

Part II

SERVICE DATA

Electrical Specifications

Power Supply Rating	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20px;">Voltage.....</td> <td>110-120 Volts AC</td> </tr> <tr> <td>Frequency.....</td> <td>50-60 Cycles</td> </tr> <tr> <td>Wattage Consumption.....</td> <td>50 Watts</td> </tr> <tr> <td>Fuse Protection.....</td> <td>1.5 Amps.</td> </tr> </table>	Voltage.....	110-120 Volts AC	Frequency.....	50-60 Cycles	Wattage Consumption.....	50 Watts	Fuse Protection.....	1.5 Amps.										
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Physical Specifications

Overall Dimensions.....	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20px;">Height (including carrying-handle).....</td> <td>14 inches</td> </tr> <tr> <td>Width.....</td> <td>7$\frac{1}{4}$ inches</td> </tr> <tr> <td>Depth.....</td> <td>17$\frac{3}{4}$ inches</td> </tr> </table>	Height (including carrying-handle).....	14 inches	Width.....	7 $\frac{1}{4}$ inches	Depth.....	17 $\frac{3}{4}$ inches
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Width.....	7 $\frac{1}{4}$ inches						
Depth.....	17 $\frac{3}{4}$ inches						
Weight packed for shipment.....	.68 pounds*						
Weight.....	39 $\frac{1}{2}$ pounds						

Circuit Description

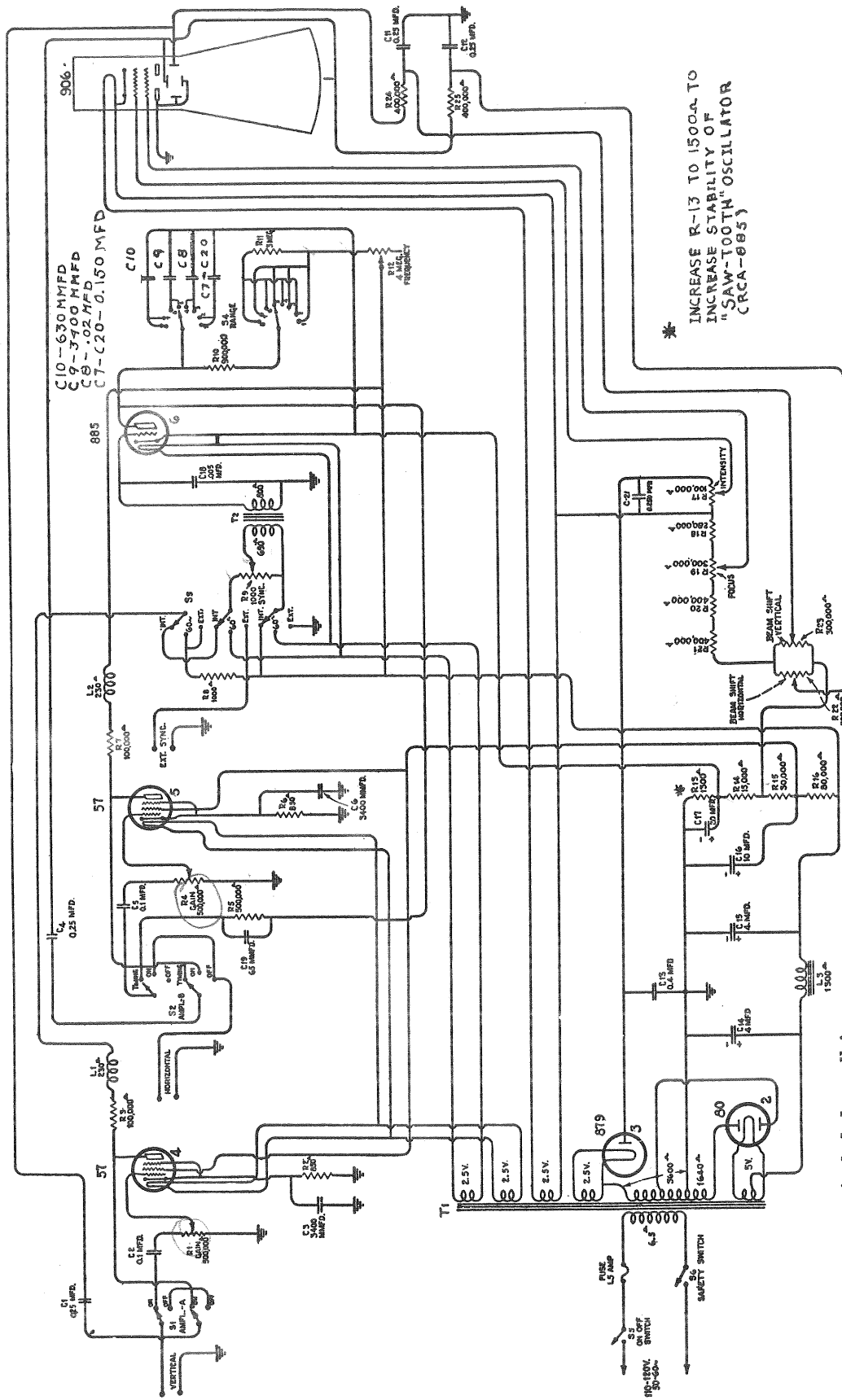
The schematic arrangement of the entire circuit is shown in Figure 37.

An amplifier consisting of a single RCA-57 constitutes the means of obtaining "gain" for the signal applied to the vertical deflecting system. The input to this stage is a high-resistance potentiometer connected to provide "gain" control. An isolation capacitor is made a part of the input circuit to exclude any DC which may be associated with the circuit being observed. The plate, or output circuit of the RCA-57 is composed of two elements in series, a resistor and an inductance whose values are so designed as to effect a broad and uniform frequency response in the amplifier stage. Coupling from the amplifier plate to the cathode-ray tube is made through a capacitor.

The amplifier for the signal applied to the horizontal deflecting plates is identical to that described above. Switches are provided to disconnect either or both amplifiers, thereby applying the voltage to be studied directly to the deflecting plates. Extra con-

tacts are used on the input switch to the horizontal amplifier for feeding in the timing or "Saw-tooth" oscillator signal.

A synchronization system is included, as shown in the input circuit of the RCA-885. This is the "Synchronizing" switch described under "Operation." The timing axis oscillator stage, using the RCA-885, is designed to have a frequency range of 20 to 15,000 cycles, controlled through the "Range" switch and "Frequency" control. The signal from this oscillator has a "saw-tooth" wave shape, obtained as follows: A d-c potential is applied across a capacitor and resistor in series in the plate circuit of the RCA-885 tube. This voltage charges the capacitor until the ionization potential (plate voltage at which the gas in the RCA-885 ionizes) is reached. When the RCA-885 ionizes the capacitor is short-circuited and the voltage across it drops nearly to zero. The RCA-885 immediately de-ionizes and allows the capacitor to start charging again. In this manner, the voltage across the capacitor has a "saw-tooth" characteristic. The capa-



NOTE: C-21 not included on all instruments.

Figure 37—Schematic Diagram

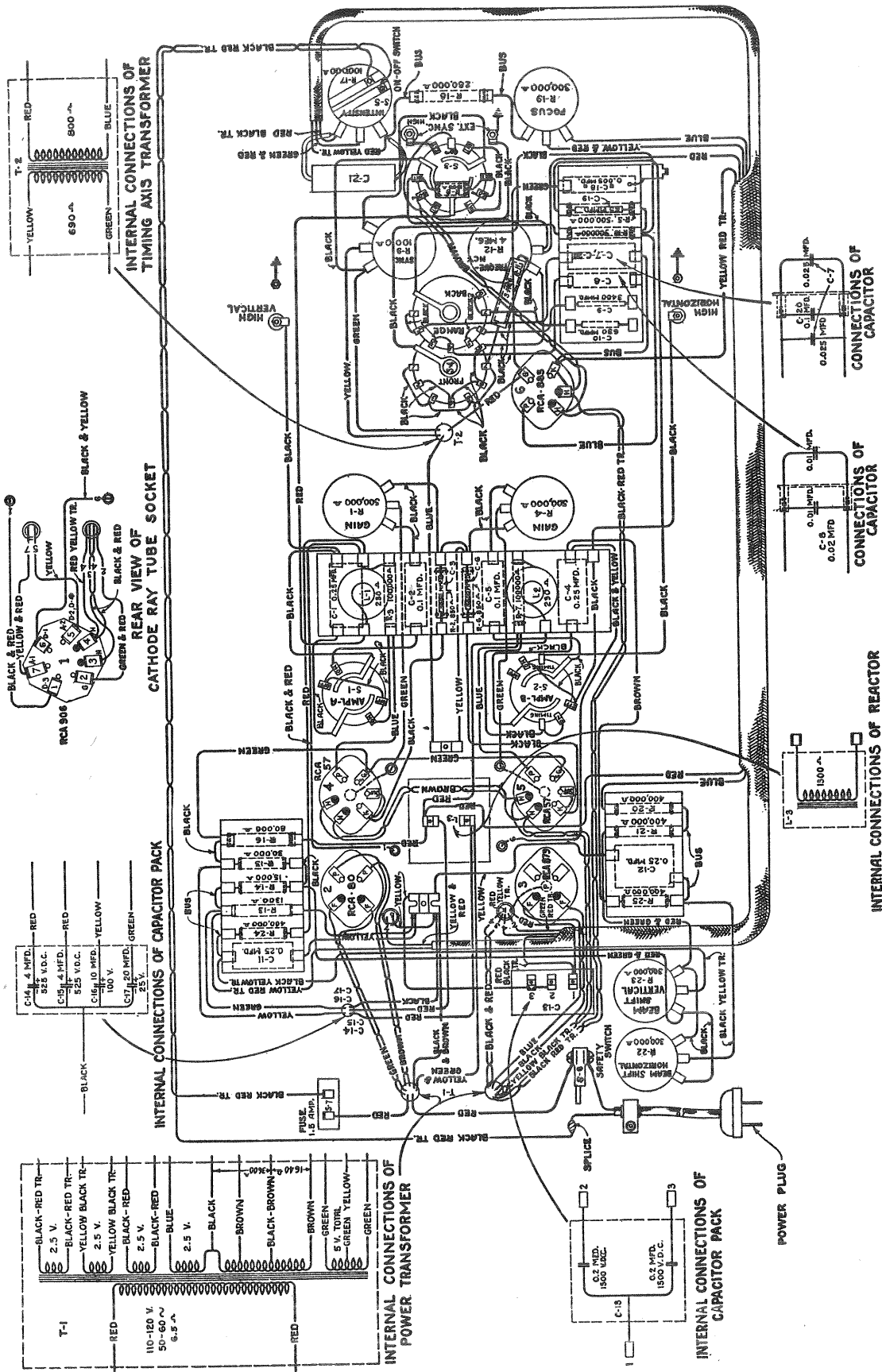


Figure 38—Wiring Diagram

citor referred to above is selected by the position of the "Range" switch as described in "Operation." With "Ampl. B" switch on "Timing," the voltage across this capacitor passes through the horizontal amplifier to the plates of the RCA-906. The operation of the "Synchronizing" control, in the grid circuit of the RCA-885 is described under "Operation."

The RCA-906 cathode-ray tube has previously been described, under "Discussion of Cathode-Ray Tubes." Controls used to control the intensity, focus and zero adjustments are described under "Operation."

Maintenance

(1) Radiotrons

Under ordinary usage within the ratings specified for voltage supply, tube life will be consistent with that obtained in other applications. The rectifier, oscillator, and rectifier tubes will wear in accordance with loss of emission; whereas the determining factor in the life of the RCA-906 cathode-ray tube is the deterioration of the fluorescent screen. It is therefore advisable to avoid leaving a bright, concentrated "spot" on the screen. Also, the image of the phenomena under observation should be removed from the screen when not actually being studied or measured; this item of care will enable a long and useful life to be obtained from the tube.

It is not ordinarily possible to test the Radiotrons in their respective sockets, due to the likelihood of circuit effects causing error. Their removal and check with standard tube-testing apparatus is therefore desirable. Replacement of the questionable tube with one known to be in good condition, is another acceptable and definite means of tracing tube troubles.

On the RCA-906, excessive wear and approach to its limit of life, is indicated by inability to obtain a satisfactory focus, and also by the screen becoming streaked and spotted. When it becomes necessary to install a new RCA-906, some rotational adjustment may be required to bring the axes of deflection into their proper horizontal and vertical planes. This is accomplished by pushing against the screen end of the tube with the hand, and turning the tube until the correct alignment is secured.

To remove the RCA-906, it is necessary to loosen the wing nut securing the tube socket to the chassis, slide the socket toward the back of the chassis, then tilting the tube up until it can be withdrawn from its socket. Replacement is the reverse operation, sliding the tube into the panel opening, *carefully spreading the metal guides*, until a slight tension is placed on the mounting spring. Tighten the wing nut securely and replace the chassis in the cabinet.

(2) Fuse Replacements

A small 1½-ampere cartridge fuse is used in the primary circuit of the power transformer. This fuse is intended for protection of the entire power system

Power required for operation of the instrument is obtained through the power unit from a 110-120-volt, 60-cycle supply. Voltage rectification is accomplished by an RCA-80 and an RCA-879 connected in the secondary windings of the power transformer. The RCA-80 supplies plate voltages for the amplifier stages and sweep oscillator, filtered through a reactor-capacitor combination. The RCA-879 supplies the high voltage to the cathode-ray tube for polarization purposes.

of the oscillograph, and should, therefore, not be replaced by one having a higher rating, nor be shorted out. A fuse failure should be carefully investigated before making a replacement, as usually in the use of fuses of accepted quality, there must be a definite cause for the fuse breakdown. The cause may originate from a surge in the power-supply line, but the greater percentage of causes may be centered in the apparatus protected, such as shorted rectifier elements, and so forth. Occasionally a fuse may open from heat generated at one of its clip contacts. These points should therefore be kept clean and in secure contact with the fuse.

(3) Resistance and Continuity Tests

The schematic circuit is shown in Figure 37, and the actual wiring layout giving color code and physical relation of the parts is shown in the chassis wiring diagram, Figure 38. All resistor and capacitor values are given to facilitate a rapid and sure test for continuity of circuit and the condition of same. Coils and transformer windings have their d-c resistances shown.

In working on the chassis of the Oscillograph, care must be observed in having the safety switch open, or better, to have the power supply completely disconnected. The high voltages associated with the circuits of the cathode-ray tube make it especially dangerous to attempt to handle or work on the chassis while the power is "On."

Care should be exercised in replacing any part that may be found faulty. All wiring associated with the part involved must be taken off, and especial attention given to possibility of damage to other wiring or parts. The relation of wiring and parts should be the same as in the original assembly. The insulation and spacing of the high-voltage leads is very necessary and an important item to be adhered to in servicing of the instrument.

The BRILLIANCY and FOCUSING controls are connected with the adjustment knobs through insulating couplings. In replacing either of these parts, the coupling has to be fitted with 5-0 taper pins.

(4) Voltage Measurements

One means of learning the condition of operation and tracing the circuit faults of the oscillograph is by checking the correctness of the voltages and currents at the Radiotron sockets. The normal values, which can be expected to be found when the instrument is working properly under the specified power ratings, are indicated adjacent to the socket positions in Figure 39, and also given by the Radiotron Socket Voltage Table. In general, the values shown are

measured from the socket contacts to ground; however, the heater or filament voltages are a-c and appear between the F-F or H-H clips. All readings given are actual operating values, and do not allow for any errors likely to be caused by current drain of the measuring instrument. Some of the voltages are not measurable with ordinary test equipment; these have been asterisked in the table. Notice should also be given to the fact that in the diagram of Figure 39 the bottom view of the sockets is shown.

REPLACEMENT PARTS

Stock No.	DESCRIPTION	List Price	Stock No.	DESCRIPTION	List Price
4146	Block—Fuse block.....	\$0.35	4876	Potentiometer—Synchronization control potentiometer (R9).....	\$0.90
4855	Bushing—Socket support bushing—Package of 2.....	.15	4846	Reactor—Filter reactor (L3).....	1.65
4873	Cable—7-conductor—Braid-covered cable...	.85	3441	Resistor—850 ohms—Carbon type— $\frac{1}{2}$ watt—Package of 5 (R2, R6).....	1.00
4868	Capacitor—.005 mfd. (C18).....	.20	2816	Resistor—1,000 ohms—Carbon type— $\frac{1}{2}$ watt (R8)—Package of 5.....	1.00
4858	Capacitor—.01 mfd. (C8).....	.25	4850	Resistor—1300 ohms—Carbon type— $\frac{1}{2}$ watt (R13)—Package of 5.....	1.00
4870	Capacitor—.025 mfd. (C7).....	.20	6279	Resistor—15,000 ohms—Carbon type— $\frac{1}{2}$ watt (R14)—Package of 5.....	1.00
4871	Capacitor—65 mmfd. (C19).....	.20	3077	Resistor—30,000 ohms—Carbon type— $\frac{1}{2}$ watt (R15)—Package of 5.....	1.00
4841	Capacitor—0.1 mfd. (C2, C5, C20).....	.22	4849	Resistor—80,000 ohms—Carbon type—3 watt (R16).....	.25
3597	Capacitor—0.25 mfd. (C1, C4).....	.40	3058	Resistor—100,000 ohms—Carbon type—1 watt (R3, R7)—Package of 5.....	1.10
3702	Capacitor—0.25 mfd. (C11, C12).....	.42	2971	Resistor—280,000 ohms—Carbon type—1 watt (R18)—Package of 5.....	1.10
4840	Capacitor—0.25 mfd. (C21).....	.30	4851	Resistor—400,000 ohms—Carbon type—1 watt (R20, R21, R24, R25).....	.25
4844	Capacitor—0.4 mfd. (C13).....	7.25	2970	Resistor—500,000 ohms—Carbon type—1 watt (R5)—Package of 5.....	1.10
3933	Capacitor—630 mmfd. (C10).....	.32	4869	Resistor—900,000 ohms—Carbon type—1 watt (R10).....	.22
4439	Capacitor—3400 mmfd. (C3, C6, C9).....	.35	4863	Resistor—3 megohms—Carbon type—1 watt (R11).....	.22
4845	Capacitor pack—Comprising two 4.0 mfd. and one 10.0 mfd. and one 20.0 mfd. capacitors (C14, C15, C16, C17).....	4.00	4268	Screw—Wing screw—Package of 10.....	.68
4867	Coil—Plate Choke Coil (L1, L2).....	.70	7487	Shield—Radiotron shield.....	.25
4877	Coupling—Potentiometer insulator and coupling—Package of 2.....	.32	4794	Socket—4-contact Radiotron socket.....	.15
4862	Escutcheon—Cathode-ray tube escutcheon...	.50	4814	Socket—5-contact Radiotron socket.....	.15
2725	Fuse—Cartridge type fuse—Package of 5.....	.40	4786	Socket—6-contact Radiotron socket.....	.15
4336	Knob—Intensity, focus, amplifier A-B, tuning or gain control knob—Package of 5...	.40	4852	Socket—Socket, socket support and springs and studs.....	1.20
4857	Post—Binding post—Engraved "HIGH"—Package of 2.....	.52	4853	Spring—Socket support spring—Package of 2.....	.10
4860	Post—Binding post—Engraved "0"—Package of 2.....	.52	4854	Stud—Socket support stud—Package of 2...	.18
4879	Potentiometer—Beam shift potentiometer (R22, R23).....	.90	4875	Switch—2-gang—8-position (S4).....	1.60
4856	Potentiometer—Brilliance control potentiometer—Complete with "Off" and "On" switch (R17, S5).....	1.25	4864	Switch—2-pole—2-position (S1).....	1.25
4859	Potentiometer—Focus control potentiometer (R19).....	.90	4865	Switch—2-pole—3-position (S2).....	1.25
4878	Potentiometer—Frequency control potentiometer (R12).....	.90	4866	Switch—3-pole—3-position (S3).....	1.25
4874	Potentiometer—Gain control potentiometer (R1, R4).....	1.00	4872	Switch—Safety switch (S6).....	1.30
			4848	Transformer—Power transformer (T1).....	8.25
			4847	Transformer—Timing axis transformer (T2)...	2.50