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CONTINUOUS IONIZATION OF FLASH LAMPS

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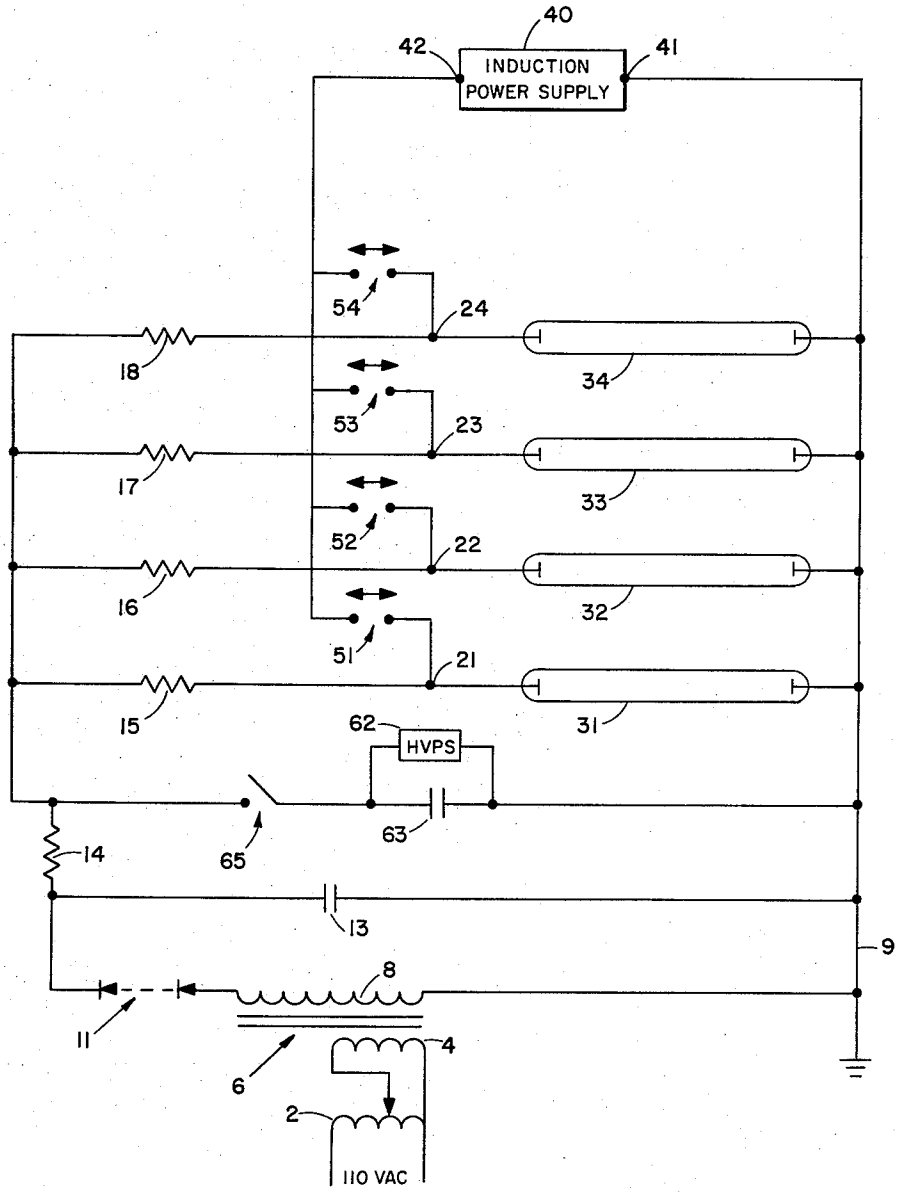

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CONTINUOUS IONIZATION OF FLASH LAMPS

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The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment of any royalty thereon.

This invention relates to the ionization of flashlamps. More particularly this invention relates to the ionization of flashlamps for laser application when used with an induction power supply.

The recent developments in laser experimentation have led to a need for higher power. In high-power applicaitons, a capacitance storage bank power supply becomes uneconomical because of large storage space and cost. The use of an induction power supply, therefore, becomes more feasible than the conventional capacitance storage bank since it can store more energy in less space and more economically. Since the voltage from an induction supply is not extremely high, it is necessary to use the laser flash-lamps in a parallel connection rather than series connection.

This arrangement creates complications in the simultaneous triggering of the lamps. The conventional high voltage pulse trigger can not be used successfully since a parallel arrangement allows one lamp to trigger earlier than the others. This lamp, consequently, absorbs all the energy with a resulting explosion. The lamps, therefore, must all be completely ionized when the coil of the induction power source releases its energy.

It is, therefore, an object of this invention to provide a lamp trigger circuit suitable for use with flash-lamps used in high power laser research.

Another object of this invention is to provide a circuit which will completely ionize lamps, connected in parallel, at the same instant of time.

A further object of the present invention is to utilize an induction power source to supply a plurality of lamps.

These and other objects and advantages of the present invention will become apparent from the following detailed description and from the accompanying drawing, in which the single figure is a schematic circuit diagram according to the invention.

A 110-volt A.C. power supply is connected across auto transformer **2**, and in turn is connected across primary winding **4** of transformer **6**. Transformer **6** produces 3,000 volts across a secondary winding **8** which has one end connected to a common lead **9**, and the other end connected to one end of a rectifier unit **11**. A capacitor **13** is connected across the rectifier unit and secondary winding **8** for filtering the 3,000 volts output of the rectified circuit.

The other end of the rectifier unit is connected through resistor **14** to one side of each of resistors **15**, **16**, **17** and **18**. The other sides of resistors **15**, **16**, **17** and **18** are connected respectively to terminals **21**, **22**, **23** and **24**. Four flash-tubes or lamps **31**, **32**, **33** and **34** are shown having first and second ends. The first ends of lamps **31**, **32**, **33** and **34** are connected to terminals **21**, **22**, **23** and **24** respectively. The other ends of the lamps are connected to lead **9**. The lamps supply the energy to a laser rod, not shown.

An induction power supply **40** is shown in the figure as having two output terminals **41** and **42**. Terminal **41** is connected to lead **9**. Terminal **42** is connected to one side of each of adjustable spark gap means **51**, **52**, **53**, and **54**. The adjustable spark gaps isolate the output of the transformer from the induction power supply. The other sides of the spark gap means are connected to terminals **21**, **22**, **23** and **24** respectively.

A high voltage supply **62** is connected across capacitor **63** to charge this capacitor to a high voltage in the order of 25,000 volts. Switch **65** connects one side of capacitor **63** to one side of resistors **15**, **16**, **17** and **18**. The other side of capacitor **63** is connected to lead **9**. The high voltage source **62** may be of any conventional high voltage, low energy source such as a capacitance storage bank.

The spark gap means must be adjustable between two settings; one for the 25,000 volts across the lamps by the capacitor **63** before ionization; and one for a final setting of approximately 1000 volts by the transformer **6** after ionization.

In the operation of the invention, first the switch **65** is set in its open position; the spark gap means are set in their high voltage position; and capacitor **63** is charged to approximately 25,000 volts by high voltage power supply **62**. Next switch **65** is closed and the lamps are ionized by the discharge from capacitor **63**. Resistor **14** keeps the capacitor **63** from discharging through capacitor **13**, and rectifier **11** prevents capacitor **63** from discharging through winding **8**. Once the lamps are ionized they are kept in a pre-ionization state by the 3,000 voltage source.

With the lamps in this pre-ionization state they may now be brought into complete ionization by a much smaller voltage souce. The spark gaps are now set in their low voltage position which is sufficient to isolate the voltage from transformer **6**.

Induction power supply **40** is now fired to ionize the lamps and provide the power for the rod, not shown, in the laser experiment. When the induction power supply releases its energy, the voltage across spark gaps **51–54** quickly rises above breakdown and the coil energy is applied to the lamps **31–34** simultaneously; resulting in their complete excitation at the same instant of time.

Resistors **15–18** will limit the amount of current flowing in the lamps (once they are ionized) to a reasonable level of approximately twenty millamperes. The spark gap means **51–54** are necessary to prevent the voltage across secondary winding **8** from passing directly to ground through the induction power source.

Although this invention has been described as supplying a plurality of lamp loads, it is obvious that the invention can be used to supply a single lamp load. In such as circuit elements **16–18**, **32–34** and **52–54** would be omitted.

While the invention has been described with reference to a preferred embodiment thereof, it will be apparent that various modifications and other embodiments thereof will occur to those skilled in the art within the scope of the invention. Accordingly, we desire the scope of our invention to be limited only by the appended claims.

We claim:

1. A lamp circuit comprising at least two lamps, each having a first and a second terminal; means connecting the first terminals of each of said lamps to a common lead; a first source of voltage having third and fourth terminals; separate connection means from the second terminal of each lamp to the third terminal of said first source of voltage; means connecting the fourth terminal to said common lead; a second source of voltage having fifth and sixth terminals; separate isolation circuit means connecting the second terminal of each lamp to said fifth terminal of the second source; means connecting the sixth terminal of said second source to said common lead; and a third source of voltage connected in parallel with said with said first source of voltage so as to trigger the ionization of said lamps.

2. A lamp circuit as set forth in claim 1, wherein said isolation means are spark gap means.

3. A lamp circuit as set forth in claim 2, wherein said spark gap means are adjustable.

4. A lamp circuit as set forth in claim 3, wherein said separate connection means are resistors.

5. A lamp circuit as set forth in claim 4, wherein said second source of voltage is an induction power source.

6. A lamp circuit comprising a lamp having a first and a second terminal; means connecting the first terminal of said lamp to a common lead; a first source of voltage having third and fourth terminals; connection means from the second terminal of the lamp to the third terminal of said first source of voltage; means connecting the fourth terminal to said common lead; a second source of voltage having fifth and sixth terminals; isolating circuit means connecting the second terminal of the lamp to said fifth terminal of the second source; means connecting the sixth terminal of said second source to said common lead; and a third source of voltage connected in parallel with said first source of voltage so as to trigger the ionization of said lamp.

7. A lamp circuit as set forth in claim 6, wherein said isolating circuit means is a spark gap means.

8. A lamp circuit as set forth in claim 7, wherein said connection means to the third terminal of the first source of voltage is a resistor.

9. A lamp circuit as set forth in claim 8, wherein said second source of voltage is an induction power source.

10. A lamp circuit as set forth in claim 9, wherein said third source of voltage is a charged capacitor.

11. A lamp circuit comprising at least two lamps, each having a first and a second terminal; means connecting the first terminals of each of said lamps to a common lead; a first source of voltage having third and fourth terminals; separate connection means from the second terminal of each lamp to the third terminal of said first source of voltage; means connecting the fourth terminal to said common lead; and induction power source having fifth and sixth terminals; separate spark gap means connecting the second terminal of each lamp to said fifth terminal of the induction power source; means connecting the sixth terminal of the induction power source to said common lead; and a further source of voltage connected in parallel with said first source of voltage so as to trigger the ionization of said lamps.

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