Jan. 10, 1967 W. N. SCHEPPE 3,297,912

LIGHT SOURCE FOR PHOTOGRAPHIC PRINTER

Filed Jan. 28, 1964 2 Sheets-Sheet 1

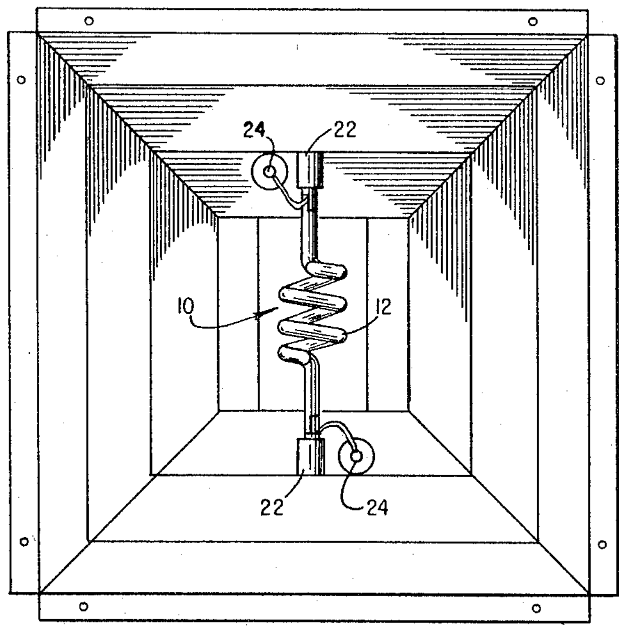

Fig: 1

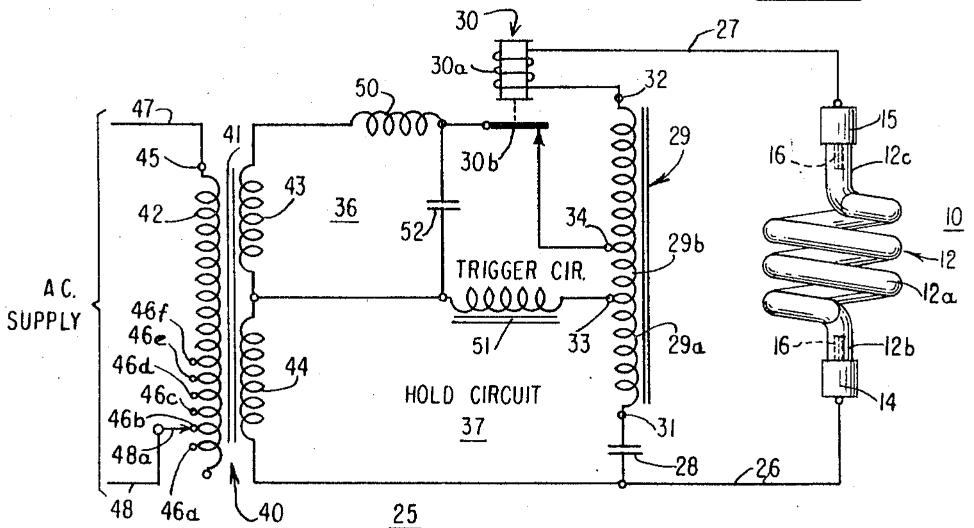

Fig: 2

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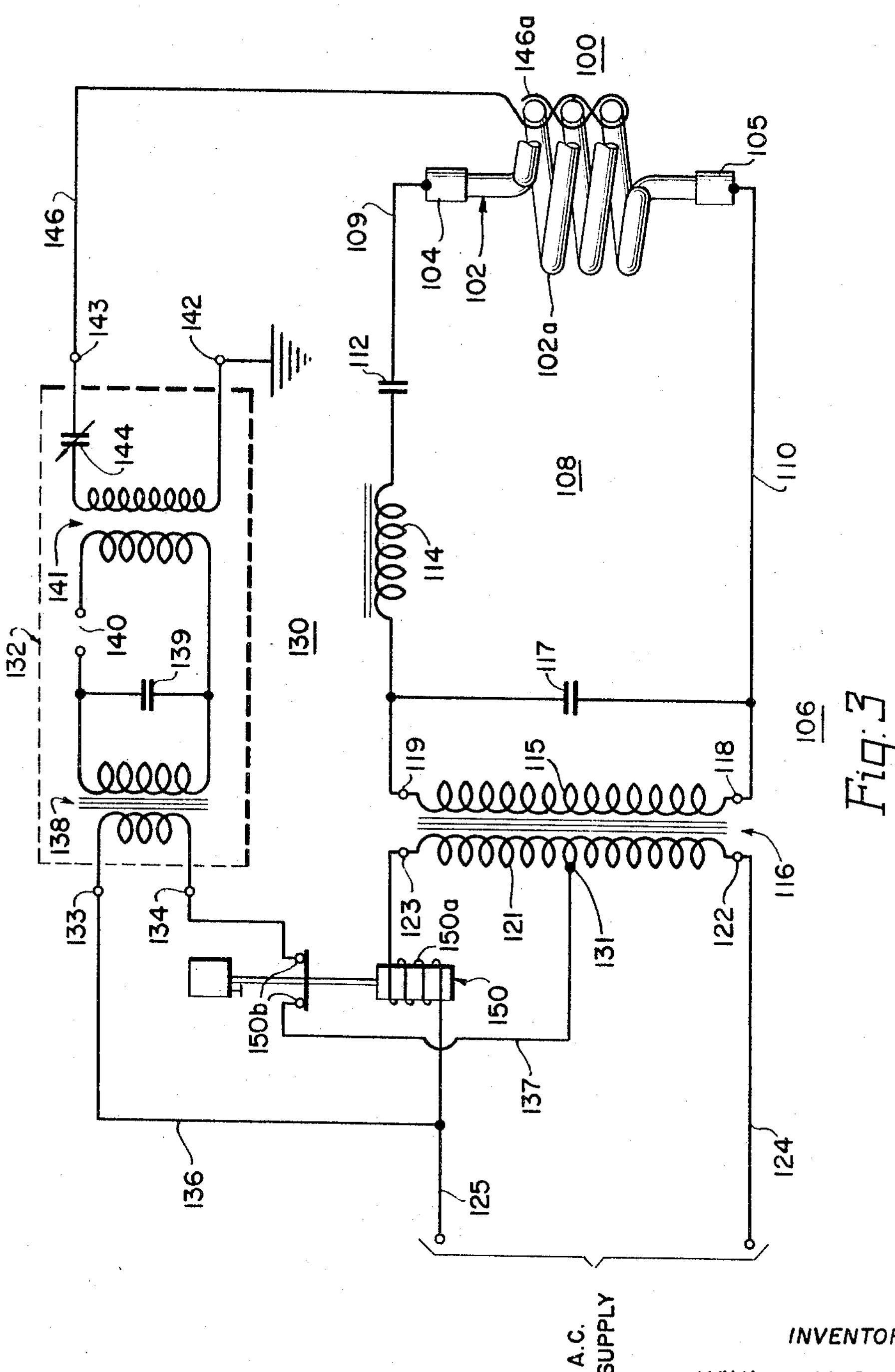

Fig. 3

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LIGHT SOURCE FOR PHOTOGRAPHIC PRINTER

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11 Claims. (Cl. 315—238)

This invention relates to light sources, and more particularly to such light sources and power supplies therefor of the type adapted for exposing sensitized metal plates in a process for photoengraving offset plates or for general photographic purposes.

In the process of producing offset printing plates, customarily a transparent negative image is produced; and this negative film is interposed between a sensitized metal plate and a light source associated with a reflector. It has been found that a light source disposed over a substantial area causes the image produced thereby to be distorted. This is particularly true if the emulsion side of the film is not in perfect contact with the photosensitive surface of the sensitized plate. Consequently, best results have only been attainable with a concentrated light source. Thus, a point source of light would be ideal.

In the past a carbon arc has been the only satisfactory light source. While a carbon arc is sufficiently concentrated to produce a good image, it has certain disadvantages due to the smoke and soot which it necessarily produces, and due to the constant replacement thereof necessary. One arrangement is disclosed in Benson Pat. No. 3,043,204, granted July 10, 1962, and assigned to the same assignee as the instant application.

In place of the carbon arc, it has been suggested that an electric discharge or arc lamp of the type comprising an envelope containing xenon or similar inert rare gas of relatively high atomic weight be used as the light source. As is well known, this type of lamp is generally in the shape of a long slender tube. Moreover, the length of this tube determines the allowable wattage which the lamp can dissipate. Obviously, to produce the high light intensity necessary, a long envelope or tube is required which will not comprise substantially a point source of light. Thherefore although the xenon lamp would eliminate the problems of smoke and soot, its use has heretofore been unsatisfactory because it has not produced a sufficiently concentrated light source. It would be desirable to have a xenon or other similar arc lamp, wherein a tube length of eighteen to thirty-six inches could be concentrated in a space between two and three inches on a side. Moreover, it would be desirable for such lamp to produce illumination as good as that previously obtained with the carbon arc.

To effectively operate an arc lamp of the type filled with xenon or other rare gas for the purpose mentioned above, it is necessary to provide a power supply which delivers a peaked waveform consisting of a series of instantaneous pulses which discharge through the lamp. Due to the negative resistance characteristics of such arc lamps, whereby a high voltage is necessary to ionize the gas within the lamp, is also necessary to provide a high initial voltage in order to start the lamp. To this end a power supply for xenon or a similar arc lamp should include an operating circuit and a starting circuit, which starting circuit is disconnected from the lamp a short time after the gas in the lamp becomes ionized.

Accordingly, it is an object of the present invention to provide a new and improved light source which is smokeless and free of soot.

It is another object of the present invention to provide a light source which is concentrated in a very small area so as to approach a point source of light.

Still another object of the present invention resides in the provision of a light source which is concentrated in a small area, but which has a large portion of its surface exposed and capable or directing light toward a sensitized plate.

It is a further object of the present invention to provide a light source which is concentrated in a small area, to allow unrestricted passage of cooling air.

A still further object of the present invention resides in the provision of a new improved power supply for both starting and operating an arc lamp.

It is another object of the present invention to provide a new and improved circuit arrangement for powering an arc lamp including a trigger circuit and a hold circuit which operates to obtain maximum luminous efficiency from the arc lamp.

Further objects and advantages of the present invention will become apparent as the following description proceeds and the features of novelty which characterize the invention wil be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of the present invention, reference may be had to the accompanying drawings in which:

FIG. 1 is a top plan view of a light source and reflector embodying the present invention;

FIG. 2 is a schematic circuit diagram of a power supply for the light source of FIG. 1 embodying the present invention; and

FIG. 3 is a schematic circuit diagram of an alternative form of power supply for the light source of FIG. 1.

Very briefly, the present invention includes an arc lamp comprising a slender tube which may be three or more feet in length coiled in the form of a helix and which is associated with a circuit arrangement having a trigger circuit and a hold circuit. Arc lamps of the type to which this invention relates have a generally negative resistance characteristic. A high voltage is necessary to ionize the gas within the lamp prior to operation. After ionization, the lamp continues to have a relatively high resistance below a certain critical voltage. Thus, in the first embodiment of the supply circuit of the invention, illustrated in FIG. 2, there is provided a trigger circuit which performs the function of providing high voltage pulses across the lamp in order to ionize the gas contained therein and a hold circuit which continues to operate the lamp after the gas becomes ionized. Provision is made to disconnect the trigger circuit from the lamp after ionization is accomplished. Both circuits are energized from a common power transformer which is connected across a suitable source of electric energy. In the alternative embodiment of the supply circuit, which is illustrated in FIG. 3, the trigger circuit produces ionization of the gas contained in the arc lamp in a very effective yet somewhat different manner, as described hereinafter.

More specifically, having reference to the drawings, and particularly to FIG. 1, there is shown a light source or arc lamp generally designated **10** constructed in accordance with the present invention. The lamp consists of an elongated quartz envelope **12**, the central portion **12***a* of which has been formed into a helix or a coil of helical shape. The spacing between adjacent turns of the helix is such as to allow light produced by the lower portions of the turns, when the helical axis is horizontal, to escape in an upward direction and, furthermore, permits air from a forced air cooling system (not shown) to cool the surface of the quartz envelope.

In devices constructed in accordance with the present invention, the envelope **12** was eighteen, twenty-four, or thirty-six inches in length depending on the particular application and the helical shape confined the effective size of the light source to a volume between two and three inches on a side.

Connected one to each end of the helical portion **12***a*, are short straight tubular leg portions **12***b* and **12***c*, respectively, the ends of which are sealed with caps **14** and **15**. Within each end of the lamp there is a thermonic self-heating electrode **16** connected to suitable terminals. The lamp **10** is mounted in a reflector unit **20** by means of mounting brackets **22**. The lamp terminals are conductably secured to insulated posts **24** which pass through the reflector **20**. The reflector **20** may be similar to that shown in the above-mentioned Benson patent, and the lamp and reflector of the present invention can be substituted for the lamp and reflector of the Benson patent with the axis of the helix horizontal.

A lamp **10** built in accordance with the illustrated embodiment was formed by heating and coiling a tube of quartz in the form of a helix. The original diameter of the tube before coiling was about ⅜ inch. The lamp was formed so that there is a minimum of one-quarter inch between successive coils of the helix. The arc length of the original tube, as for example twenty-four inches, was preserved in the final lamp but the over-all length of the lamp, rated at two thousand watts, was reduced to about five inches. The length of the helical portion was about two and three-fourths inches, and its width was about two and three-eights inches. The quartz envelope was filled with a rare inert gas, in this instance xenon at a pressure somewhat less than atmospheric pressure.

It should be understood that lamps of any arc length may be formed into a helix in accordance with the present invention. Applicant has successfully used lamps having arc lengths of from eighteen to thirty-six inches The two arc lengths found most useful are the twenty-four inch, 2,000 watt lamp and the thirty-inch, 4,000 watt lamp. It is not intended, however, to limit the present invention to lamps having arc lengths within any particular limits.

It has been found that the addition to the inert gas of a slight quantity of metallic vapor, such as mercury vapor, results in an increased amount of ultra violet light. This result is highly advantageous because the photosensitive plates adapted to be exposed by the light source of the present invention are customarily primarily sensitive to ultra violet light.

When the lamp **10** is operated in a unit, such as that disclosed in the Benson patent, light emanates from its entire length. Thus, the majority of light will come from the helical portion of the lamp. Because of the helical shape, light generated at the lower portions of the helix when mounted as in the Benson patent will be directed upwardly through the spaces between the upper potions of the coils. Thus, most of the light will emanate from a small concentrated area. Since the lamp **10** also generates a substantial amount of heat, the helical construction provides ample air space around the various portions of the lamp to allow the passage of cooling air over and between the turns or coils thereof.

To obtain maximum lumious efficiency from the lamp **10**, it is necessary that it operates from a highly peaked current source, preferably of the alternating type. In accordance with the present invention and to produce maximum lumious efficiency for lamp **10**, there is provided a power supply and control circuit generally designed as **25** in FIG. 2 of the drawings. As there illustrated, the terminals of lamp **10** are connected by conductors **26** and **27** to a circuit including a capacitor **28**, a peaking transformer **29**, and the winding **30***a* of a relay **30** all connected in series. The peaking transformer **29** includes terminals **31** and **32** at each end and terminals **33** and **34** at points intermediate the ends thereof. The portion of peaking transformer **29** between terminals **31** and **33** is designated as **29***a* and can be characterized as the holding circuit winding portion. The portion of peaking transformer **29** between terminals **33** and **34** is designated as **29***b* and can be characterized as the trigger circuit winding portion, the latter comprising only a small portion of the turns of peaking transformer **29**.

To initiate the arc in lamp **10**, a voltage of three to seven thousand volts is required to ionize the gas filling the envelope **12**. Because of the lamp's inherent negative resistance characteristic, this is approximately ten to twenty times the normal voltage required to operate the lamp. Accordingly, there is provided a starting or trigger circuit **36** which includes winding portion **29***b* and a holding or operating circuit **37** which includes winding portion **29***a*. To energize both the circuits **36** and **37**, there is provided a power transformer **40**. Transformer **40** comprises a tapped primary winding **42** and two secondary windings **43** and **44**. The primary winding **42** is illustrated as having a fixed terminal **45** and a plurality of taps **46**, specifically designated as **46***a*, **46***b*, **46***c*, **46***d*, **46***e* and **46***f*. The terminal **45** is connected to one side of an alternating current supply by a conductor **47**. The taps **46** are adapted to be selectively connected to the other side of the alternating current supply by a conductor **48** including a sliding contact **48***a*. The secondary windings **43** and **44** are preferably physically separated on the core **41** and should be additively connected for best operation.

The starting or trigger circuit **36** comprises the secondary winding **43** of power transformer **40**, an inductor **50** to limit the starting current, normally closed contacts **30***b* of the relay **30**, the trigger portion **29***b* of peaking transformer **29**, and a saturable type inductor **51**. The trigger circuit **36** also includes a capacitor **52** connected across the winding portion **29***b* and the saturable inductor **51**. It should be understood that the winding portion **29***b*, which as mentioned above, comprises a very small portion of the peaking transformer **29** could, of course, be a separate winding if desired.

The holding or operating circuit **37** comprises the secondary winding **44** of the power transformer **40**, the capacitor **28**, and the portion **29***a* of peaking transformer **29**. It will be apparent from the above description that the starting reactor or staurable inductor **51** has been incorporated in the common leg of the trigger circuit **36** and the hold circuit **37** which means that it is also included in the hold or operating circuit **37**. It has been found that by having this saturable inductor **51** in this position it produces a more uniform starting voltage. It is believed that this is partially due to the fact that the starting voltage is in phase with the operating or holding circuit voltage rather than opposing it and partially due to the fact that the saturable inductor **51** as part of the hold circuit **37** reduces the amount of the starting or trigger voltage that is short-circuited by the hold circuit. It will be appreciated that the inductance of saturable inductor **51**, although it has an important function in the trigger circuit **36**, has such a small value as far as the hold circuit **37** is concerned that its inductance during the normal operating cycle of the latter circuit is negligible.

Considering now the operation of the lamp circuit **25**, when an alternating current voltage is applied across the conductors **47** and **48** a voltage will appear across the secondary windings 43 and 44 and a current will flow through inductor 50 charging capacitor 52 of the trigger circuit 36. When capacitor 52 becomes charged, the saturable inductor 51 will become saturated allowing capactior 52 to discharge in a pulse through the winding portion 29b of peaking transformer 29. This pulse through winding portion 29b will, by auto-transformer action, produce a high voltage pulse across terminals 31 and 32 and will, in turn, produce a high voltage across the lamp 10 which will cause the gas contained therein to become ionized. This pulse will be repeated numerous times during each half cycle of the alternating current source. In a device buit in accordance with the present invention, the high voltage pulse of the trigger circuit was found to occur approximately 500 to 800 times per second. In this device, the winding section 29b comprised approximately six turns of the three hundred twenty turns comprising winding 29 whereby the voltage across terminals 31 and 32 was of the order of five to ten thousand volts, which is more than sufficient to ionize the gas in lamp 10.

After the gas in lamp 10 has been ionized, the operating or hold circuit 37 serves to continue energizing the lamp 10. Voltage applied to the conductors 47 and 48 across primary winding 42 of transformer 40 will also energize secondary winding 44. The voltage induced in winding 44 causes a current to flow through the winding portion 29a (in a device built in accordance with the present invention, winding portion 29a comprised one hundred sixty turns) of peaking transformer 29 to charge capacitor 28. This current flows into the capacitor 28 rather than through the lamp 10, since the lamp has a very high internal resistance even though the gas is ionized, until the voltage across the tube is greater than 150 to 200 volts. As the input voltage reaches the peak of the alternating current wave, the capactior being fully charged starts to discharge through the winding portion 29a as the voltage input starts to fall. Due to auto-transformer action, the voltage appearing across the terminals 31 and 32 of peaking transformer 29 is approximately double that across secondary winding 44. This higher voltage causes the lamp 10 to be highly conductive and a surge of the capacitor discharge current of capacitor 28 as well as the current from the power transfer secondary winding 44 is passed through the lamp 10. Each half cycle of the alternating current causes a repetition of the high peaked current pulses required for maximum luminous efficiency. The peaking transformer 29 acts somewhat as a saturable inductance and becomes saturated near the peak voltage which tends to aid in forming the sharply peaked pulses.

Once the hold or operating circuit has taken over, the start or trigger circuit 36 is no longer necessary and the function of relay 30 is to render ineffective the trigger circuit 36. The relay 30 is a current type relay having its winding 30a in series with lamp 10, and it is adjusted to operate at a current of approximately fifty percent of the normal operating current of lamp 10. Although the relay contacts 30b are illustrated as being adjacent terminal 34, these contacts could have been inserted between inductor 50 and the secondary winding 43. There is a slight advantage in having the contacts 30b in the position shown in FIG. 2 of the drawings since the capacitor 52 is never disconnected from the secondary winding 43 thus providing a slight power factor correction to the transformer 40, reducing the line current requirement of the lamp circuit 25 without affecting the input power to the lamp 10.

It will be understood that various circuit arrangements and various circuit constants may be employed in the lamp circuit 25. In order, however, to illustrate the relative magnitudes of the principal elements of the illustrated embodiment which has been found to satisfactorily embody the present invention, the following approximate values of such elements together with other pertinent information are given for a particular arrangement. It

should be understood that these values are given by way of example and not by way of limitation.

Lamp 10:	
Rating	2,000 watts.
Arc length	24 inches.
Capacitor 28	28 microfarads.
Peaking transformer 29	320 turns.
Winding portion 29a	160 turns.
Winding portion 29b	6 turns.
Supply voltage	60 cycle A.C. 230 volts (R.M.S.).
Transformer 40	Taps 46 arranged at 5 volt intervals. Maximum open circuit voltage induced—winding 43, 280 volts (R.M.S.); winding 44, 500 volts (R.M.S.); resonant voltage measured across—winding 44, 1350 volts (R.M.S.).
Inductor 50	0.3 henry (linear).
Inductor 51	1.0 henry (saturable) before saturation.
Capacitor 52	12 microfarads.
Current flow in lamp 10	8½ amperes (R.M.S.).
Setting at which relay 30 operates	5 amperes (R.M.S.).

The operating circuit arrangement is such that a series resonant condition exists in the holding circuit 37. This resonance, during operation, causes an increase in effective voltage which would normally exist in a nonresonant circuit. Due to this increase in effective voltage across winding portion 29a, the voltage gain across the peaking transformer 29 is, of course, also increased resulting in a higher voltage across the lamp 10. The increased voltage across this lamp is such that although it will not ionize the gas in the lamp, it will maintain and stabilize the lamp after operation. This permits the use of a direct action current relay 30 to disconnect the trigger or starting circuit 36 rather than some delayed switching means usually employed. In a device built in accordance with the present invention, voltage peaks of about seven thousand volts appeared across terminals 31 and 32 of peaking transformer 29 when the trigger circuit was in operation and peaks of four to five hundred volts when the hold circuit was in operation.

One of the unique features of the operating or hold circuit 37 of the present invention is the high voltage produced across the unlit tube 12 before the starting or trigger circuit 36 is operated to ionize the gas in lamp 10. The power transformer 40 is of the high leakage type. The windings are such that the open circuit voltage across winding 44 of this transformer is approximately five hundred volts. However, when the winding portion 29a of the peaking transformer 29 and the capacitor 28 are connected in series with the output of this secondary winding 44, the voltage measured across the terminals of secondary winding 44 is approximately 1350 volts or more than twice the open circuit voltage of this transformer winding. This voltage plus the additional voltage buildup in the hold circuit 37 described above, when the operating circuit is energized, produces a much higher hold circuit open circuit voltage. The higher this voltage the better, since it helps to stabilize and hold the initial arc in the lamp 10 when the gas is ionized by the high voltage of the trigger circuit 36. This permits the turning off of the trigger circuit as soon as current flows in the hold circuit 37 thereby eliminating the need for a time delay device in the relay 30. This high voltage is believed to occur as a result of series resonance between the inductive and capacitive components of the hold circuit 37.

Referring now to FIG. 3 of the drawings, there is illustrated an alternative embodiment of the power supply for the light source of the present invention. While the circuit 25, illustrated in FIG. 2, is highly satisfactory for use with a 2,000 watt lamp having an arc length of twenty-four inches, and while the circuit 25 is efficient in the operation of lamps having arc lengths less than twenty-four inches, a different type of circuit has been found to be more effective in the operation of lamps having longer arc lengths, such as the thirty-six inch, 4,000 watt lamp.

The difficulty encountered in the operation of lamps having long arc lengths, such as the thirty-six inch lamp, is that it is hard to obtain effective ionization of the lamps with the start or trigger circuit 36 described above which acts to subject the lamp to a series of high voltage, high frequency pulses in order to ionize the gas therein. It will be understood that the process of ionization is more difficult in lamps of longer arc lengths because the lamp contains more gas, and because the electrodes of the lamp are farther apart. The control circuit of the alternative embodiment of the invention, illustrated in FIG. 3 of the drawings, overcomes this difficulty. Briefly, this control circuit modification includes a hold circuit functioning in a manner somewhat similar to the hold circuit described above, and a start or trigger circuit which aids in initial ionization of the gas in the lamp. The start circuit of the present embodiment includes a Tesla coil which provides points spaced along the lamp with high voltage, high frequency pulses. In addition, a time delay relay is provided to disconnect the start circuit from the lamp once ionization is accomplished.

More particularly, FIG. 3 illustrates an arc lamp or light source generally designated as **100**. This lamp or light source includes an elongated quartz envelope **102**, the central portion **102*a*** of which is formed into a helix or coil of helical shape similar to lamp **10** described above. In a device built in accordance with the present invention, lamp **102** had an arc length of thirty-six inches and the lamp was rated at 4,000 watts. The diameter of its helical turns or loops was approximately 2.1 inches. Thus, it should be understood that the above-described advantages of a helical lamp fully apply to the lamp **100**. As illustrated, the lamp **100** is provided with a pair of end terminals **104** and **105** for connection with a supply and control circuit generally designated as **106**. As above described, terminals **104** and **105** are suitably connected to thermionic self-heated electrodes within the lamp envelope **102**.

In order to operate the lamp **100** after ionization, the supply and control circuit **106** is provided with a hold circuit portion designated as **108** which is connected to the lamp terminals **104** and **106** by the conductors **109** and **110**. The hold circuit **108** includes a number of series connected components comprising a capacitor **112**, a saturable reactor **114**, and the second winding **115** of a power transformer **116**. Preferably transformer **116** is a high reactance transformer. To provide a series resonant arrangement, a capacitor **117** is connected across the terminals **118** and **119** of the secondary winding **115** of transformer **116**.

To energize the secondary winding **115**, transformer **116** includes a primary winding **121** having terminals **122** and **123** connected to a suitable source of A.C. supply voltage by conductors **124** and **125**, respectively. Although not so illustrated, the primary winding **121** of the power transformer **116** may be provided with a plurality of taps to adjust for various voltage inputs, as will be readily understood by those skilled in the art.

Considering now the operation of the hold circuit **108** after ionization of the lamp **100** from a suitable A.C. supply voltage across the conductors **124** and **125**, the voltage induced in the secondary winding **115** of the power transformer **116** will cause a current to flow through the lamp **100**. Inductance **114** serves to sharpen the voltage peaks and stabilizes the output of hold circuit **108**. The series resonant arrangement is provided to maintain the ionization of the gas in lamp **100** by maximizing the open circuit voltage of the hold circuit.

In order to provide for initial ionization of the lamp **102**, there is provided a start or trigger circuit **130**. Trigger circuit **130** is connected across a portion of the primary winding **121** of transformer **116** between a tap **131** and terminal **123** so as to provide an output of approximately 115 volts. The start circuit **130** includes a Tesla coil **132** which acts as a high frequency, high voltage pulse generator. As illustrated, the Tesla coil **132** includes input terminals **133** and **134** which are connected to terminals **131** and **123** by conductors **136** and **137**, respectively.

The Tesla coil is a standard readily purchasable electrical component and customarily includes, in addition to input terminals **133** and **134**, an input iron core transformer **138**, a condenser **139**, a spark gap **140**, an output air core transformer **141**, and output terminals **142** and **143**. A variable tuning capacitor **144** is preferably also provided to obtain resonance. The operation of the Tesla coil will be readily understood by those skilled in the art and for the present application the output may be of the order of fifteen thousand to twenty-five thousand volts at a frequency of the order of three thousand cycles.

In accordance with the present invention, the output terminals **142** and **143** of the Tesla coil are connected in an ionization circuit to accomplish ionization of the lamp **100**. To this end terminal **142** is grounded and a conductor **146** extends from the terminal **143** to the lamp **100** where it is entwined about successive loops of the lamp, as illustrated at **146*a*** in FIG. 3 of the drawings.

It has been found that the high voltage, high frequency output of the Tesla coil, when associated with the lamp **100** in the manner illustrated, is a highly effective means of accomplishing ionization of the lamp. However, the invention is not limited to the construction illustrated in so far as it shows the conductor portion **146** intertwined with the turns or loops of the lamp **100**.

To provide for disconnection of the start or trigger circuit **130** from the lamp **100** after starting has taken place, a normally closed time delay relay **150** has its winding **150*a*** connected in series with input conductor **125** and its switch contacts **150*b*** connected in series with input conductor **137** to Tesla coil **132**. The operation of the relay **150** is such that when the gas within the lamp **100** becomes ionized and current begins to flow through the hold circuit **108**, the contacts **150*b*** are opened after a predetermined time delay. Obviously, instead of a current relay a voltage relay might be employed.

It will be understood that various circuit arrangements and various circuit constants may be employed in the circuit **106**. In order, however, to illustrate the relative magnitudes of the principal elements of the illustrated embodiment which has been found to satisfactorily embody the present invention, the following approximate values of such elements, together with other pertinent information are given for particular arrangement. It should be understood that these values are given by way of example only and not of limitation.

Lamp **100**:	
Rating	4,000 watts.
Arc length	36 inches.
Capacitor **112**	17 microfarads.
Saturable inductor **114**	1.0 henry before saturation.
Capacitor **117**	14 microfarads.
Supply voltage	60 cycle A.C. 230 volts (R.M.S.).
Transformer **116**	Open circuit voltage of winding **115**, 500 volts (R.M.S.).
Trigger circuit voltage, measured between terminals **142** and **143**	15,000–25,000 volts at 3000 cycles.

While there has been illustrated and described several embodiments of the present invention, numerous changes and modifications are likely to occur to those skilled in the art, and it is aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the present invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A point source of light for exposing sensitized photographic plates comprising an arc lamp including a generally tubular quartz envelope between eighteen and thirty-six inches in length coiled in the form of a helix, said envelope filled with an inert rare gas at a pressure less than atmospheric pressure, and an energization circuit for said lamp including a single winding peaking transformer and a capacitive reactance in series with said lamp, a trigger circuit including a first portion of said winding, a hold circuit including a second portion of said winding, a power transformer having a primary winding connected to a A.C. voltage source and separate secondary windings for energizing said trigger circuit and said hold circuit, and means for disconnecting said trigger circuit from said lamp after ionization of the gas in said envelope.

2. A light source as defined in claim 1 wherein said disconnecting means comprises a normally closed direct action current operable relay including a winding connected in series with said lamp and a switch connected in said trigger circuit.

3. A light source as defined in claim 1 wherein said hold circuit includes inductive and capacitive reactance means adapted to be series resonant at the operating frequency.

4. A light source as defined in claim 1 wherein said first portion includes a small number of the turns of said winding, and said second portion includes approximately one-half of the turns of said peaking transformer.

5. A light source as defined in claim 1 wherein said energization circuit includes a common leg of said trigger and hold circuits, and a saturable inductor in said common leg.

6. An energization circuit for an arc discharge lamp comprising a lamp circuit loop including a serially connected arc lamp, reactance, and peaking transformer, a hold circuit loop including a first portion of the winding of said peaking transformer comprising approximately one-half the turns of said peaking transformer, a trigger circuit including a second portion of the winding of said peaking transformer comprising a very small fraction of the turns of said peaking transformer, said trigger circuit and hold circuit having a common leg including a suturable inductor, relay means to render said trigger circuit ineffective when an arc discharge is initiated in said lamp, a power transformer having its primary winding connected to an alternating current source, a first secondary winding for powering said trigger circuit, and a second secondary winding for powering said hold circuit, said second secondary winding being arranged to limit the current in said hold circuit.

7. An energization circuit for an arc discharge lamp comprising a lamp circuit loop including a serially connected arc lamp, capacitance, and peaking autotransformer; a hold circuit loop including said capacitance and a first portion of the winding of said peaking auto-transformer comprising about one-half the turns of said winding; a trigger circuit including reactance means and a second portion of the winding of said peaking autotransformer comprising a very small fraction of the turns of said winding; said trigger circuit and said hold circuit having a common leg including a saturable inductor; a power transformer having a metallic core, physically separated additively connected secondary windings for powering said trigger and hold circuits, and a primary winding including spaced taps near one end thereof adapted to be alternatively connected to an A.C. power supply; said hold circuit loop adapted to be series resonant at the operating frequency; and a direct action current operable relay means having a coil in series with said arc lamp operable to render said trigger circuit ineffective when an arc discharge is initiated in said lamp.

8. An energization circuit for an arc discharge lamp comprising a lamp circuit including a serially connected arc lamp, saturable inductance, capacitor and transformer winding, means for energizing said transformer winding from an A.C. power source, said lamp circuit being series resonant at the operating frequency, and a trigger circuit including means for providing high voltage high frequency pulses at one or more points along the length of said arc lamp.

9. The energization circuit of claim 8 wherein said last-mentioned means comprises a Tesla coil.

10. The energization circuit of claim 9 wherein said last-mentioned means includes a conductor interconnecting said Tesla coil and said arc lamp, said conductor being wrapped around said arc lamp at said one or more points.

11. An energization circuit for an arc lamp of the type having an envelope containing an ionizable gas comprising a single winding peaking transformer and a capacitive reactance in series with said lamp, a trigger circuit including a first portion of said winding, a hold circuit including a second portion of said winding, a power transformer having a primary winding connected to an A.C. voltage source and separate secondary windings for energizing said trigger circuit and said hold circuit, and means for disconnecting said trigger circuit from said lamp after ionization of the gas in said envelope.

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