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SPARK COMPRESSOR AND TRIGGER FOR SPARK DISCHARGE LIGHT

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Fig. 1

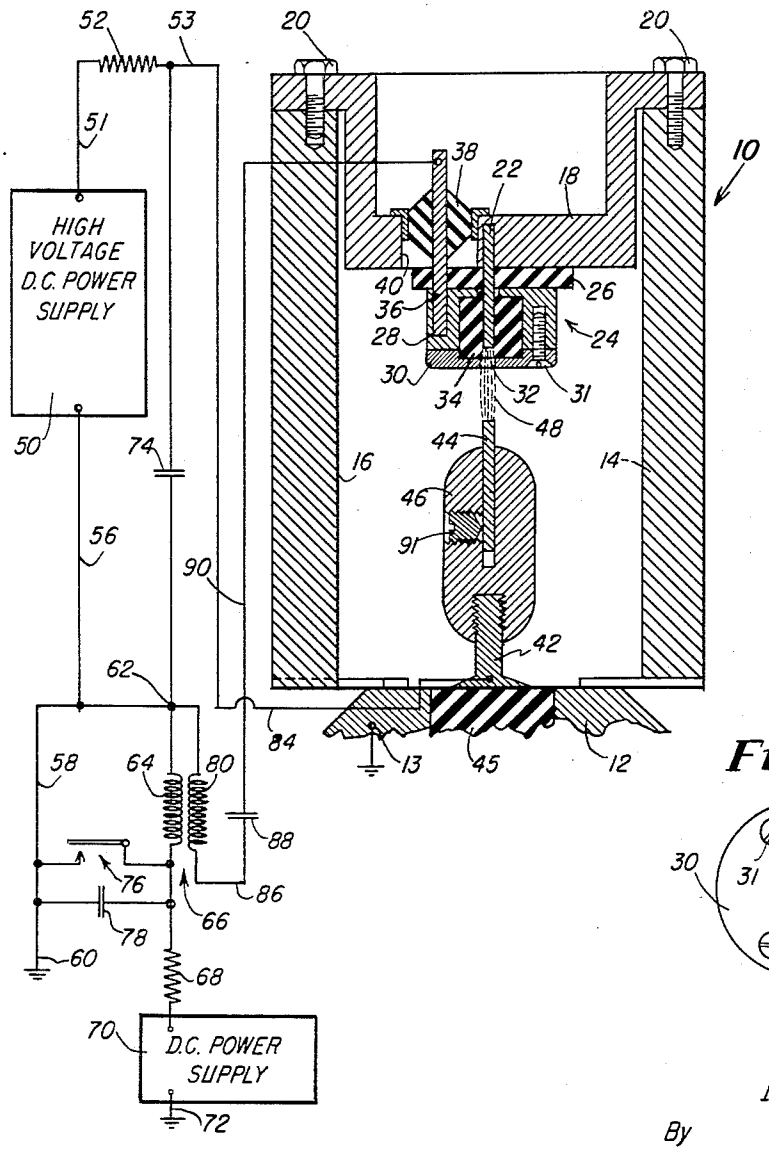
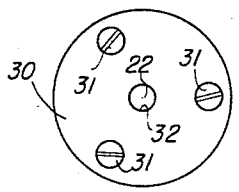


Fig. 2



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SPARK COMPRESSOR AND TRIGGER FOR SPARK DISCHARGE LIGHT

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5 Claims. (Cl. 313—205)

This invention relates to new and useful improvements in electric spark discharge lights, and more particularly to an improved spark discharge light in which one of the spark electrodes is recessed within a trigger electrode.

In recent years there have been developed improved electric spark discharge lights for producing high brightness and/or intensity light flashes of short duration. These spark discharge lights have proved to be very effective as high intensity light sources for photographic work, for stroboscopic observation, and for optical range finding equipment. In the electric spark discharge light, a high voltage D.C. power supply is used to charge an electrical condenser which is then discharged across a pair of spark electrodes. In some spark discharge lights, a trigger electrode is used to provide an ionized path for the initiation of the discharge of a spark between the main spark electrodes. In the development of spark discharge lights, one problem which has arisen and which has not been satisfactorily solved is that of the wandering of the electric spark. This wandering frequently causes the useably bright part of the discharge to occur outside the useful region.

It is therefore one object of this invention to provide an improved spark discharge light which is capable of producing a high brightness confined spark.

Another object of this invention is to provide an improved spark discharge light in which the spark discharge is compressed to provide a light flash of substantially higher brightness.

A feature of this invention is the provision of an electric spark discharge having a pair of spark discharge electrodes and a trigger electrode, with one of the spark discharge electrodes being recessed within the trigger electrode.

Another feature of this invention is the provision of a spark discharge light having a pair of spark discharge electrodes and a trigger electrode having an aperture extending therethrough with one of the spark discharge electrodes being recessed in said aperture and insulated from the trigger electrode.

Other objects and features of this invention will become apparent from time to time throughout the specification and claims as hereinafter related.

In the accompanying drawings, to be taken as a part of this specification, there is clearly and fully illustrated a preferred embodiment of this invention, in which drawings:

Fig. 1 is a view in cross-section of an improved spark discharge light and showing a schematic wiring diagram for the light, and

Fig. 2 is a plan view of the trigger electrode and recessed spark electrode of the spark discharge lamp shown in Fig. 1.

This invention comprises an improved spark discharge light having a pair of spark discharge electrodes and a trigger electrode. In this spark discharge light the trigger electrode is of cylindrical or cup-shaped construction, having a central aperture aligned with an aperture in insulating material adjacent thereto and having one of the spark discharge electrodes mounted concentrically with and spaced from the trigger electrode so that the spark discharge is compressed into the passage formed by the aperture in the insulating material and by the aperture in the trigger electrode. This structural restriction of a portion of the spark discharge path is operable to reduce wander of the spark and to confine the spark to produce a substantially greater intensity of light generated by the spark. The brightness of the spark in the aperture of the trigger electrode exceeds conventional spark discharge lights by 75 to 100 percent.

Referring to the drawings by numerals of reference and more particularly to Fig. 1 there is shown a spark discharge light assembly **10** which is mounted on a base **12** (which may be one end of the casing of a capacitor **74**) which is grounded as at **13**. The base **12** has supporting and conducting members **14** and **16** mounted thereon which support at their other end a cup-shaped supporting and conducting member **18** which is held in position by a plurality of bolts or screws **20**. The supporting member **18** supports a spark discharge electrode **22** which extends into a trigger electrode assembly **24**. The trigger electrode assembly **24** is supported on the supporting member **18** and insulated therefrom by an insulating member **26**.

The trigger electrode assembly **24** consists of a cup-shaped metal base member **28** which may be of brass or copper and a disk-shaped trigger electrode **30** which is preferably of molybdenum and secured in place by a plurality of screws or bolts **31**. The spark electrode **22** is insulated from the trigger electrode assembly by an insulating member **26** and by a cylindrical insulating member **34** positioned within the cup-shaped supporting member **28** and the molybdenum trigger **30**. The trigger assembly **24** has an aperture **32** extending through the trigger **30** and the insulating member **34** which receives the spark electrode **22**. As shown in Fig. 1, the spark electrode is positioned with its blunt discharge end recessed in the insulating member so that it forms an inner end surface of the insulator aperture. The confined passage or channel thus formed is aligned with the trigger aperture and has a depth dimension on the order of the cross sectional diameter of the insulator aperture. The trigger electrode **30** is provided with an electrical connector **36** which extends into a recess in the supporting member **28** and which extends through an aperture **40** in the supporting member **18**. The electrical connector **36** is supported on an insulator member **38** in the aperture **40**. At the base portion of the spark light assembly there is positioned a threaded electrical connector **42** for a second spark discharge electrode **44**. The spark electrodes **22** and **44** may be made of tungsten. The spark discharge electrode **44** is supported by a metal cylinder **46** which provides for adjustment of the electrode **44** by means of the set-screw **91**. The connector **42** is insulated from the base member **12** by a supporting insulator **45**. When the spark discharge light is energized a spark discharge **48** will occur between the electrodes **22** and **44** in a manner which will be subsequently described.

The spark discharge light assembly **10** is provided with a high voltage D.C. power supply **50** which may produce a voltage of the order of 5,000 to 10,000 volts. The high voltage power supply **50** is connected through a lead **51** to one side of a resistor **52**, the other side of which is connected by a lead **53** to the connector **42** which provides an electrical connection to the spark discharge electrode **44**. The resistor **52** preferably has a high resistance of the order of 500,000 ohms. The other side of the high voltage power supply **50** is connected by electric leads **56** and **58** to ground as indicated at **60**.

The electrical lead **56** is also connected as at **62** to one end of the primary coil **64** of a spark coil assembly **66**. The other end of the primary coil **64** is connected to a resistor **68** which is in turn connected to a D.C. power supply **70** which is grounded as at **72**. The resistor **68** has a resistance of the order of 47,000 ohms and the D.C. power supply is of the order of 150 volts. There is also provided a capacitor **74** which may have a capacitance of the order of 0.5 mfd. and rated at 5,000 volts, connected between the lead **53** at the end of the resistor **52** and the ground connection point **62** at one end of the primary coil **64**. A switch means **76** is connected from a point between the primary coil **64** and resistor **68** to the lead **58**. The switch means **76** is shown as a simple switch but in most assemblies would preferably be a switch tube circuit arrangement of known design. There is also provided a capacitor **78**, having a capacitance of the order of 0.1 mfd. and rated at 200 volts, connected in parallel with the switch means **76** from a point between the coil **64** and resistor **68** to a point on the lead **58**.

The spark coil **66** has a secondary coil **80** which is connected to the point **62** which provides a ground connection. The other end of the secondary coil **80** is connected by the lead **86** to one side of the capacitor **88** the other side of which is connected by a lead **90** to the connector **36** for the trigger electrode assembly **24**. The capacitor **88** preferably has a capacitance of the order of 0.001 mfd. and rated at 5,000 volts.

Operation

The circuit which has been described for this electric discharge spark light assembly is a standard circuit for spark discharge lights and functions in a standard manner. The capacitor **74** is charged from the high voltage power supply **50**. The capacitor **78** is charged from the low voltage power supply **70**. When the switch means **76** is closed the capacitor **78** is discharged and a current pulse passes through the primary coil **64** of the spark coil assembly **66**. The pulse of current through the primary **64** causes a high voltage electric pulse to be induced in the secondary coil **80** and passed through the leads **86** and **90** and capacitor **88** to the connector **36** for the trigger electrode **24**. The circuit for the electric pulse from the secondary coil **80** is completed through the ground connection point **62** which is in common with ground **13** for the spark electrode **22**. The electric pulse from the secondary coil **80** causes a spark to jump between the trigger electrode **30** and the spark electrode **22**.

The spark discharge from the trigger electrode causes an ionized path to be produced which permits the discharge of a high intensity spark between the spark electrodes **22** and **44**. When the trigger electrode fires its spark the capacitor **74** discharges through the spark electrodes **22** and **44** to produce a high intensity spark therebetween. Because of the fact that the electrode **22** is recessed in the aperture or passage **32** in the insulator **34** the tendency of the electric spark **48** to expand is restricted, and the spark in effect is compressed and a spark light of substantially higher brightness is formed. The brightness of a spark discharge light has been found to be greater immediately adjacent to the trigger electrode. Since the spark discharge in this assembly occurs between the electrode **44** and the electrode **22** which is recessed within the trigger electrode **24** and insulator **34**, the entire spark must pass through the hole in trigger electrode assembly **24** and a higher light brightness is thus obtained. In this spark light assembly the light which is generated in the aperture **32** in the trigger electrode assembly **24**, has an intensity which is 75 to 100 percent greater than the light generated by an ordinary spark discharge light having exposed electrodes with a simple trigger electrode positioned adjacent to one of the spark discharge electrodes.

At various points in this specification, specific resistances, voltages, and capacitances were given for various power supplies, resistors and capacitors. It is to be understood that these specific values were intended to illustrate a particular operating example of this invention. It is obvious that any electrical engineer skilled in this art could select or design an electric circuit using other voltages, resistances, and capacitances than those specifically mentioned herein. This spark light assembly should therefore be considered to be applicable for use with any suitable energizing circuit.

We claim:

1. A spark discharge device including in combination, first and second spark electrodes having spaced ends and adapted to be connected in a high voltage circuit for discharge of a high energy spark in a path between said ends, a trigger electrode having an aperture therethrough and positioned between the spaced ends of said spark electrodes with said aperture aligned with the spark path for passage of a spark discharge therethrough, insulating means surrounding one of said spark electrodes and having a portion extending toward the other spark electrode with an aperture therein aligned with said aperture in said trigger electrode, said apertures constituting a channel having dimensions to confine the spark discharge therein for increasing the brightness level of said high energy spark discharge passing therethrough, and said trigger electrode being adapted to be connected in a high voltage trigger circuit to initiate an ionizing spark to trigger a discharge between said spark electrodes.

2. A spark discharge device for producing high energy pulsed light, said device including in combination, first and second spark electrodes having spaced ends defining a spark discharge path therebetween, insulating means surrounding said first spark electrode and having an elongated aperture therethrough, said first spark electrode being positioned in said aperture with its end terminating within said insulating means, said aperture having such dimensions to confine a high energy spark discharge passing therethrough for increasing the brightness level thereof, a trigger electrode positioned adjacent said aperture, said spark electrodes being adapted to be connected in a high voltage discharge circuit, and said trigger electrode and said second spark electrode being adapted to be connected in a high voltage trigger circuit for initiating an ionizing spark to trigger a high energy spark discharge through said aperture and between said spark electrodes.

3. A spark discharge device including in combination, first and second spark electrodes having spaced ends, a trigger electrode having a disk shaped portion, a cylindrically shaped insulator adjacent said disk shaped portion, said disk shaped portion of said trigger electrode and said insulator having aligned apertures therethrough having substantially the same cross section area as the cross section area of the said first and second electrodes, said apertures constituting a channel having such dimensions to confine the spark discharge therethrough for increasing the brightness thereof, said first electrode being positioned in said insulator with its end terminating within said insulator aperture, said spark electrodes being adapted to be connected in a high voltage capacitive discharge circuit, and said trigger electrode and said second spark electrode being adapted to be connected in high voltage capacitive discharge circuit to initiate an ionizing spark to trigger a discharge through said channel between said spark electrodes.

4. A spark discharge device as defined in claim 3 in which said first and second spark electrodes are formed of tungsten and said first electrode is positioned with its end terminating within said insulator so that the depth of the insulator aperture is on the order of the cross sectional diameter of said insulator aperture.

5. A spark discharge device for producing high energy pulsed light, said device including in combination, first and second spark electrodes having spaced ends defining a spark discharge path therebetween, insulated means

having an elongated aperture therethrough, said means being positioned adjoining the discharge end of said first spark electrode with said discharge end forming one end of said aperture of said insulating means, said aperture having such dimensions to confine a high energy spark discharge passing therethrough for increasing the brightness level thereof, a trigger electrode positioned adjacent the other end of said aperture, said spark electrodes being adapted to be connected in a high voltage discharge circuit, and said trigger electrode and said second spark electrode being adapted to be connected in a high voltage trigger circuit for initiating an ionizing spark to trigger a high energy spark discharge through said aperture and between said spark electrodes.

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