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ELECTRONIC FLASH TUBE APPARATUS

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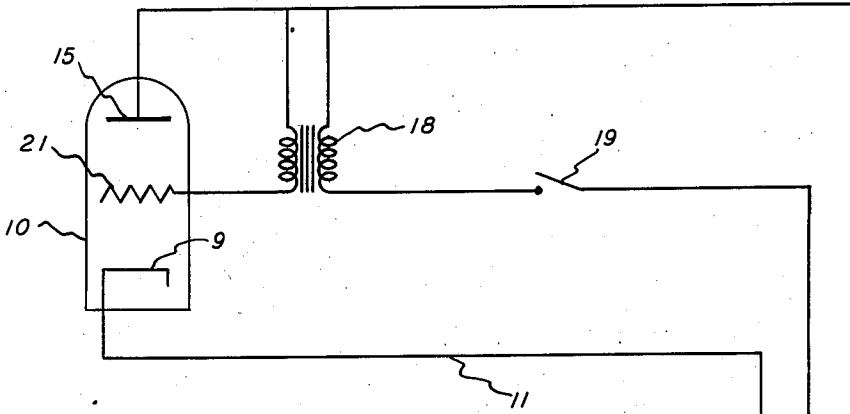
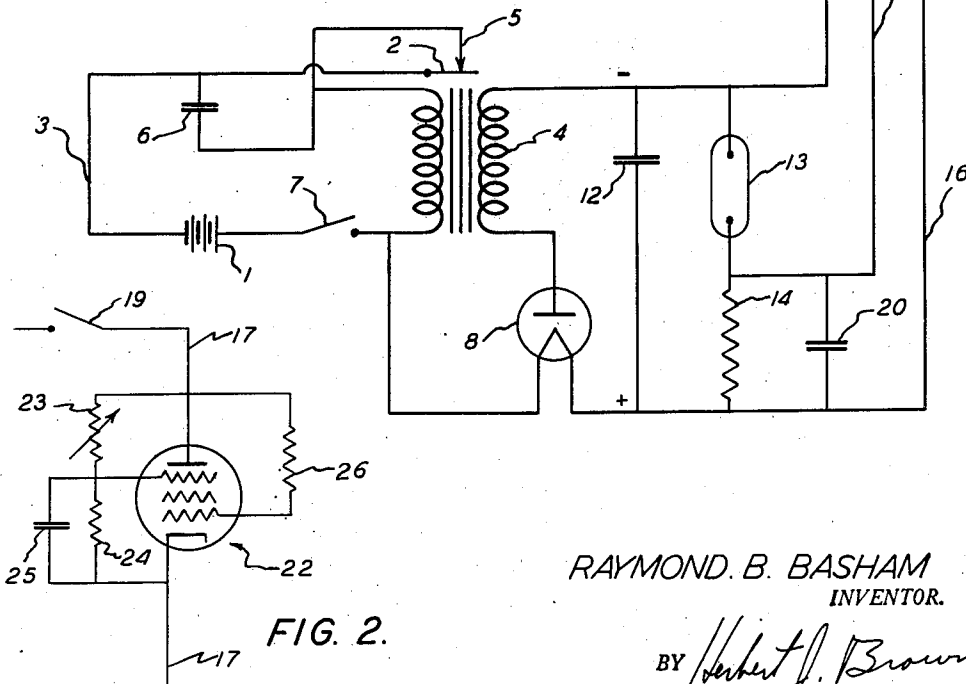


FIG. 1.



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ELECTRONIC FLASH TUBE APPARATUS

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1 Claim. (Cl. 315-238)

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This invention relates to photographic equipment, and has reference to repeating electronic flash tube apparatus.

An object of the invention is to provide improvements in apparatus of the referred to class whereby higher efficiency is attained, and wherein there is less drain on the battery of the device.

Another object of the invention is to provide, in a flash tube apparatus, higher voltage stability, i. e., to provide means whereby the voltage delivered at the flash tube will not vary.

Another object of the invention is to provide means in apparatus of the referred to class whereby the flash tube cannot be operated unless the delivered voltage is high enough to produce sufficient light output and thus prevent underexposure of the film.

A further object of the invention is to provide a light-weight and small power pack unit for operating flash tubes attached to cameras.

These and other objects will become apparent from the accompanying drawing, wherein:

Figure 1 is a wiring diagram of an exemplary form of the invention, and

Figure 2 is a wiring diagram of an electronic synchronizer which may be used in conjunction with flash tube apparatus, such as illustrated in Figure 1.

The numeral 1 designates a source of power such as a battery or the like. The negative terminal of the battery is connected with a vibrator reed 2 which is preferably short and stiff to produce a high peak wave form.

The reed 2 is positioned for operation with a vibrator transformer 4 and the vibrator point 5 of which is connected with the primary of the said transformer and, in turn, is connected with a condenser 6 between the said primary and the vibrator reed connection 3. A power switch 7 is connected between the positive terminal of the battery 1 and the primary of the transformer 4.

The secondary of the transformer 4 is connected with the anode of a rectifier 8, whereas the other end of the said secondary is connected with the cathode 9 of the flash tube 10 to be operated by means of a connecting wire 11. Another condenser 12 stores energy for discharging the flash tube 10 and is connected in parallel between the cathode of the rectifier 8 and the secondary connecting wire 11. Similarly, a gas filled discharge tube 13 and resistor 14, connected in series with respect to each other, are also connected in parallel with the said secondary wire 11 and cathode of the rectifier 8, the said discharge tube and resistor together forming a voltage regulator.

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The cathode of the rectifier 8 is connected with the anode of the flash tube 10 by means of a connecting wire 16. Another wire 17 is connected between the discharge tube 13 and resistor 14 and is connected with the primary of an ignition coil 18 after passing through a momentary trip switch 19. A condenser 20 is connected in parallel between the wire 16 and the induction coil lead 17, preferably near the resistor 14 for compactness.

Both the primary and secondary of the ignition coil 18 are connected with the wire 16 at corresponding ends, whereas the remaining end of the ignition secondary is connected with the igniter electrode 21 of the flash tube 10.

By closing the power switch 7, the transformer 4 is energized and its magnetic field excites the reed 2. The reed 2 is normally in contact with the vibrator point 5. The condenser 6 tunes the transformer 4 to the natural frequency of the vibrator reed 2. By reason of the described short stiff reed, the frequency of the vibrator is set to produce a high peak wave form in the transformer secondary. Since this peak is of a uni-directional polarity, it makes possible a low inverse voltage when used with a half-wave rectifier. The high peak wave thus formed is regulated by the discharge tube 13 and resistor 14. The electrodes of the discharge tube 13 are so spaced that the said tube does not start to discharge until the desired voltage is reached. The resistor 14 is adjusted to draw enough current through the discharge tube 13 to maintain an equilibrium with the source of power 1. The condenser 20 across the resistor 14 charges up to the voltage drop that appears across the said resistor when the discharge tube 13 conducts. By closing the momentary trip switch 19, the condenser 20 is discharged, and thus energizes the flash tube 10.

It is to be understood that the momentary trip switch 19 is connected for coaction with the shutter of a camera (not shown).

The novel electronic synchronizer, illustrated in Figure 2, may be connected in the wire 17 between the trip switch 19 and the condenser 20. The tube illustrated is a cold cathode thyratron and is generally referred to by the numeral 22, and is herein referred to as a trigger tube. The control grid of the tube 22 is connected with the anode of the same through a variable resistor 23. Similarly, the control grid is connected with the cathode of the tube 22 through a resistor 24 which has a condenser 25 connected across the last referred to resistor 24. A keep-alive current limiting resistor 26 is connected in series between the anode and the cathode of the tube 22.

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When the trip switch 19 is closed, the anode of the trigger tube 22 will be immediately made positive with respect to the cathode. The condenser 25 then starts to charge, making the control grid of the tube 22 go from zero voltage to some positive voltage approaching that of the anode. The gas in the tube 22 will then break down and the tube will conduct. The condenser 20, previously referred to, is then discharged into the primary of the ignition coil 18, and causing the flash tube 10 to be energized. The time delay of the synchronizer 22 may be regulated by the variable resistor 23.

What I claim is:

A flash tube unit comprising: a grid controlled flash tube, a high voltage direct current supply including positive and negative terminals, a positive lead connecting said positive terminal with the anode of said flash tube, a negative lead connecting said negative terminal with the cathode of said flash tube, an ignition coil including primary and secondary windings, said secondary winding being connected between the grid and the anode of said flash tube, a condenser connected between said primary and said negative leads, a voltage regulator comprising a gas filled discharge tube and resistor connected with each

other in series and between said positive and said negative leads, and an ignition coil lead connected between said discharge tube and said resistor of said voltage regulator and with one end of said primary winding of said ignition coil, means connecting the remaining end of said primary winding of said ignition coil with the anode of said flash tube, a condenser connected between said positive lead and said ignition coil lead, and a switch within said ignition coil lead between said primary winding and the last said condenser.

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