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CIRCUIT ARRANGEMENT FOR GAS-FILLED DISCHARGE TUBES

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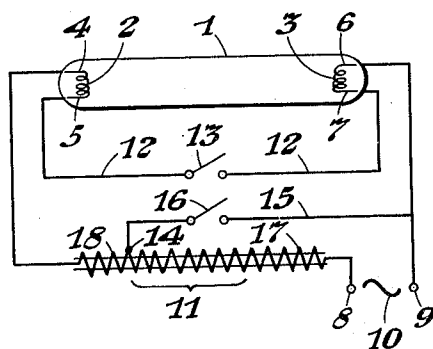


Fig. 1

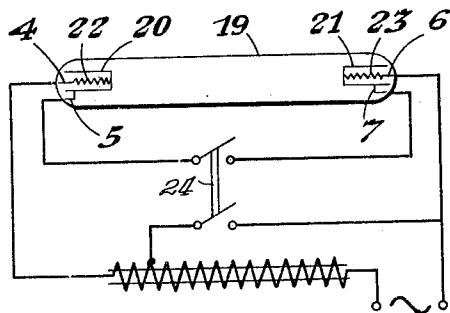


Fig. 2

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CIRCUIT ARRANGEMENT FOR GAS-FILLED
DISCHARGE TUBESGustav Zecher, Eindhoven, Netherlands, assignor
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2 Claims. (Cl. 176—124)

It is known to provide a gasfilled electric discharge tube at either end with an incandescent electrode and to connect one of the current supply wires of each incandescent electrode to one of the terminals of a source of alternating current from which the discharge tube is supplied, to insert a choke coil in the circuit formed and to interconnect the further current supply wires of the electrodes via a switch. When the discharge tube is put into operation, this switch is temporarily closed with the result that the discharge path is short-circuited and the incandescent electrodes are directly connected to the source of current so that without a discharge being produced in the tube, these electrodes are traversed by a current by which they are heated. When these electrodes are heated to a sufficient temperature, the above-mentioned switch is opened with the result that the circuit located in parallel with the discharge path is interrupted and the tube is ignited. The ignition is facilitated by the voltage impulse produced in the choke coil due to the switch being opened. During further operation no particular heating current is sent through the incandescent electrodes and the heating is effected by the discharge current.

The circuit arrangement may also be applied to discharge tubes having incandescent electrodes adapted to be indirectly heated. In this case the discharge tube is short-circuited in such manner that the heaters of these incandescent electrodes are supplied directly from the source of current.

The invention now concerns such a circuit-arrangement comprising a gas filled discharge tube with at least two incandescent electrodes, a choke coil connected in series with said tube and a circuit provided with an interruptor and connected in parallel with the discharge path in such manner that when the interruptor is closed the incandescent electrodes or their heaters are connected, with the interposition of the choke coil, to the source of current from which the discharge tube is supplied. The invention has for its purpose to improve this circuit-arrangement.

In fact, it has been found that when the described circuit-arrangements are put into operation there may arise the drawback that the incandescent electrodes are not preheated to a sufficient extent to be able to bring about the ignition of the discharge. The initial heating current is limited by the series connected choke coil which must be so dimensioned that in normal operation the discharge current has the desired intensity. In order to preheat the incandescent electrodes to a sufficient extent, a current is often needed

which is several times as large as the discharge current. The initial heating current may consequently be limited too much by the series-connected choke coil.

If one would increase this heating current by short-circuiting part of the choke coil, there would arise the drawback that the current taken from the source of current would have a much higher intensity than the normal operating current, which would lead to a more solid and more expensive construction of the current supply conductors, switches, fuses, etc.

According to the invention, an improvement is obtained by temporarily connecting part of the choke coil by means of a switch directly to the source of current so that in this case the choke coil forms an auto-transformer. Owing to the fact that when the discharge tube is put into operation not only the current interruptor located in the branch circuit connected in parallel with the discharge path but also the switch by means of which the choke coil is connected as an auto-transformer is closed, a current of such intensity is produced in the circuit of the incandescent electrodes or of their heaters that the incandescent electrodes are heated to the temperature desired. By altering the ratio of the two portions into which the choke coil when acting as an auto-transformer is divided it is possible to regulate the intensity of the heating current. If desired, the choke coil portion which furnishes the heating current may be made of a thicker wire than the remainder of the choke coil. After the incandescent electrodes have thus been raised to the desired temperature, said current interruptor and also the above mentioned switch are opened with the result that the discharge tube is ignited. This interruptor and this switch are preferably united to form a bipolar switch so that they can both be operated in a single manipulation.

The invention will be explained more fully by referring to the accompanying drawing which represents diagrammatically, by way of example, a few embodiments thereof.

In Figure 1, 1 denotes a gas-filled discharge tube which has to be understood to mean not only a tube filled exclusively with gas but also one filled with vapour or with a mixture of gas and vapour. The tube may be filled, for example, with neon and may be used for the emission of light. During operation it exhibits a positive column discharge and it has two incandescent electrodes 2 and 3 coated with a material having strongly electron emitting properties, e. g. alkaline earth oxide. The current supply wires of these elec-

trodes are denoted by 4, 5 and 6, 7 respectively. The wires 4 and 6 are connected to the terminals 8 and 9 respectively of the source 10 of alternating current which consists, for example of alternating current mains of usual low voltage, e. g. 220 volts, and of usual frequency, e. g. 50 cycles. A choke coil 11 is located between the wire 4 and the terminal 8. The current supply wires 5 and 7 are connected to one another by a conductor 12 in which a current interruptor 13 is located. The point 14 of the choke coil is connected to the terminal 9 by means of a conductor 15 comprising a switch 16, the choke coil 11 being consequently divided into two portions 17 and 18. If desired, the portion 18 may consist of a thicker wire than the portion 17.

In putting the discharge tube 1 into operation one may proceed as follows: After the source of current 10 has been switched into circuit the switches 13 and 16, which may be united to form a single bipolar switch, are closed so that the conductor 12 forms a branch circuit connected in parallel with the discharge path and the discharge tube is short-circuited. By closing the switch 16 the choke coil is transformed into an auto-transformer whose portion 17 is connected to the source of current 10 and into whose portion 18 is induced such a voltage that the current flowing in the circuit formed by the choke coil portion 18, the incandescent electrode 2, the branch circuit 12, the electrode 3 and the conductor 15, has a sufficient intensity to raise the incandescent electrodes rapidly to the temperature required for a satisfactory ignition. Then the two switches 13 and 16 are opened, if desired automatically, which results in the discharge tube being ignited. If desired, the ignition may be facilitated by connecting a condenser in parallel with the discharge tube 1. In the further operation the electrodes 2 and 3, which act alternately as anode and as cathode, are maintained by the discharge current at the required temperature.

The following magnitudes of a practically realized installation are given for illustration: pressure of the filling consisting of neon 2 mms., internal diameter of the tube 15 mms., distance between the electrodes 30 cms., voltage of the source of alternating current of 50 cycles 220 volts, choke coil of such a value that the normal discharge current was 1 amps. The ratio between the number of turns of the portions 17 and 18 was 43 to 1.

With closed switches the current flowing through the electrodes had an intensity of 10

amps., while the current taken from the source of current 10 had an intensity of 1,3 amps. and was consequently only slightly heavier than the ordinary operating current.

The discharge tube 10 of Figure 2 comprises 5 two indirectly heated incandescent electrodes 20 and 21 having heaters 22 and 23 connected at one end to the electrodes 20 and 21 respectively. Current supply wires 4, 5 and 6, 7 respectively are connected to the other elements of the circuit arrangement in the manner indicated in Figure 1. A bi-polar switch 24 is provided to make and break the connection in the heater circuit and the choke coil circuit simultaneously. The putting into operation takes place in the same manner as described in connection with Figure 1.

What I claim is:—

1. A starting and operating circuit for a gaseous electric discharge device having electrodes sealed therein which are provided with heaters and which electrodes are electron emitting when heated comprising in combination a current source for said device, a choke coil connected in series with said device across the terminals of said current source, means to connect said electrode heaters in series across the terminals of said current source and to connect a part of said choke coil across the terminals of said current source during the starting of said device, said choke coil serving as an auto transformer during the starting period and said electrodes being thereby rapidly raised to an electron emitting, discharge supporting temperature.

2. A starting and operating circuit for a gaseous electric discharge device having electrodes sealed therein which are provided with heaters and which electrodes are electron emitting when heated comprising in combination a current source for said device, a choke coil connected in series with said device across the terminals of said current source, part of said choke coil comprising larger diameter wire than the other part thereof and means to connect said electrode heaters in series across the terminals of said current source and to connect the part of said choke coil comprising the wire of smaller diameter across the terminals of said current source during the starting of said device, said choke coil serving as an auto transformer during the starting period and said electrodes being thereby rapidly raised to an electron emitting, discharge supporting temperature.

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