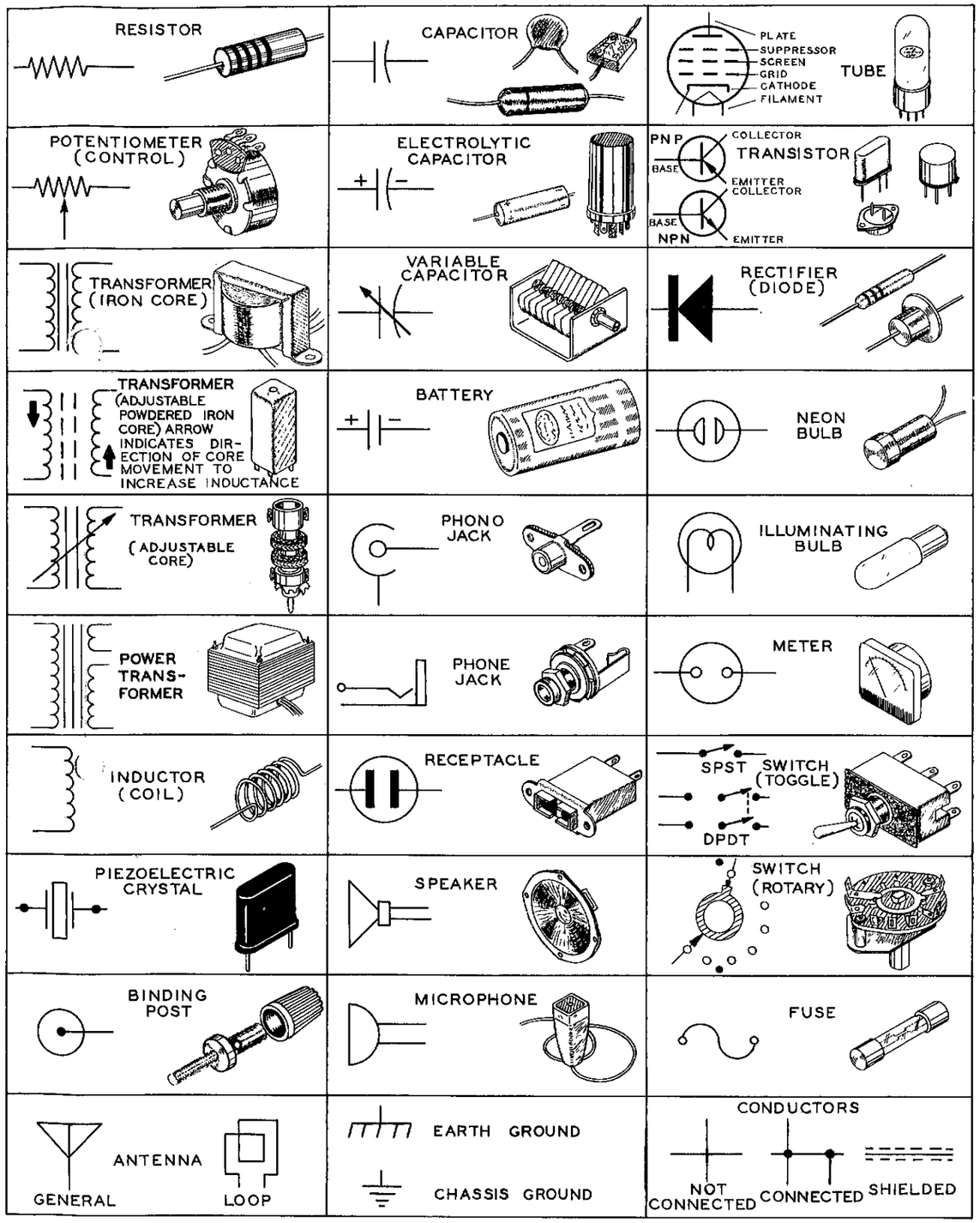
HEATH COMPANY





TYPICAL COMPONENT TYPES

This chart is a guide to commonly used types of electronic components. The symbols and related illustrations should prove helpful in identifying most parts and reading the schematic diagrams.



HEATH COMPANY

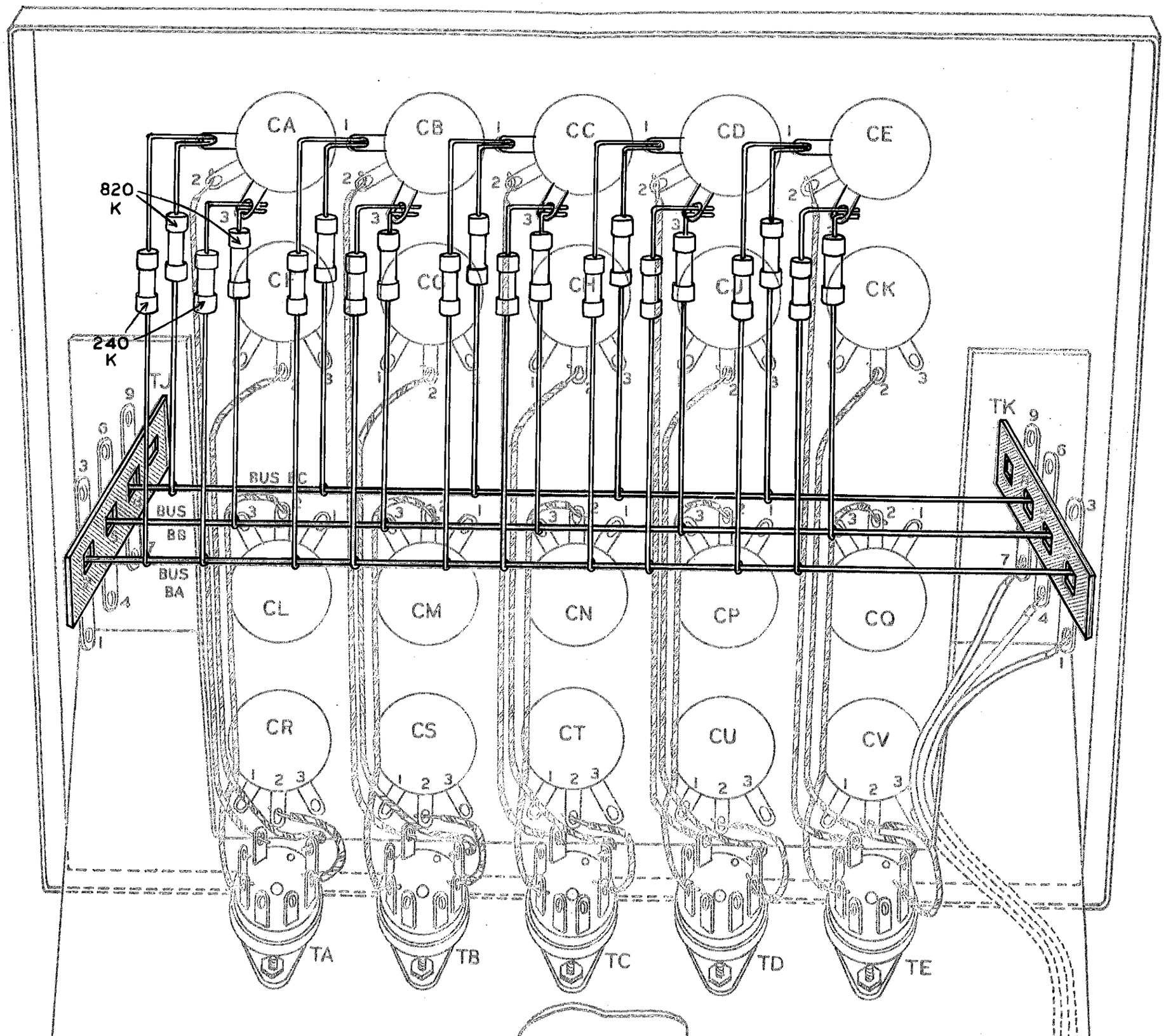
a subsidiary of

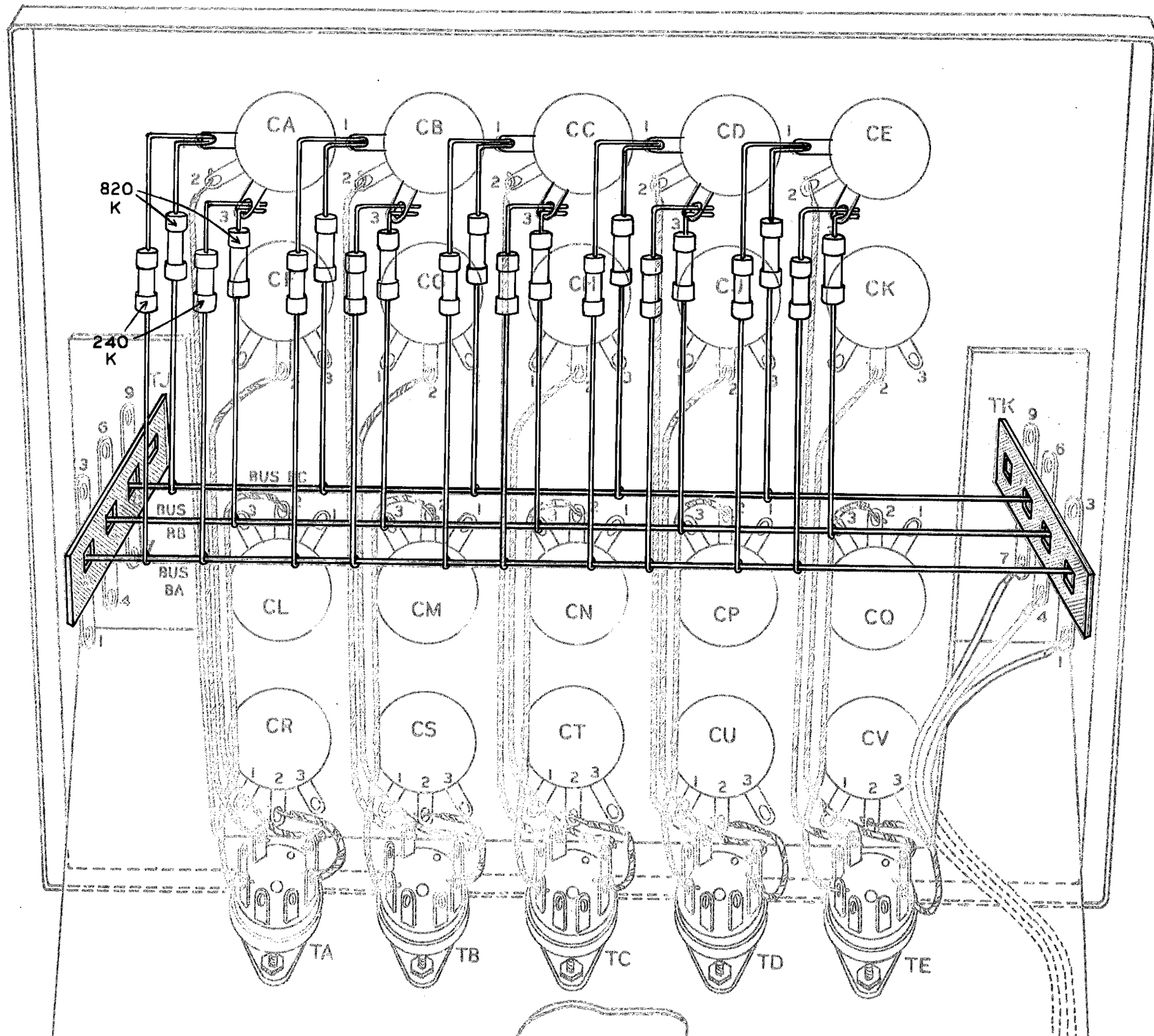
DAYSTROM, INCORPORATED

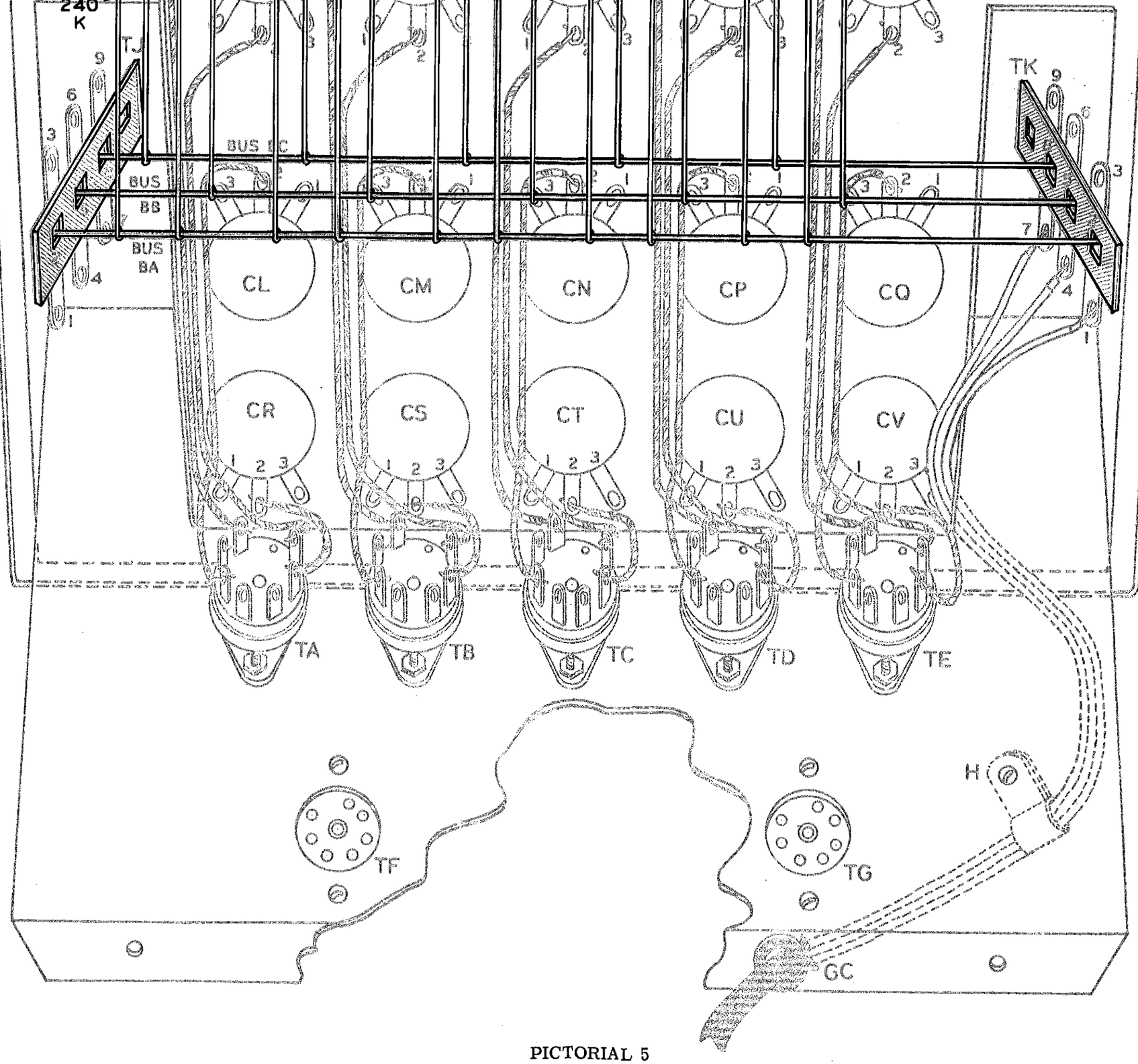
THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

595-150

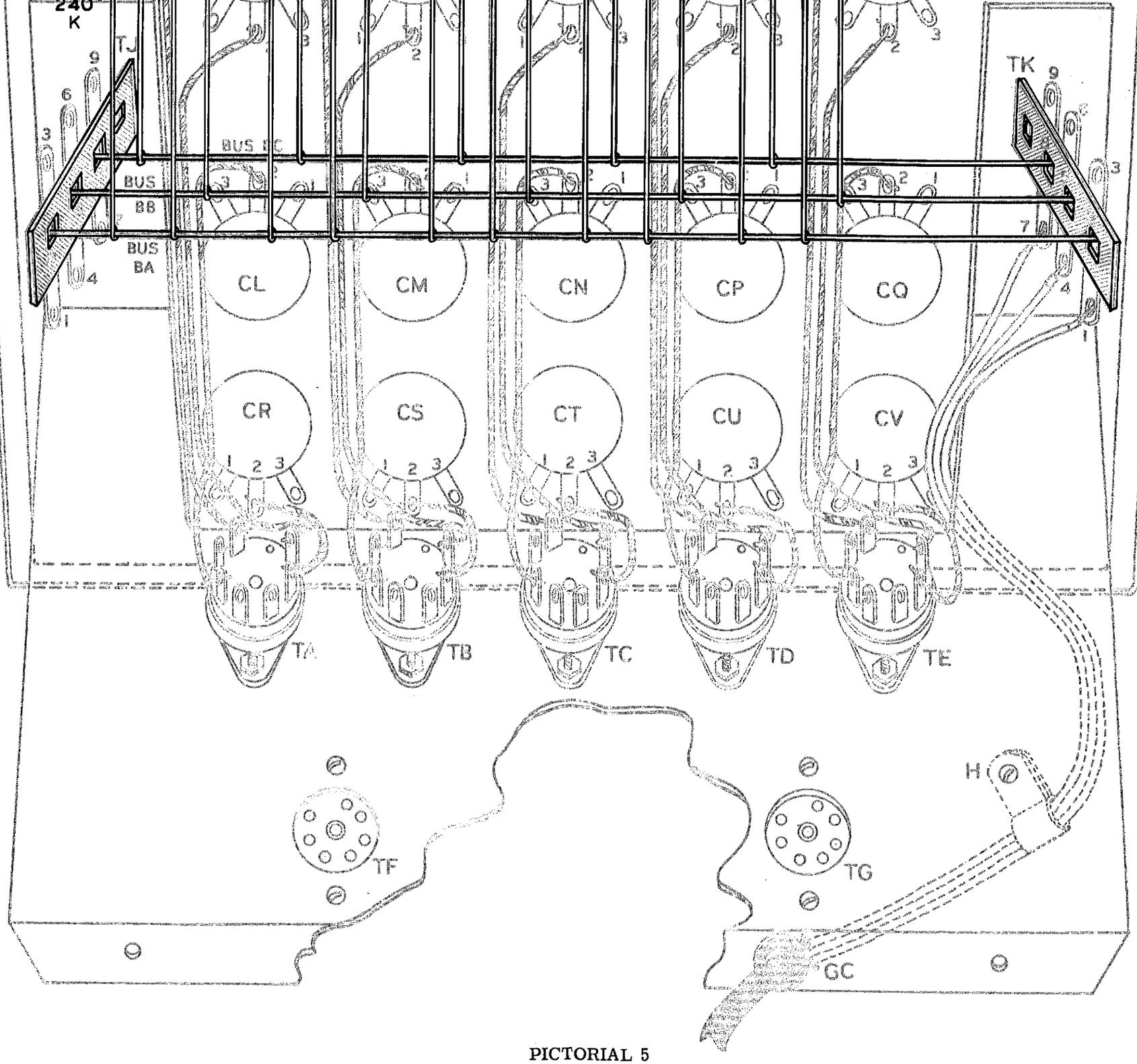
LITHO IN U. S. A.


CA
CB
CC
CD
CE
820 K
240 K
CK
TJ
TK
BUS BC
BUS BB
BUS BA
CL
CM
CN
CP
CQ
CR
CS
CT
CU
CV
TA
TB
TC
TD
TE


CA
CB
CC
CD
CE
CF
CG
CH
CJ
CK
820 K
240 K
BUS BC
BUS BB
BUS BA
CL
CM
CN
CP
CO
CR
CS
CT
CU
CV
TK
TA
TB
TC
TD
TE

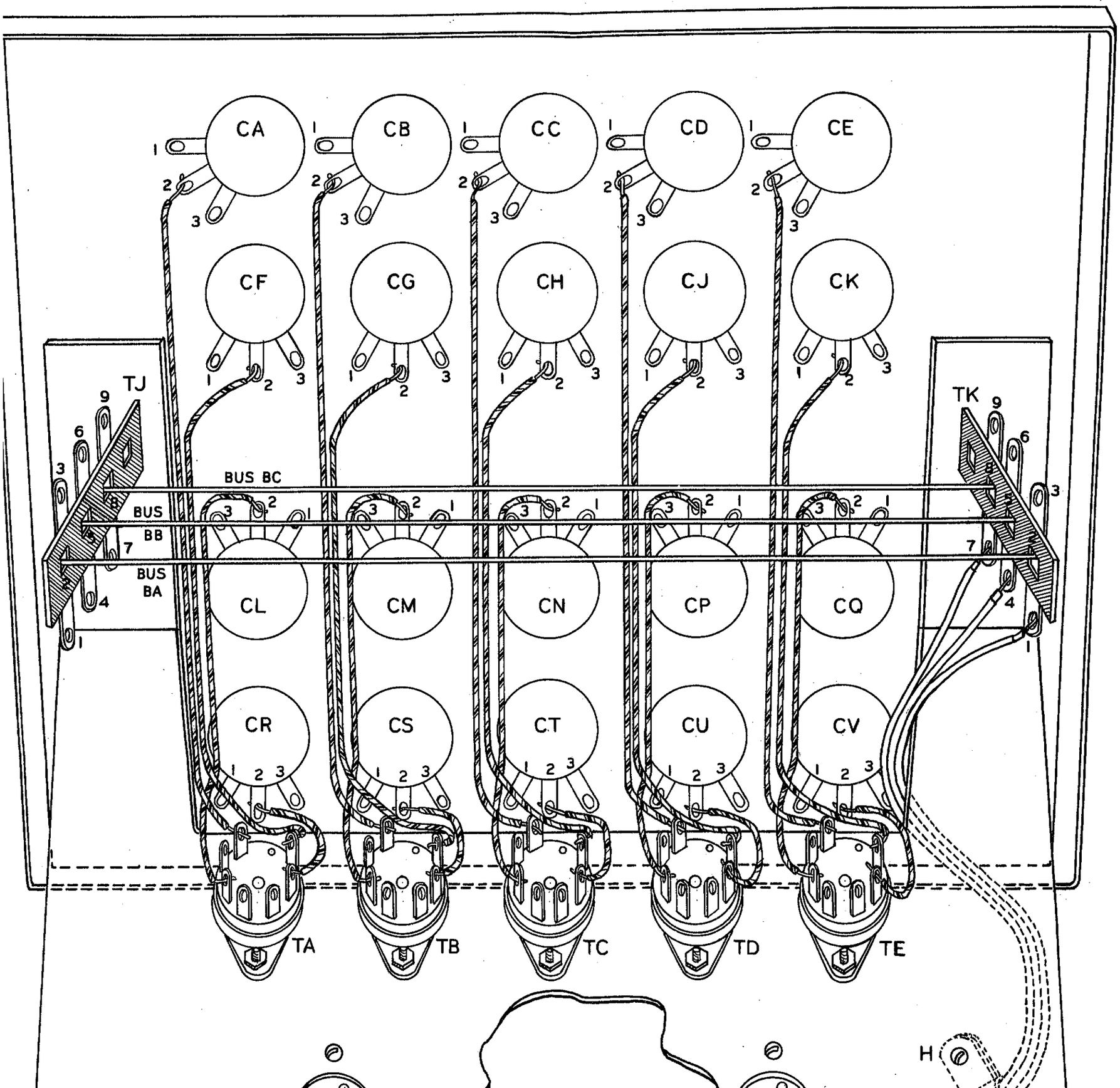

240
K
TJ
TK
BUS BC
BUS BB
BUS BA
CL
CM
CN
CP
CQ
CR
CS
CT
CU
CV
TA
TB
TC
TD
TE
TF
TG
H
GC

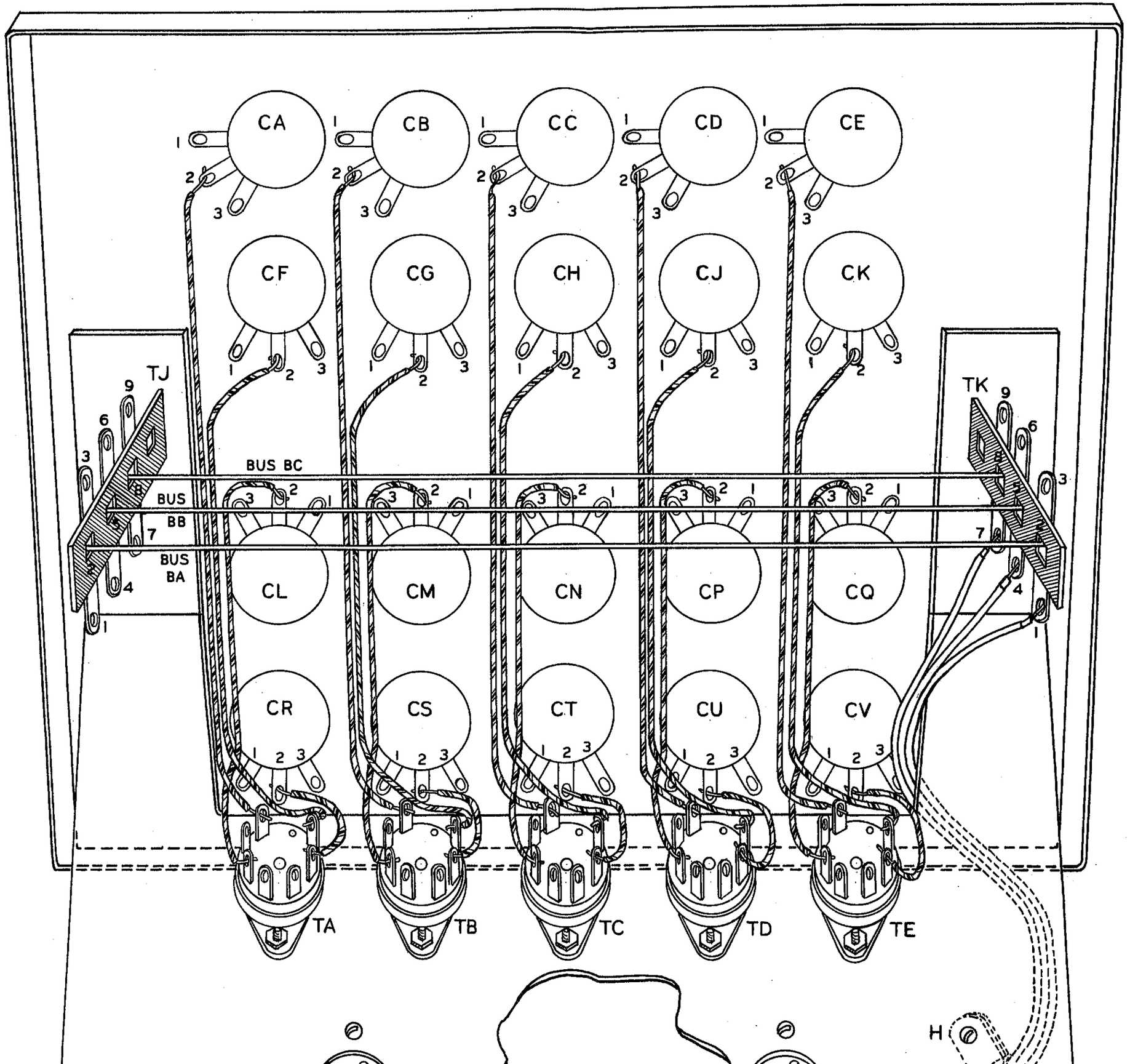
PICTORIAL 5

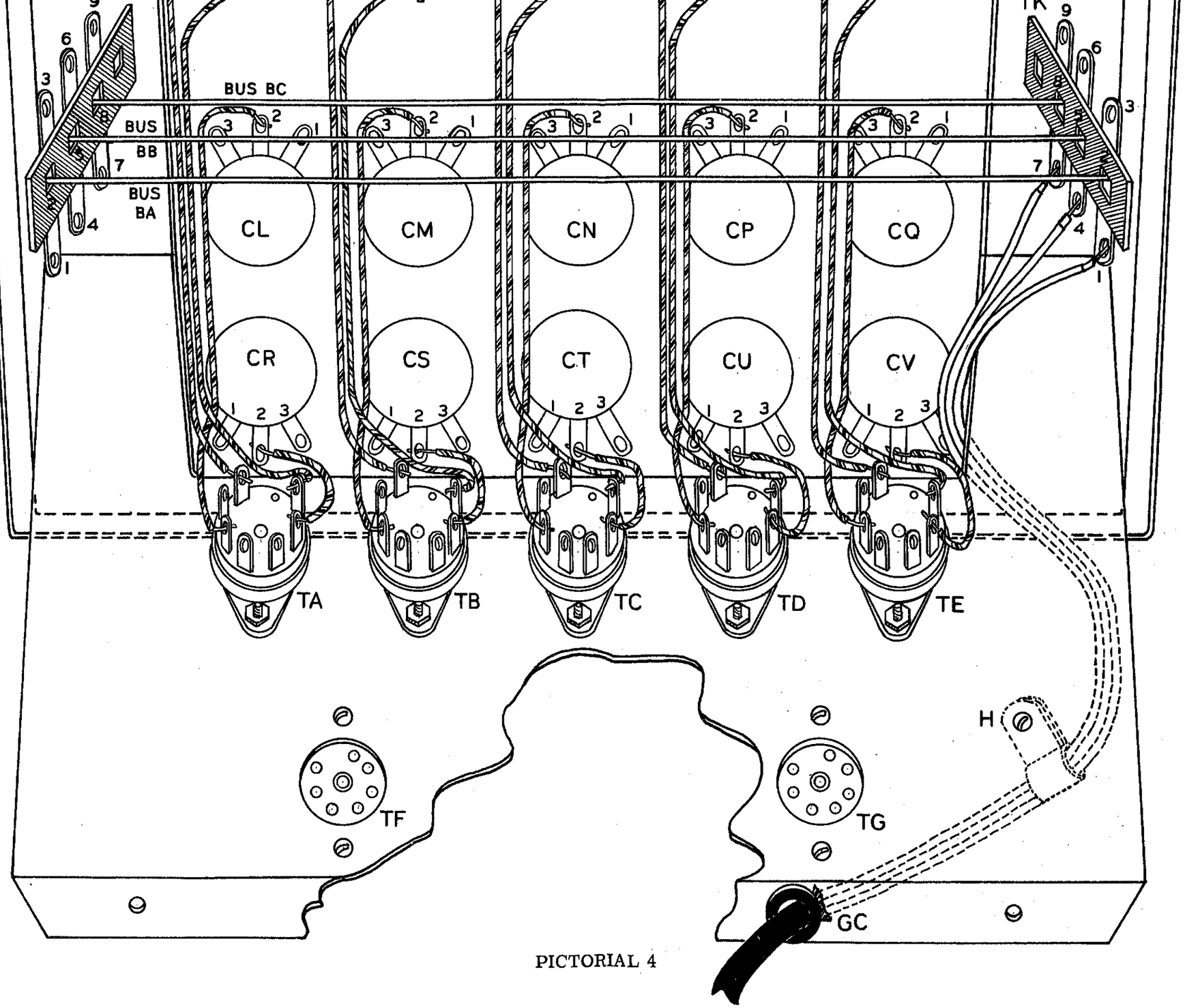


PICTORIAL 5

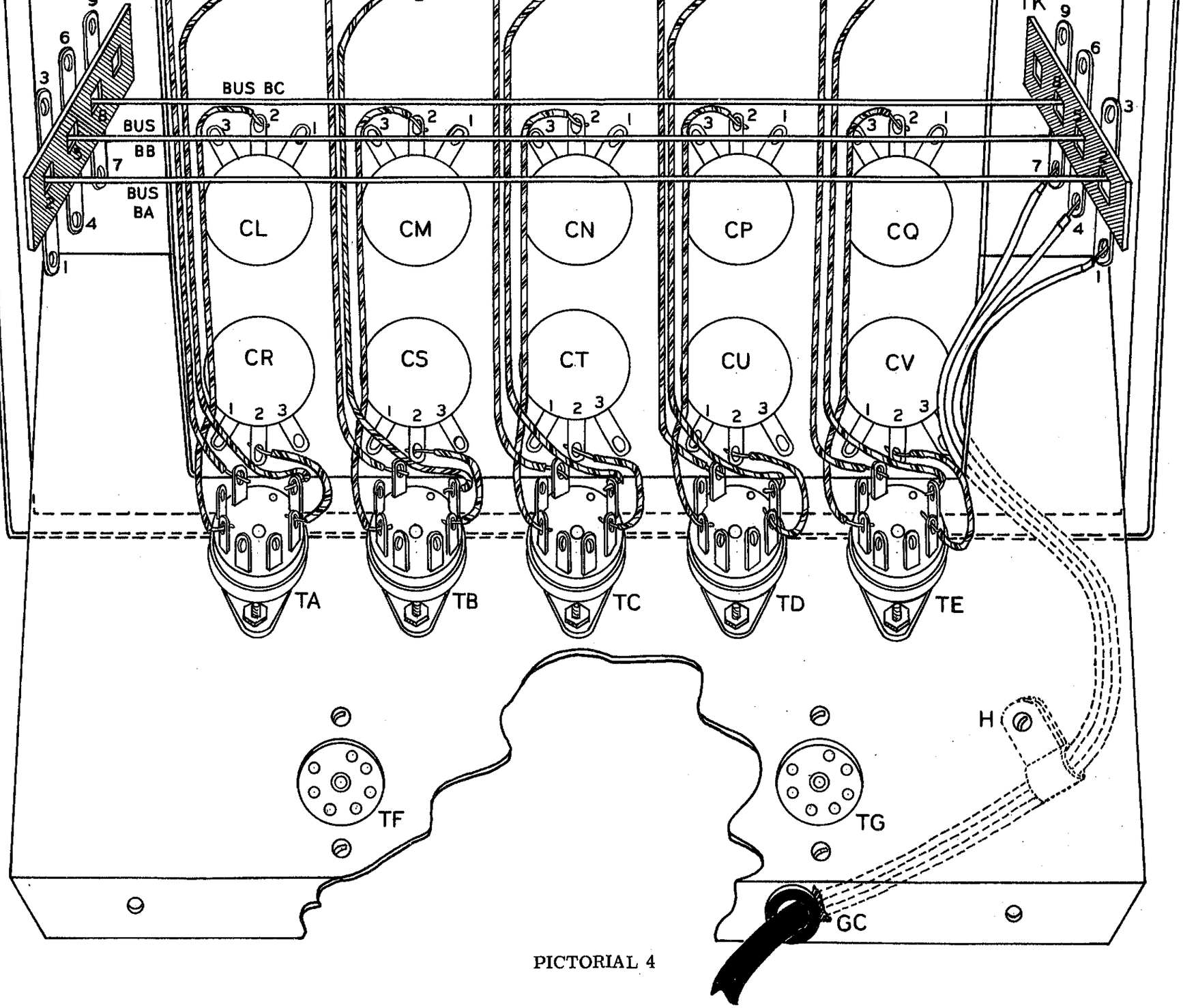
MODEL ES-600


CA
CB
CC
CD
CE
CF
CG
CH
CJ
CK
CL
CM
CN
CP
CQ
CR
CS
CT
CU
CV
TJ
TK
BUS BC
BUS BB
BUS BA
TA
TB
TC
TD
TE
H


CA
CB
CC
CD
CE
CF
CG
CH
CJ
CK
TJ
TK
BUS BC
BUS BB
BUS BA
CL
CM
CN
CP
CQ
CR
CS
CT
CU
CV
TA
TB
TC
TD
TE
H

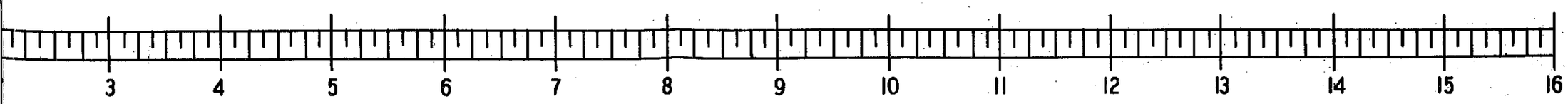

BUS BC
BUS BB
BUS BA
CL
CM
CN
CP
CQ
CR
CS
CT
CU
CV
TA
TB
TC
TD
TE
TF
TG
H
GC

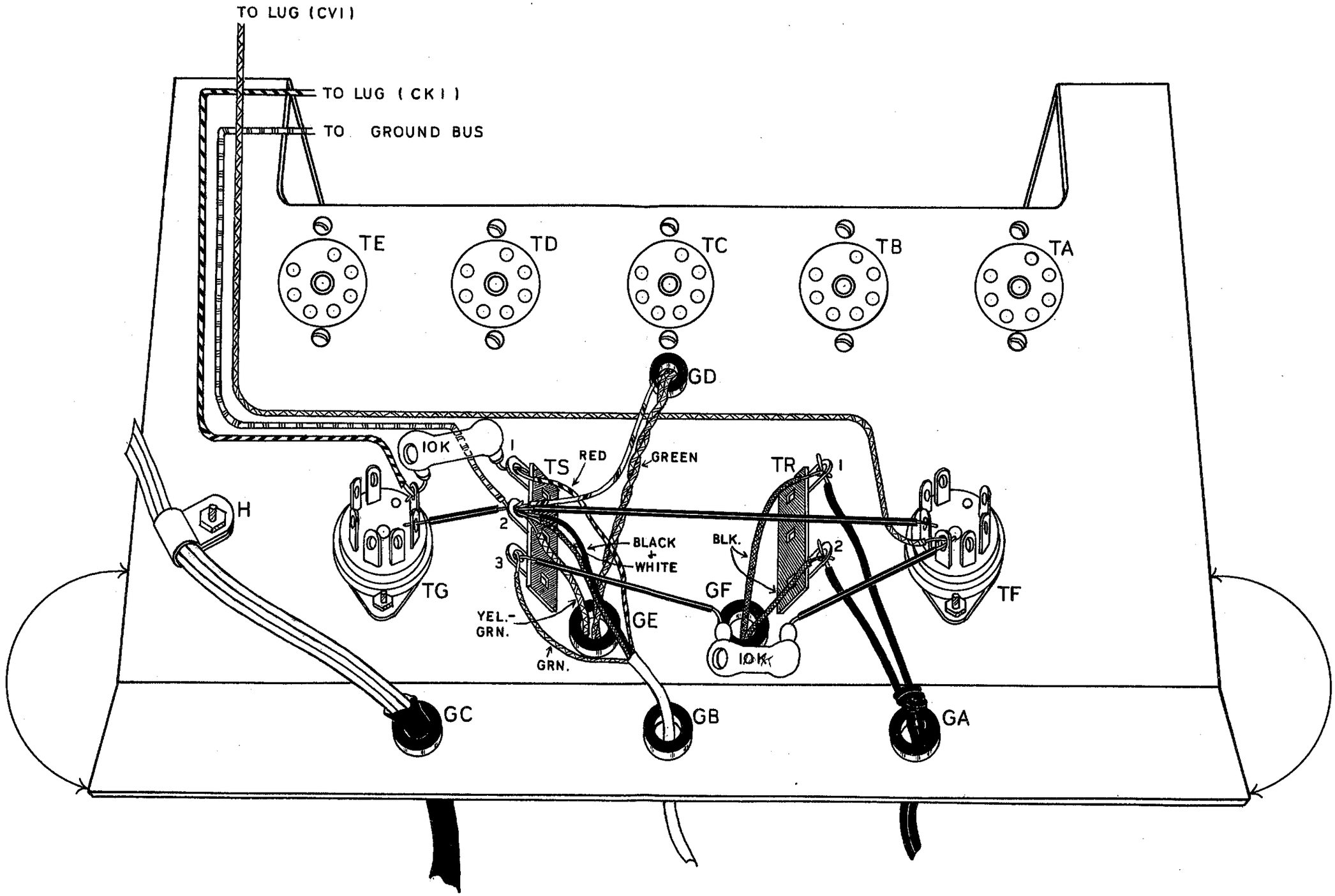
PICTORIAL 4



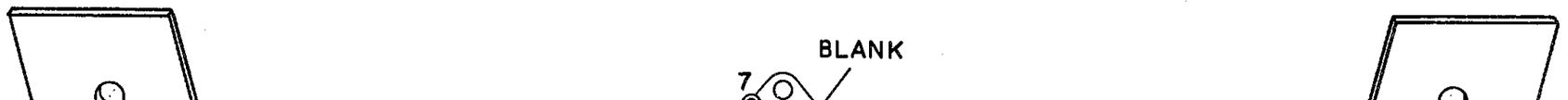
PICTORIAL 4

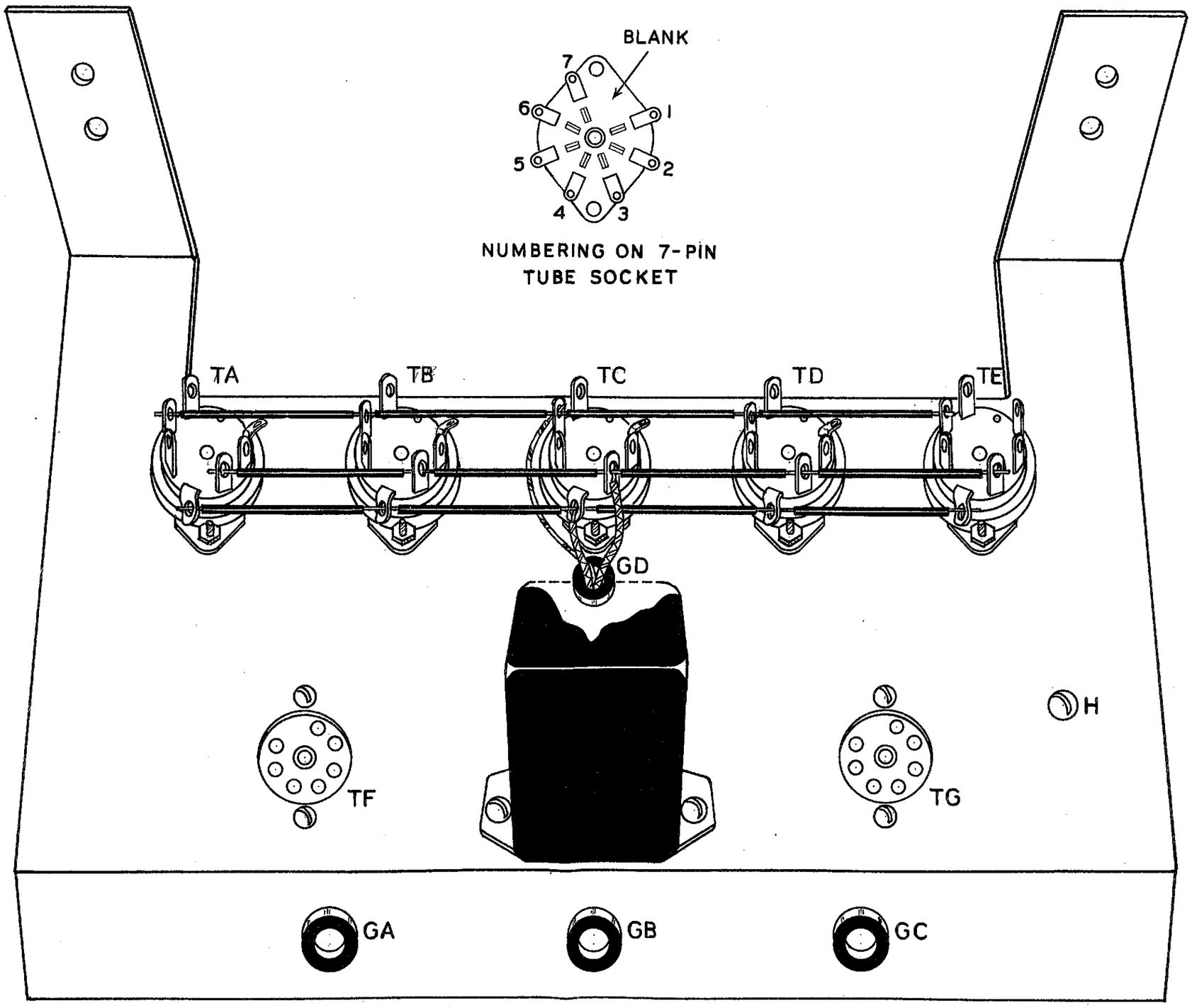
MODEL ES-600




TO LUG (CV1)
TO LUG (CK1)
TO GROUND BUS
TE
TD
TC
TB
TA
GD
10K
1
TS
RED
GREEN
TR
1
H
2
BLACK
+
WHITE
BLK.
2
3
TG
GF
TF
YEL.-
GRN.
GE
GRN.
10K
GC
GB
GA

PICTORIAL 2


BLANK
7


BLANK
7
6
1
5
2
4
3
NUMBERING ON 7-PIN
TUBE SOCKET
TA
TB
TC
TD
TE
GD
TF
TG
H
GA
GB
GC

PICTORIAL 3