

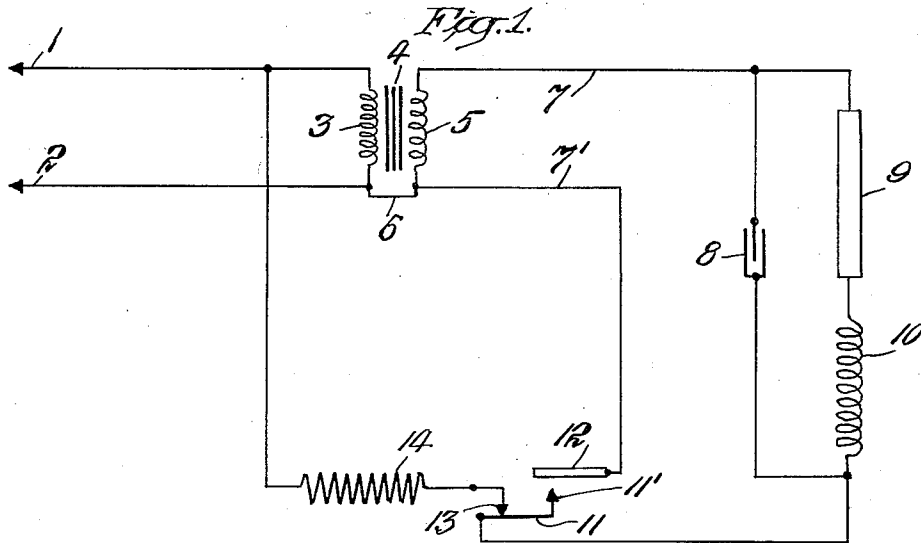
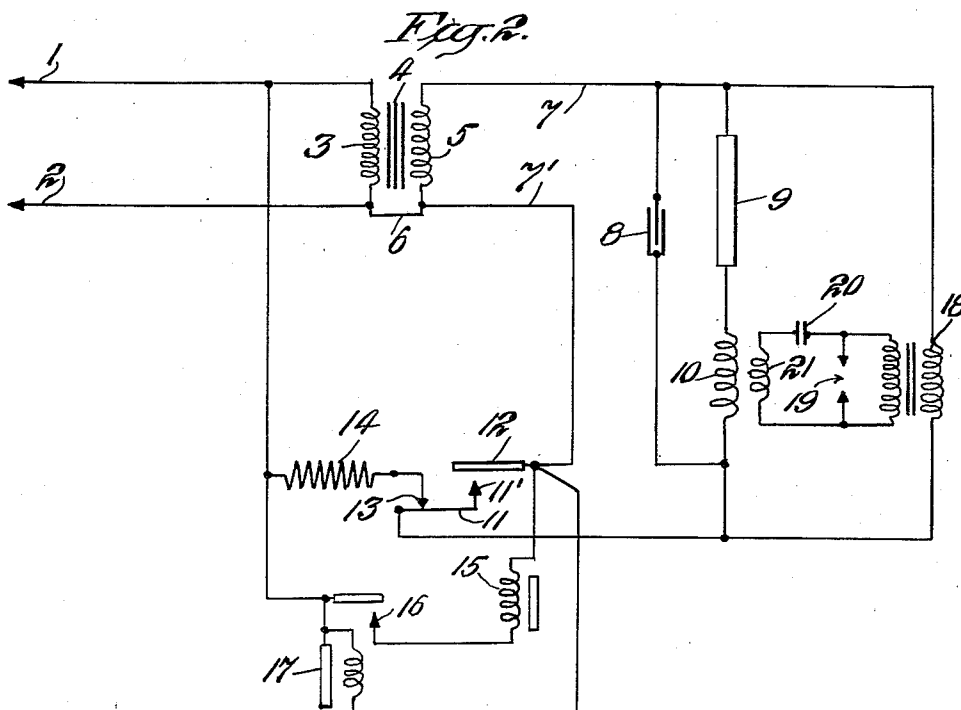
Feb. 25, 1958

L. F. BIRD

2,825,005

OPERATING CIRCUITS FOR ELECTRICAL DISCHARGE LAMPS

Filed Sept. 26, 1955



INVENTOR.

LESTER F. BIRD

BY

[Signature]
ATTORNEY

1

2,825,005

OPERATING CIRCUITS FOR ELECTRICAL DISCHARGE LAMPS

Lester F. Bird, Newark, N. J., assignor to Hanovia Chemical and Manufacturing Company, Newark, N. J., a corporation of New Jersey

Application September 26, 1955, Serial No. 536,592

3 Claims. (Cl. 315-239)

The present invention relates to an operating circuit for electrical discharge lamps and, more particularly, to an operating circuit for the ignition and operation of high pressure gaseous discharge lamps.

While the ignition and operating circuit hereinafter described may be advantageously applied for the ignition and operation of high pressure mercury vapor arc lamps, it is especially applicable for the ignition and operation of a compact type lamp containing solid electrodes spaced apart to provide a discharge path from a few millimeters to about two centimeters in length in an enclosed atmosphere consisting of xenon at a pressure exceeding one atmosphere.

It is an object of this invention to provide an economical ignition and operating system for high pressure gaseous discharge lamps. It is another object of this invention to provide an ignition and operating system for compact type arc lamps and including means for segregating the voltage requirements for the lamp in conformity with a starting and operating condition of the lamp. Other objects and advantages will become apparent from the description hereinafter following, and the drawings forming a part hereof, in which:

Figure 1 is a diagrammatic representation of a basic circuit according to the invention, and

Figure 2 is a diagrammatic representation of a modification of Figure 1.

The invention deals with an ignition and operating system for high pressure discharge lamps and including switch means which in combination with a particular transformer construction is capable of segregating the voltage requirements for the lamp in conformity with a starting and operating condition of the lamp.

It is very desirable for economical operation of arc lamps, such as described above, that the arc be operated from a reactive type of transformer having a low voltage secondary in the order of about 50 volts alternating current. The voltage across the arc lamp is usually in the order of 30 volts, and with this difference in voltage the lamp can be operated stably from such a transformer.

It is not possible to operate the lamp entirely from such a low voltage system because of the ignition conditions involved in starting a lamp. It has been determined from many experiments that it is desirable to have about 150 volts or more across the electrodes of the arc lamp when ignition is accomplished.

With the voltage about 150 across the electrodes of the lamp, a suitable current limiting ballast must be used to restrict the current through the lamp to safe values. This may be a reactance or a resistance ballast. Ignition of the arc is accomplished by impressing a high voltage pulse across the lamp, usually in series with the power supply, so that the normally high impedance of the high pressure gases inside of the lamp is broken down and a spark passes between the electrodes. With a suitable kind of pulse, the low voltage follows across

2

the ionized path formed between the electrodes, and the current follows.

As soon as the arc is established, it is no longer necessary to have the voltage supply maintained at the 150 volt point, and it can be reduced to the secondary voltage of the reactive transformer at about 50 volts. The arc can then operate from the reduced voltage supply with no further change until it is extinguished and re-lighted.

The invention describes a circuit that has been found to be successful in the operation of this kind of arc lamp. The circuit utilizes a reactive transformer, in which the leakage has been adjusted so that the lamp operates at the correct current from the secondary of the transformer. A resistor ballast has been provided which is only employed when the lamp is operating from the high voltage system. A switching means has been provided to change the operating lamp from one system to the other at the desired time. This switching means may be either manual or automatic and consists of a "make before break" switch arrangement. For the high voltage supply, the secondary of the reactive transformer is connected in an additive relationship to the line supply voltage such that the line supply is increased by about 50 volts above the usual value. When the line supply is 115 volts, the supply to the lamp is increased by this means to about 165 volts, and with this voltage the ignition of the arc lamp is satisfactory. The resistance ballast serves as the stabilizing ballast for the arc lamp, and limits the starting current to the correct amount during the starting period.

Regarding Figure 1, supply lines 1 and 2 carrying, for example, 115 volts at 60 cycles, are connected across a primary winding 3 of a reactive transformer having an iron core 4 and a secondary winding 5 of lower voltage than the primary winding, said primary and secondary windings being electrically connected to each other by means of a conducting bridge or jumper 6. Conducting leads 7 and 7' are connected across the secondary coil 5. One of said leads is connected, preferably directly, to one end of the lamp 9 having a series coil 10 having one end connected to the other end of said lamp, and a capacitor 8 is connected across the combined lamp and coil structure. The other conducting lead, e. g. lead 7', is connected to the other end of coil 10 or the bridge 6 and through a switch comprising a movable contact arm 11, with a contact 11' thereon, and movable arm 12. The coil 10 is a component of a suitable pulse system and an example of which is more particularly illustrated in Figure 2. Preferably, when the switch is open, the bridge member 6 is connected to said movable arm, and said coil 10 is connected to said contact arm 11. As hereinbefore stated, the switch is a "make before break" type switch, which includes in addition to the switch members 11 and 12 at least another contact member 13, positioned to contact the said contact arm 11 for an opening and closing of the circuit associated therewith sequentially with the opening and closing of the circuit associated with contact 11' and arm 12. For example, the movable arm 12 first contacts the contact 11', thereby closing the circuit associated therewith and moves further to disengage contact 13 from arm 11, thereby opening the circuit associated with contact 13. A resistor ballast 14 is connected in series with the contact 13 and to one of the supply leads, e. g. lead 1.

This arrangement momentarily connects the resistor ballast 14 to the supply line before contact 13 is separated from arm 11. As soon as contact 11' and arm 12 are connected, the lamp is operated from the transformer secondary coil 5 alone.

3

The purpose of the capacitor 8 is to assist in the ignition of the lamp 10 in two ways, in that it provides a low impedance path for the pulse circuit through the lamp and, also, to assist in the establishment of a stable arc through the lamp.

While Figure 1 illustrates the basic system for the invention wherein the switch member is a manually operated switch, it is possible to make the switching from ignition to steady operation under reduced voltage completely automatic, as illustrated by Figure 2, which includes the automatic operating circuitry.

According to Figure 2, the arm 12 and contacts 11' and 13 are connected to a relay having an actuating coil 15 connected to and controlled by contact 16 of an auxiliary time delay member 17 having, for example, a time delay of about 10 seconds. Power is supplied to relays 15 and 17 from the supply line.

The pulse circuit illustrated has a step up transformer 18 of the high leakage type connected across the combined arc lamp 9 and coil 10 structure, and therefore receiving the voltage normally supplied to this lamp. Before an arc is struck in the lamp, the voltage across the primary winding of this transformer is about 165 volts, and, as soon as the arc is lighted, this voltage is reduced to be about 20 volts or the arc operating voltage. When the voltage is high, the pulse circuit continues to send pulses through the lamp, but as soon as an arc is struck, there is no longer sufficient voltage to operate the pulsing system, and it ceases to function.

Transformer number 18 delivers several thousand volts across the spark gap 19 and the series circuit comprising the capacitor 20 and the primary of the radio frequency transformer 21. The operation of this type of pulsing circuit is well known.

Immediately upon the application of the line power to the circuit, 165 volts is impressed across the primary winding of the transformer 18, and the resultant high voltage from the secondary passing across the spark gap causes a pulse to pass through the lamp between the electrodes, and in this manner produce an ionized path in the enclosed gas through which the low voltage can flow. At the same time, line voltage has been applied to the coil of the relay 17, and, after the normal time delay

4

period, this relay operates and through its contact 16 applies line voltage to the coil of the switching relay 15. Contact 12 moves to engage contact 11' and then moves with arm 11 to separate arm 11 from contact 13, leaving 11 and 12 closed. The arc is now lighted and operating from the secondary coil of the reactive transformer coil 5.

While the foregoing description is directed to the invention as illustrated, the invention is intended to include modifications and equivalent changes within the scope of the appended claims.

What I claim is:

1. A starting and operating system for high pressure gaseous discharge lamps, comprising a transformer having a core with primary and secondary windings thereon, input means connected across said primary winding, electrical conducting means bridging said primary and secondary windings, conductors connected across said secondary winding, a gaseous discharge lamp, a pulse type ignition system comprising a coil connected in series with said lamp, said conductors, discharge lamp, and coil comprising a series circuit connected across said secondary winding, make-before-break switch means in said series circuit between said coil and said secondary winding, and a ballasting resistance circuit connecting said switch mean to said input means, whereby the said switch means operates to sequentially connect said series circuit across said transformer secondary winding and disconnect said ballasting resistance circuit.

2. A starting and operating system according to claim 1, comprising a capacitor connected across the structure including said lamp and said coil.

3. A starting and operating system according to claim 1, comprising a time delay system operatively associated with said switch means for automatically actuating said switch means at a predetermined interval.

References Cited in the file of this patent

UNITED STATES PATENTS

2,114,842	Inman	Apr. 19, 1938
2,182,609	Bethenod	Dec. 5, 1939
2,373,402	Lecorguier	Apr. 10, 1945
2,487,092	Bird	Nov. 8, 1949