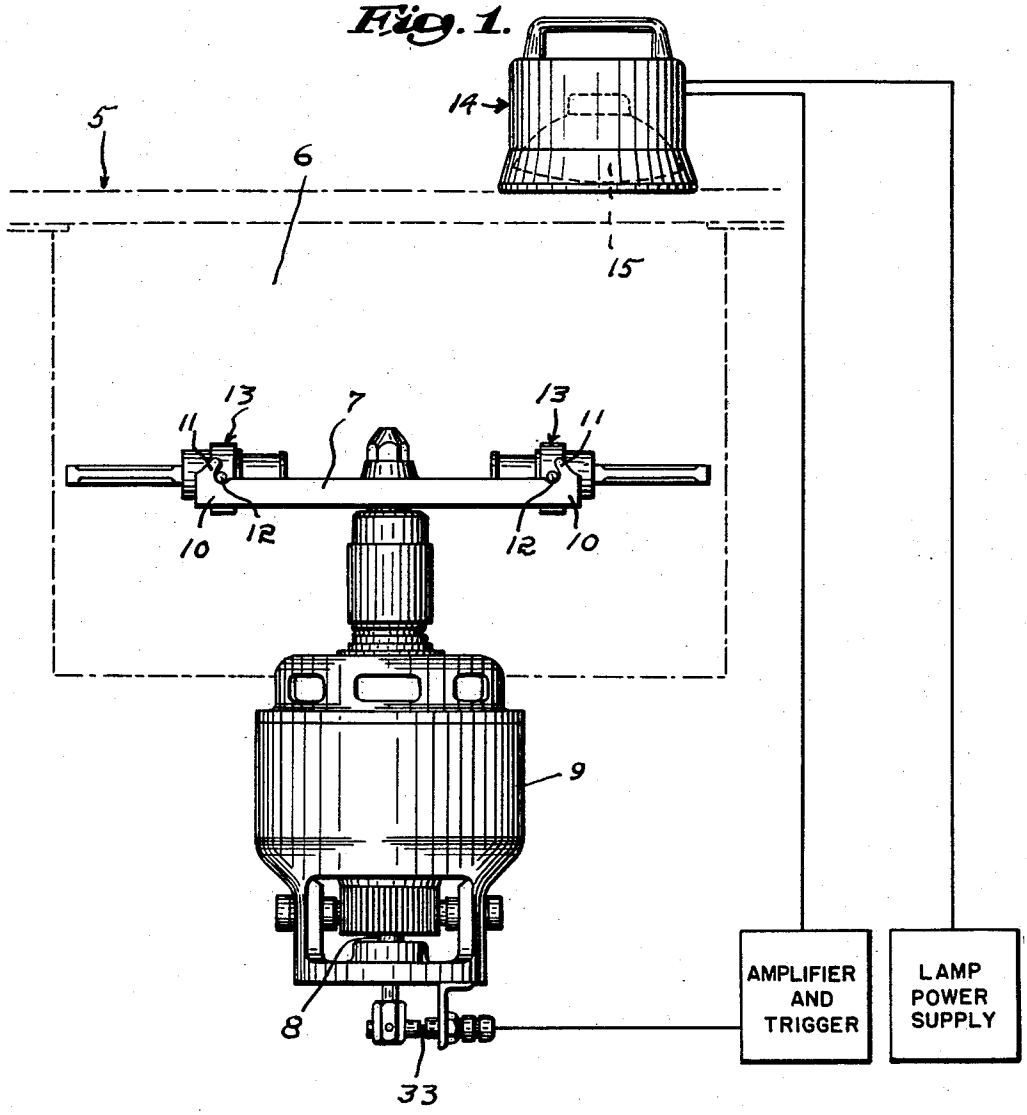
Jan. 12, 1965 S. F. MARCOTTE 3,165,669

TRIGGERING MEANS FOR STROBOSCOPIC DEVICES

Filed Aug. 11, 1961 2 Sheets-Sheet 1

Fig. 1.



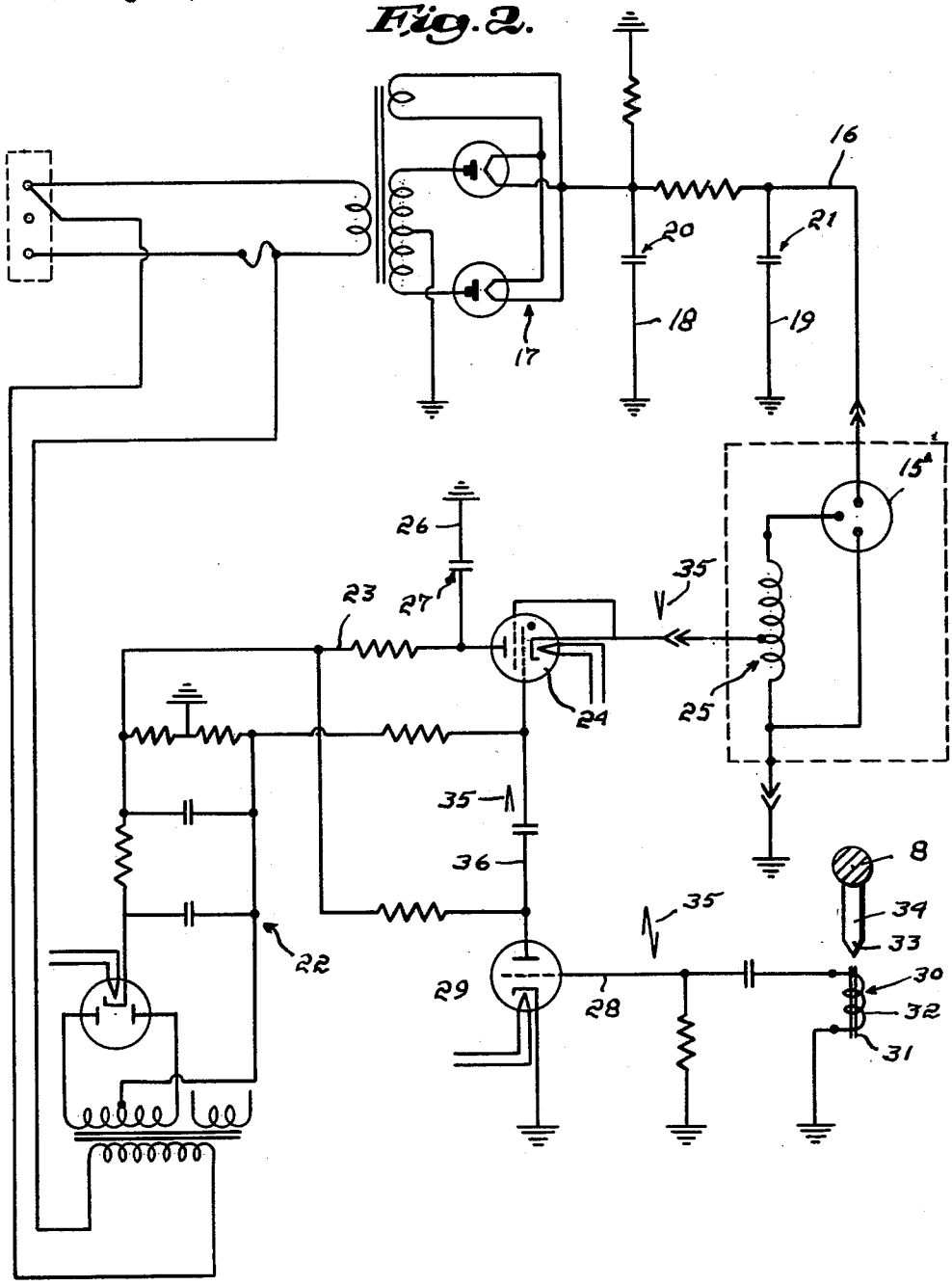
Inventor:
Stephen F. Marcotte,
by Abbott Spear,
Attorney

Jan. 12, 1965 S. F. MARCOTTE 3,165,669

TRIGGERING MEANS FOR STROBOSCOPIC DEVICES

Filed Aug. 11, 1961 2 Sheets-Sheet 2

Fig. 2.



Inventor:
Stephen F. Marcotte,
by Albert Spear
Attorney

United States Patent Office 3,165,669 Patented Jan. 12, 1965

3,165,669

TRIGGERING MEANS FOR STROBOSCOPIC DEVICES

Stephen F. Marcotte, Norfolk, Mass., assignor to International Equipment Company, Boston, Mass., a corporation of Massachusetts

Filed Aug. 11, 1961, Ser. No. 130,924
1 Claim. (Cl. 315—237)

The present invention relates to stroboscopes, particularly those for use with instruments operating at high speeds and associated electronic circuitry.

While stroboscopes in accordance with the invention are adapted for other uses, they are herein discussed with particular reference to their use in centrifuges. In centrifuges, it is frequently desired to observe the effects of a high centrifugal field on a sample and presently available stroboscopes do not provide sufficient illumination to permit observations to be made with sufficient clarity.

It is the general objective of the invention to eliminate this objectionable limitation and, in accordance with it, that objective is attained by providing, in combination, a rotatable member and a stroboscopic device. The rotatable member has an interceptor including a point disposed at right angles to the axis of rotation. The stroboscopic device has a flash tube in a first circuit supplying a potential less than the threshold voltage requirement of that tube and includes a grounded lead provided with a capacitor.

A normally inactive, gas discharge tube and a transformer are in a second circuit provided with a grounded lead including a capacitor and with the transformer being connected to the flash tube. Discharge from the discharge tube is operative to reduce the threshold voltage requirement of the flash tube to a level satisfied by the potential of the flash tube circuit, the capacitor of the first circuit then discharging to provide a surge resulting in the desired brightness of the resulting flash.

The second circuit is controlled by a third circuit provided with an electromagnetic field developing unit consisting of a permanent magnet within a coil arranged and disposed to establish a field to be cut by the interceptor point thus to generate a pulse of approximately right angular leading edge and having positive and negative halves. The third circuit also has an amplifier tube which is connected to the control grid of the discharge tube and functions to transmit one of the pulse halves thereto to render the discharge tube operative with the second circuit capacitor to provide energy for transmitting that pulse half to the flash tube.

In the accompanying drawings, there is shown an illustrative embodiment of the invention from which the above and other objectives, novel features, and advantages will be apparent.

In the drawings:

FIGURE 1 is a somewhat schematic side view of the centrifuge provided with a stroboscope in accordance with the invention, and

FIGURE 2 is a view of the circuitry.

A centrifuge is generally indicated at 5 by dot-dash lines and is shown as having a chamber 6 in which there is a head 7 fast on the shaft 8 of the motor 9. The head 7 is shown as having a pair of oppositely disposed forks 10 with each fork provided with a pair of shoulders 11 for retaining the transverse pivots 12 of sample supports 13 which are shown as they would be positioned with the centrifuge in operation and with each passing under the generally indicated holder 14 for the flash tube 15.

The flash tube 15 is in a first circuit 16 from a full-wave power supply 17 which is conventional and hence is not detailed. The circuit 16 has parallel, grounded leads 18 and 19 provided with capacitors 20 and 21, respectively and is connected to the cathode electrode of the flash tube 15 with the anode electrode grounded. The capacitor 20 has a substantially greater capacity than the capacitor 21 and the former is sometimes referred to as the "reservoir" capacitor. The potential supplied by the circuit 16 is less than the threshold voltage requirement of the flash tube 15 so that normally the flash tube 15 is not ionized.

A second, full-wave power supply is generally indicated at 22 and as it is conventional it is not herein detailed. The power supply 22 includes a second circuit 23 which has a normally inactive, gas discharge tube 24 and a pulse transformer 25 connected to the control element of flash tube 15. The circuit 23 also includes a grounded lead 26 provided with a capacitor 27 whose charge is released when the tube 24 discharges, such discharges being triggered by a third circuit 28 shown as connected to the power supply 22 and includes an amplifier tube 29 and an electromagnetic field developing unit 30 consisting of a permanent magnet 31 within a coil 32 and operative to produce a field that is cut by the tapered point 33 of an interceptor 34 shown as carried by the lower end of the motor shaft 8. The electro-magnetic field developing unit 30 is disposed within the centrifuge in close proximity to the rotatable shaft 8.

The point 33 is effective to induce a voltage pulse, indicated at 35, in the third circuit 28, each time it cuts the field established by the unit 30, the pulse 35 being characterized by approximately right angular leading edges for both its positive and negative halves. The amplifier tube 29 is connected by a lead 36 to the control grid of the discharge tube 24 and is operative to clip and transmit one of the pulse halves to trigger the discharge tube 24. Upon conduction of tube 24 the capacitor 27 discharges through the tube and pulse transformer 25 to induce a high peaked voltage which is added to the voltage potential already supplied by the first circuit 16 to the flash tube electrodes. This peak pulse is applied to the control element of flash tube 15 and results in instantaneous ionization of same. Capacitor 21 in the voltage supply circuit 16 then discharges rapidly through flash tube 15 to produce the high degree of luminosity of the resultant intense flash. Because of the high rate of rotation of the motor shaft 8, it is desirable to ensure that the capacitor 21 is again quickly charged and this is ensured by the discharge of the reservoir capacitor 20.

From the foregoing it will be apparent that the use of a tapered point on the interceptor ensures the generation of pulses whose leading edges are steeply inclined and preferably approaching as nearly as possible a right angular relationship thus to ensure precision control of the triggering of the flash tube and the maximum luminosity for the observation of rapidly revolving objects in modern day high speed centrifuges.

I claim:

In a centrifuge device having a rotatable shaft member, the combination including stroboscopic means for illumination of revolving objects at high speeds together with associated electronic circuitry and triggering means for actuation of the stroboscopic means communicating with said rotatable member; said stroboscopic means comprising a flash tube including an anode, cathode and control element and having a predetermined threshold voltage potential requirement; a first circuit series connected to said cathode and including a power supply, first and second parallel grounded leads intermediate said supply and said cathode with said first lead including a large capacity reservoir capacitor and said second lead including a discharging capacitor, said anode of the tube being grounded, said first circuit supplying less voltage than the threshold voltage requirement of the flash tube; a second circuit connected to the control element of the

flash tube and including in series a normally non-conductive gas discharge tube having a cathode connected to the control element of said flash tube, anode, control and suppressor grids, a second power supply with output terminals connected to said anode and control grid, a parallel grounded lead having a capacitor connected to said anode, and a pulse transformer whose primary winding is interconnected to the suppressor grid and whose secondary winding is connected across the anode and the control element of the flash tube; a third circuit including in series an electromagnetic field generating means comprising a permanent magnet and coil arrangement disposed in close proximity to said centrifuge rotatable member, an amplifier tube including an anode, cathode and control element, the anode being interconnected to the control grid of said discharge tube and said second power supply and the control element being connected to said field; said triggering means comprising an interceptor arm disposed at right angles to the axis of said rotatable member and defining a tapered point, said interceptor point rotating to intermittently cut the electromagnetic field to thereby generate a pulse having an approximately

right angular leading edge and a postive and negative polarity halves; said third circuit transmitting only the pulse halves of negative polarity to ionize said gas discharge tube; said second circuit capacitor discharging upon conduction of said discharge tube to transmit a voltage pulse through the pulse transformer to render the flash tube conductive; said first circuit capacitor connected to said second lead discharging rapidly upon incidence of conduction of the flash tube to result in a highly intense luminous discharge at the precise moment a revolving object is displaced beneath the stroboscopic means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,490,960	Hanchett	Dec. 13, 1949
2,955,232	Hosking et al.	Oct. 4, 1960

FOREIGN PATENTS

1,097,267	Germany	Jan. 12, 1961
1,227,228	France	Aug. 19, 1960