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CONTROLLER

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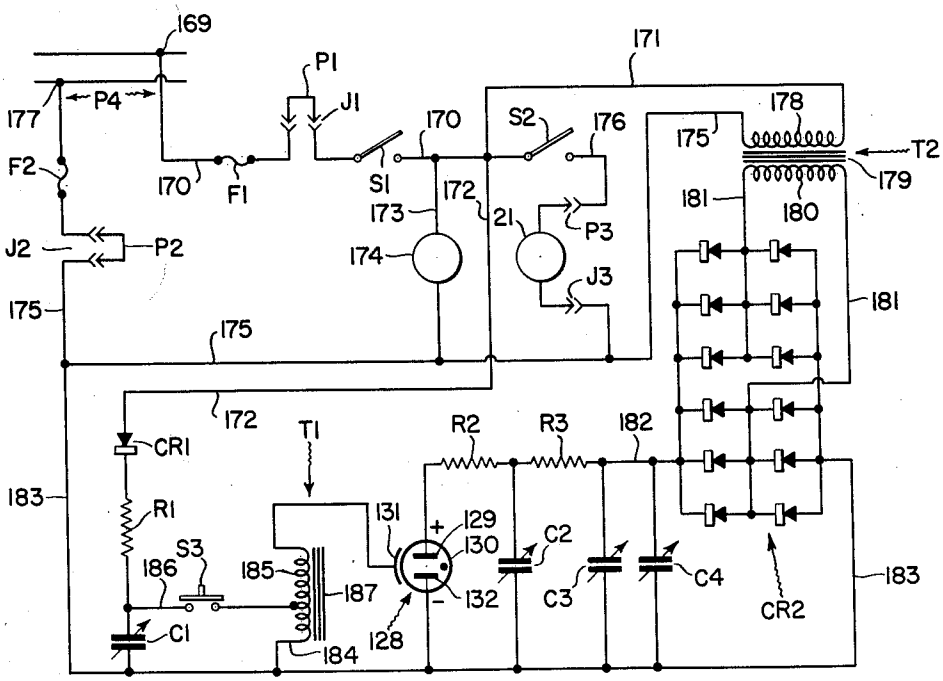


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# CONTROLLER

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2 Claims. (Cl. 315—203)

A general object of this invention is to provide improvements in recorders in which electrical, optical, and mechanical components are cooperatively associated to reveal an immediately visible and permanent trace or image having a high degree of resolution and contrast. This trace provides a record of physical, mechanical, electrical, chemical, or other phenomena which may fluctuate rapidly with lapse of time.

In a preferred embodiment of the invention, a beam of radiant energy having a spectral composition comprising wave-lengths adjacent those of visible light and/or those of visible light, is reflected by a mirror. The mirror, in turn, is attached to and moves with the deflecting element of a galvanometer in response to the current fluctuations in an electric circuit, which fluctuations are representative of changes in the phenomena under observation. The reflected beam of radiant energy is directed to the surface of a travelling, sensitized, recording medium or film to produce a sharply defined, permanent, and immediately visible trace or image having a higher degree of resolution and contrast than has heretofore been possible.

A specific object of the invention is to provide a recorder of the type described which is operative to produce such immediately visible and permanent traces or images of high resolution and contrast at writing speeds far in excess of those heretofore permissible. To this end, the recording medium or film employed preferably is conditioned according to the process disclosed in co-pending application of R. A. Le Massena and R. S. Kempf, Serial No. 631,078, filed December 28, 1956. The apparatus constituating a recorder in which the starting and power-supply electric circuit of this invention is useful is disclosed in a second co-pending application of R. A. Le Massena and R. S. Kampf, Serial No. 638,279, filed February 7, 1957.

It is yet another object of this invention to provide an electric circuit useful for supplying power to the driving motor and to the fan motor of an oscillographic recorder and operable to start the high-pressure, mercury-vapor lamp which provides a source of radiant energy for such a recorder.

It is a further object of this invention to provide an improved starting circuit for the mercury-vapor lamp in which a condenser is employed to furnish starting current to the starting or trigger electrode of the lamp. Such a starting circuit is much lighter in weight, simpler on operation, and cheaper to manufacture than those heretofore known and involving the use of heavy and expensive transformers.

A better understanding of the present invention may be had from the following detailed description when read in connection with the accompanying drawing in which the single figure of the drawing is of a diagram of an electric circuit showing means whereby electric power is supplied to the recorder.

These means comprise a plug P4 having a pair of input terminals 169 and 177. Input terminals 169 and



177 are adapted for connection to a commercial supply of alternating current electricity of 115 volts, 60 cycles, which can supply four amperes.

Terminal 169 is connected to a wire 170 containing a fuse F1 rated at five amperes, a plug P1 cooperating with the jack J1 ,a power switch S1, and a drive switch S2.

Wire 170 connects to four circuit branches. One branch is wire 171 is connected to one terminal of the primary coil 178 of a transformer T2. The other side of primary coil 178 is connected to wire 175. Wire 175 is connected through plug P2, jack J2, fuse F2, rated at five amperes, to input terminal 177.

The second branch of wire 170 is wire 173 which connects fan motor 174 across the wires 173 and 175. Fan motor 174 is of commercially available, constant speed, rotating field, electric motor adapted for connection to a commercially available source of 115 volt, 60 cycle, A.C.

The third branch of wire 170 is drive switch S2 which is connected, on its off-going side, to wire 176 containing plug P3 and jack J3 cooperating with plug P3 to connect drive motor 21 between wires 176 and 175. Drive motor 21 is a commercially available, constant speed, shaded pole, rotating field, electric motor adapted for connection to a commercially available source of 115 volt, 60 cycle, A.C.

The fourth branch of wire 170 is wire 172 which connects selenium rectifier CR1 in series with resistor R1 having, for example, a value of 5,100 ohms, and a rating of two watts, and condenser C1 having, for example, a capacity of two microfarads (mfd.), and a working voltage of 200 volts, to wire 183.

Connected to the junction between resistor R1 and condenser C1 is a wire 186 containing a lamp switch S3 and connected at its opposite end to one input terminal of a trigger coil or auto transformer T1. This trigger coil has a primary winding 184 consisting, for example, of 20 turns No. 25 American Wire Gauge wire. It has a secondary 185, consisting, for example, of 6,000 turns of No. 40 American Wire Gauge wire, and a core 187. The output end of secondary coil 185 is connected to starting contact 131 of the lamp or source of radiant energy 128. The other input contact of primary coil 184 is connected through wire 183 to the cathode contact 132 of lamp 128.

Lamp or source of radiant energy 128 comprises a high-pressure, mercury-vapor lamp having a point-shaped arc. An example of such a lamp is that manufactured by Osram, Munich, West Germany, and identified as their model HBO–107/1, super pressure mercury lamp. The lamp 128 comprises a quartz envelope 130 containing an inert gas and a certain quantity of mercury. The anode consists of tungsten and is connected to the lower contact 129. The cathode is smaller and is connected to the upper contact 132. An ignition or starting electrode 131 projects from the side of the envelope.

Such a lamp produces such a point-shaped arc (0.3 by 0.3 millimeter square) the brightness of which is about 100,000 stilb or candles per square centimeter. A high percentage of this radiation is ultra violet. The lamp is heated to a high temperature during service. The high pressure within the lamp causes great mechanical stress during service.

Transformer T2 has a core 179 and a secondary coil 180 which is connected by means of conductors 181 to a rectifier CR2 comprising twelve germanium rectifiers connected thereto.

Rectifier CR2 has an output wire 182 connected thereto and containing a series resistor R3, which may have a value of 3 ohms and a rating of 120 watts, and a series resistor R2, which may have a resistance of 3 ohms and

a rating of 120 watts. The opposite end of wire 182 is connected to the anode terminal 129 of the lamp 128.

The rectifier CR2 also has an output wire 183 connected thereto which connects, at its opposite end, to wire 175 and jack J2. Across wires 182 and 183 are connected three condensers C2, C3, and C4, each of which may have a capacity of 2,000 mfd. and a working voltage of 75 volts.

The opeartion of the power supply is as follows. The plug P4 is operated so that the input terminals 169 and 177 connect to the terminals of a commercial supply of 115 volts, 60 cycle, A.C. electricity. The power switch S1 is electrically interlocked with the drive switch S2 and with the lamp switch S3. Therefore, the power switch S1 must be closed so as to energize the fan motor 174 before the drive switch S2 can be closed to energize the drive motor 21 and before the lamp switch S3 can be closed to energize the lamp 128.

When it is desired to start up and ignite the lamp 128 the procedure is as follows. When the lamp is not on, i.e. when there is no current through lamp 128, the voltage applied to the anode terminal 129 and to the cathode terminal 132 is about 68 volts. The lamp switch S3 is then closed thus energizing the starting electrode 131 by a voltage causing a very short, high frequency, capacitor discharge into the low impedance coil 184 of trigger transformer T1. The frequency of this discharge is about 50 kilocycles per second. The voltage across the secondary coil 185 of trigger transformer T1 is about 15,000 volts. This high frequency discharge between starting electrode 131 and cathode electrode 132 ionizes the mercury vapor in lamp 128 and initiates a flow of current between the anode electrode 129 and the cathode electrode 132. When a flow of current is established between anode electrode 129 and cathode electrode 132, the voltage across lamp 128 drops to about 10 volts because the current flow of about 7 amperes reduces the voltage applied to the lamp because of the voltage drop across resistors R2 and R3. Changes in the current and voltage occur in the practical operation of the apparatus, however, because of the heating of lamp 128. The current decreases to about 5 amperes as the tube heats, and the voltage increases to a normal operating voltage across the tube 128 of about 20 volts. The lamp voltage then tends to remain constant because lamp 128 is in the nature of a voltage regulator.

What is claimed is:

1. Means for conducting electric power to a recording oscillograph, including, a normally non-conducting mercury-vapor lamp having an anode and a cathode and a normally unenergized starting electrode, means connecting the anode and the cathode to a source of energy, a normally unenergized transformer, means connecting the transformer to the starting electrode to energize the starting electrode when the transformer is energized, thereby to render the lamp conducting to cause energy from the source to pass between the anode and the cathode through the lamp and to produce radiant energy from the lamp, an electric-discharge device, and a manually operable electric switch connecting said discharge device to said transformer to cause the electric discharge device suddenly to energize the transformer, thereby to energize the starting electrode to render the lamp suddenly conducting.

2. Means for supplying electric power to a recording oscillograph, including a normally non-indicating high-pressure mercury-vapor lamp having an anode and a cathode and a normally unenergized trigger electrode and serving as a source of radiant energy for a recording oscillograph, and a trigger circuit, including, a pair of electrical energizing terminals adapted for connection to a source of electric energy, a first manually operable electric switch connected to one of said terminals, a rectifier connected in series with said first manually operable electric switch, a resistor connected in series with said first manually operable switch and said rectifier, a condenser connected in series with said first manually operable switch and said rectifier and said resistor, a second manually operable switch connected at one side between said resistor and said condenser and connected at the other side with the primary and secondary windings of a transformer, said primary winding being connected at the other side to said condenser, to the cathode of said lamp, and to the other of said pair of terminals, said secondary winding being connected at the other side to said trigger electrode.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 2,557,809 | Willoughby | June 19, 1951 |
| 2,562,887 | Beese | Aug. 7, 1951 |
| 2,721,959 | Nessel | Oct. 25, 1955 |
| 2,757,318 | Noel et al. | July 31, 1956 |
| 2,793,323 | Miller | May 21, 1957 |
| 2,825,852 | Barton | Mar. 4, 1958 |

FOREIGN PATENTS

| | | |
|---|---|---|
| 1,019,071 | France | Jan. 16, 1953 |