Jan. 1, 1935. W. F. SKEATS 1,986,607

CATHODE RAY OSCILLOGRAPH CONTROL

Filed April 7, 1934

Fig. 1.

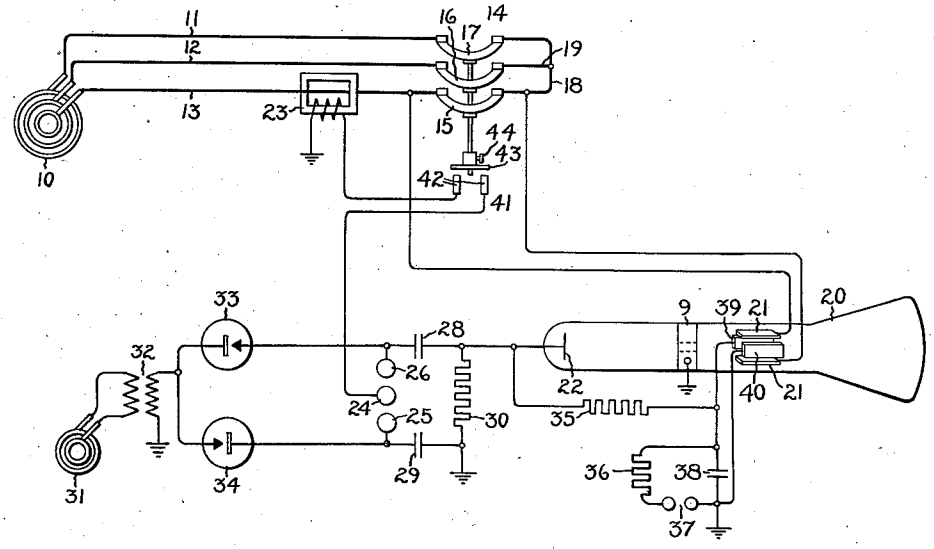
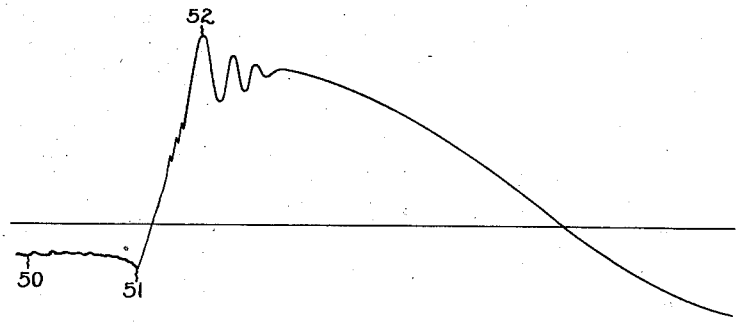


Fig. 2.



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CATHODE RAY OSCILLOGRAPH CONTROL

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10 Claims. (Cl. 171—95)

My invention relates to cathode ray oscillographs and more particularly to a method of controlling the initiation of operation of such a device.

It is often desirable to have an oscillograph set into operation by means associated with the occurrence of phenomena to be recorded since this insures a complete record of the phenomena. Accordingly, an object of my invention is to insure that the cathode ray oscillograph begins its operation at a time which is consistent with the occurrence of the phenomena to be recorded thereby.

Another object of the invention is to provide means associated with the phenomena to be recorded, of a simple and faithful character, to insure the discharge at the proper time, of a spark gap which sets the oscillograph into operation.

A better understanding of the invention can be had and further objects of the invention will appear from the following specification taken in connection with the accompanying drawing in which Fig. 1 is a schematic representation of my invention, and Fig. 2 shows a curve to be referred to in explaining my invention. The curve shown in Fig. 2 consists of a portion 50 to 51 which represents the arcing voltage of a circuit interrupter designated in Fig. 1 by the numeral 14. The rapidly increasing recovery voltage of this interrupter is shown in Fig. 2 by the position of the curve between 51 and 52. It will be obvious that while my invention is shown in connection with a polyphase system, it is equally applicable to a single phase system.

In order to obtain a record of this rapidly increasing recovery voltage, apparatus of a quickly responding character must be used. Such apparatus is shown schematically in Fig. 1 in which 10 designates an alternating current generator connected to the conductors 11, 12 and 13. These conductors can be short circuited by the switch bridging contacts 15, 16, 17 and the conductors 18 and 19. It is assumed that the circuit interrupter is of the automatic type which opens in response to an overload such as would be caused by the short circuit indicated.

The recovery voltage of the interrupter 14 is recorded by a cathode ray oscillograph 20 of the usual type with a pair of sweep plates 39 and 40 and a pair of deflecting plates 21, connected across the line. By recovery voltage I mean the voltage existing between the arc voltage and the normal line voltage. The oscillograph is provided with a cathode 22 and an anode 9 at ground potential.

The cathode ray oscillograph 20 is energized by means of a separate source of supply. This source comprises an alternator 31 which supplies two condensers 28 and 29 through a transformer 32 and rectifiers 33 and 34. The oscillograph side of the condensers is connected to a resistance 30 which is grounded. Connected in parallel to this resistance is a resistance 35 and a condenser 38, the condenser 38 energizing the sweep plates 39 and 40. The condenser 38 is protected from overcharge by the spark gap 37. The resistance 36 prevents the return of the electron beam.

The oscillograph is actuated responsive to the phenomena to be recorded. To accomplish this there is connected across the supply side of the condensers 28 and 29 a spark gap comprising spheres 25 and 26 between which spheres there is a third electrode or sphere 24. This middle sphere is connected through a switch 41 to the secondary of an easily saturable current transformer 23 responsive to the current in line 13.

The switch 41 is operated through mechanical interconnection by the movement of the interrupter 14. The relationship between the movements of these two switches is adjustable by means of the set screw 44 which allows the bridging member 43 to be moved relative to the switch contacts 42.

Transformer 23 which is employed to impress a voltage on the midsphere 24 is of the easily saturable type so that during the part of the cycle of the current in the line when the current is high, the core of the transformer will be saturated. Hence although the primary current may be changing at a high rate at this time, the flux in the core will remain practically constant and no voltage will be induced in the secondary of the transformer. When the current has decreased in the primary to a point where the core is no longer saturated, a large flux change in the core will begin to take place and a correspondingly high voltage will be induced in the secondary. The highest voltage will be induced in the secondary at the time the flux in the core is changing most rapidly which will be during the time the current is passing through zero. By zero current I mean the current at zero and also the current within the half cycle preceding zero which is in the unsaturated portion of the current curve. As the circuit interrupter opens contacts 41 and 42 will be closed and any voltage induced in the secondary of current transformer 23 will then be conveyed to sphere 24.

The operation of the above described device will be obvious to those skilled in the art from the

foregoing description, but for the purpose of rendering the description complete, I shall describe the operation as follows:

The condensers 28 and 29 which are connected to assist each other are constantly charged from the alternator 31 but do not normally have a charge sufficient to cause a breakdown between the spheres 25 and 26. The mid-sphere 24 is so arranged that when a proper voltage is induced in the secondary winding of the transformer 23 and the switch 41 is closed, the gap between spheres 25 and 26 will be broken down. This induced voltage can be impressed directly on the sphere 24 or can first be amplified in any well known manner such as for example by thermionic valves. The switch 41 is so adjusted relative to the interrupter 14 that the switch 41 is closed at any time during the half cycle preceding the last current zero which is in the saturated portion of the current curve.

This relationship between the switch 41 and interrupter 14 is necessary to insure a complete record of the recovery voltage. The voltage recorded by the oscillograph will include the part from 51 to 52 of the curve of Fig. 2.

The breakdown of the air gap between spheres 25 and 26 effects the discharge of the condensers through the resistance 30. The voltage drop across the resistance 30 impresses a negative voltage on the cathode 22 causing it to emit electrons. The electrons will be deflected by the plates 39, 40 and 21 to indicate the recovery voltage characteristics desired to be examined.

While I have described a particular embodiment of my invention, it will be obvious to those skilled in the art that various modifications may be made without departing from the spirit of my invention, and, I, therefore desire to cover all such modifications as fall within the scope of my invention by the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination with a cathode ray oscillograph, a source of alternating current and means including a current transformer saturable within the normal range of variation of said alternating current and influenced by said alternating current for initiating the operation of said cathode ray oscillograph.

2. In combination with a source of alternating current, means for shortcircuiting said source, means for interrupting the shortcircuit on said source, a cathode ray oscillograph for determining a characteristic of said source, and means associated with said shortcircuiting means and said interrupting means for initiating the operation of said cathode ray oscillograph.

3. In combination with a source of alternating current and means influenced by said alternating current, means for shortcircuiting and interrupting said source, an indicating device and means operated by and in timed relation to said shortcircuiting and interrupting means for allowing the means influenced by the alternating current to set said device into operation.

4. In combination with a source of alternating current and a cathode ray oscillograph, means including a spark gap associated with said cathode ray oscillograph, and a transformer saturable within the normal range of variation of said alternating current and influenced by said source for causing a discharge across the spark gap to set the cathode ray oscillograph into operation.

5. In combination with an alternating current circuit and a cathode ray oscillograph, means including a spark gap for initiating the operation of said cathode ray oscillograph, including a saturable transformer energized from said circuit, means to shortcircuit and interrupt said circuit, and means operating in timed relationship with said shortcircuiting and interrupting means for causing said transformer to impress a breakdown voltage on said spark gap, thereby bringing about the operation of said cathode ray oscillograph.

6. In combination, an indicating means normally idle, a source of alternating current and means influenced by alternating current supplied from said source for setting said indicating means into operation at substantially the zero value of the cycle of said alternating current.

7. In combination with a source of alternating current and a cathode ray oscillograph, transformer means influenced by the cyclic variation of said alternating current and a spark gap subject to the voltage of said transformer means to set the cathode ray oscillograph into operation at a definite point in said cycle.

8. In combination with a source of alternating current and a cathode ray oscillograph, a saturable transformer influenced by the cyclic variation of said alternating current and a spark gap subject to the secondary voltage of said transformer and so adjusted that it will set the cathode ray oscillograph into operation at a selected point in the cycle of said alternating current.

9. In combination with a source of alternating current, and a cathode ray oscillograph, means for short-circuiting and interrupting said source and means operable in timed relationship both to said last mentioned means and to the cyclic variation of said alternating current to initiate the operation of the cathode ray oscillograph.

10. In combination with an alternating current circuit and a cathode ray oscillograph for determining a characteristic thereof and means for interrupting said current, a transformer connected to said line and saturable during a portion of the cycle of said alternating current, a spark gap connected to said cathode ray oscillograph and means for connecting said transformer to said spark gap during the half cycle when it is saturated for the last time before the circuit is interrupted, thus causing the cathode ray oscillograph to operate when the current in said circuit passes through zero for the last time before interruption of the circuit.

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