Oct. 10, 1933. K. WIEGAND ET AL 1,930,116

VAPOR LAMP SYSTEM

Filed Aug. 7, 1928

Fig. 1

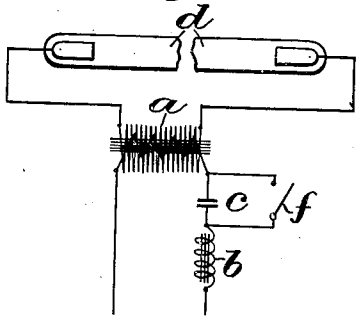


Fig. 4

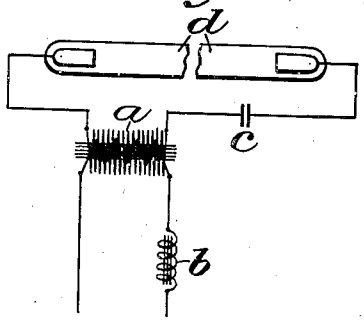


Fig. 2

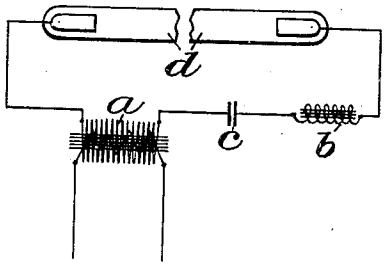


Fig. 5

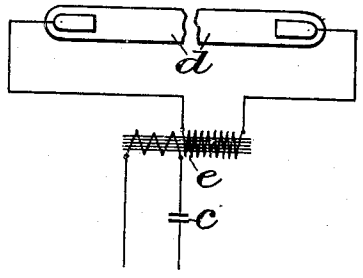


Fig. 3

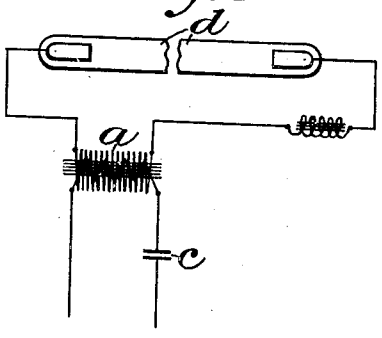
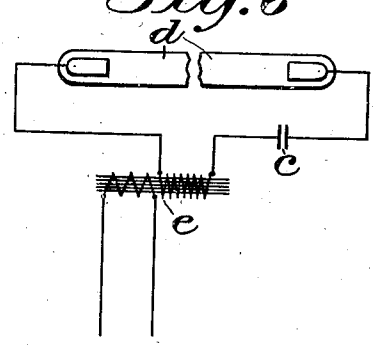


Fig. 6



Inventors:
Kurt Wiegand,
Kurt Bratel,
by Charles O'Mullan
Their Attorney.

Patented Oct. 10, 1933 1,930,116

UNITED STATES PATENT OFFICE

1,930,116

VAPOR LAMP SYSTEM

Kurt Wiegand and Kurt Bratel, Berlin, Germany, assignors to General Electric Company, a corporation of New York

Application August 7, 1928, Serial No. 298,105, and in Germany September 15, 1927

2 Claims. (Cl. 176—124)

The present invention relates to electric gas or vapor tube lamps and apparatus for operating the same.

In the case of gaseous electric discharge tubes which are operated on high tension alternating current, it is common practice to build into the primary circuit of the transformer either an inductive resistance (choke coil), or an ohmic resistance, or also a capacitive resistance (condenser), to produce the necessary potential drop after starting has taken place. Although the transformer is always given such dimensions that its secondary voltage is somewhat higher than starting voltage of the tubes, it happens, nevertheless, when the ambient air contains a certain humidity, for instance in the case of fog of a certain density, that the tubes fail to start or start only with difficulty. Especially on flying fields where ground fog usually occurs in the hours of evening this disadvantage, which does not occur in the case of rain, is often noticeable in an unpleasant degree. A faint partial discharge can then be observed on the tubes in the darkness, and this indicates as probable that the gas discharge path is not closed in the interior of the tubes, but rather outside them between the electrodes and the moist glass enclosure which acts as a capacitance. As a result of this current leakage through the moist film the voltage impressed between the electrodes of the tube is materially reduced from that which is normal at starting.

In conformity with the invention, it was established that a reliable connection can be attained even for moist or very foggy ambient air if the capacitive condenser is connected in series with an inductive resistance or ohmic resistance The two different resistances, in this case, may be placed either in series in the primary circuit or secondary circuit of the transformer, or may also be coupled through the transformer, the one located in the primary circuit and the other in the secondary circuit of the transformer. If the leakage field transformer, instead of an ordinary transformer with coils wound one upon the other, is used for the operation of the tubes, it is possible, on account of the inductive potential drop created by the leakage, to do without an inductive resistance and it suffices to build a capacitive resistance (condenser) into the primary circuit, or also the secondary circuit, of the leakage field transformer. With any of these arrangements the condenser compensates wholly or in part for the high inductive drop which results from the flow of a leakage current through the moist surface film prior to the starting of a discharge in the tube, and thereby minimizes the decrease in the starting voltage which would otherwise be caused by this leakage current.

Various arrangements made up according to the invention are shown in the wiring diagrams on the drawing.

In the case of the wiring diagram according to Figure 1, an inductive resistance (*b*), in whose place also an ohmic resistance could be used, and a condenser (*c*) are connected in series in the primary circuit of the transformer (*a*) which is provided in the usual manner with two coils wound one upon the other. Between the terminals of said condenser (*c*) there is connected a switch (*f*). The secondary circuit of the transformer (*a*) in this case contains exclusively the gaseous discharge tube (*d*).

In the case of the wiring diagram according to Figure 2, the inductive resistance (*b*) and the condenser (*c*) are arranged in series in the secondary circuit of the transformer (*a*).

The wiring diagram according to Figure 3 shows the placing of the condenser (*c*) in the primary circuit of the transformer (*a*) and the inductive resistance (*b*) in its secondary circuit. The two resistances (*b*) and (*c*) in this case are coupled through the transformer, so that a series connection is again obtained of the two resistances which act differently in the known manner.

The wiring diagram according to Figure 4 shows a similar arrangement of the two resistances with the difference that, in this case, the condenser (*c*) is placed in the secondary circuit and, therefore, the inductive resistance (*b*) in the primary circuit of the transformer (*a*).

In the case of the wiring diagrams according to Figures 5 and 6, a leakage field transformer (*e*), that is, a transformer with coils placed side by side, is used in the place of an ordinary transformer, and with it the degree of leakage, and thus the inductive potential drop at the transformer, can be regulated in the conventional manner by adjusting the coil spacing, or by inserting a sheet iron body in the space between the coils. In this case the inductive resistance is eliminated, and only a condenser (*c*) is placed in either the primary circuit (Figure 5) or the secondary circuit (Figure 6) of the transformer.

In the case of gaseous discharge tubes which are operated not only with high tension, but at the same time also with high frequency oscillations, it is customary to use, besides the con-

denser, an inductive resistance (choke coil) in the working circuit. However, now the choke coil is not in series with the condenser and, besides, it serves only the purpose of keeping the high frequency oscillations away from the other parts of the installation which do not carry high frequency currents; in other words, it does not, as in the case which is being considered, serve the purpose of creating the necessary potential drop after the connection is made.

The effect of the new arrangement with both an inductive and capacitive resistance built in should be self evident from the fact that the condenser, as is known, comes into effect much quicker than the inductive resistance as the current is applied. By the instantaneous charging of the condenser and the discharging of it which follows immediately, a very great rush of current is produced, which suffices to cause the initial puncture of the filling in the tube and thus, to start the tube. The arising of the rush of current makes itself noted without difficulty by the large deflection of an ammeter which should be connected in the circuit.

When the starting has been brought about, the condenser can be disconnected by short-circuiting by closing the switch (*f*). Then the discharge remains also in the second half wave of the alternating current, since a sufficient amount of free ions from the first discharge is present.

If the gaseous discharge tube installation is used at places where the ambient air does not contain any considerable amount of moisture, that is, at places where no ground fog occurs, for instance, the connection of a condenser in series with an inductive resistance permits a considerable reduction in the voltage of the transformer and thus in its cost, as a consequence of the attained amplification of the starting rush. A luminescent tube installation which ordinarily, that is, when only an inductive resistance or an ohmic resistance is provided, requires at least 300 volts primary transformer potential, needs only 240 volts primary potential when a capacitive resistance is connected in series with an inductive resistance or with an ohmic resistance. In other words, the starting potential is reduced by about 18 to 20% by the connection made.

What we claim as new and desire to secure by Letters Patent of the United States, is:

1. In combination, an electric transformer comprising a primary and a secondary, a gaseous electric discharge device, a condenser, and an inductance device connected in series across the terminals of said secondary, and a short circuiting means connected across the terminals of of the said condenser.

2. In combination, an electric transformer comprising a primary and a secondary, a gaseous electric discharge device connected across the terminals of said secondary, and a condenser and an inductance device in operative relation to said transformer and said gaseous electric device and a short circuiting means connected across the terminals of the said condenser.

KURT WIEGAND.
KURT BRATEL.