Feb. 11, 1936. K. WIEGAND 2,030,805

GASEOUS ELECTRIC DISCHARGE LAMP

Filed March 25, 1935

Fig. 1

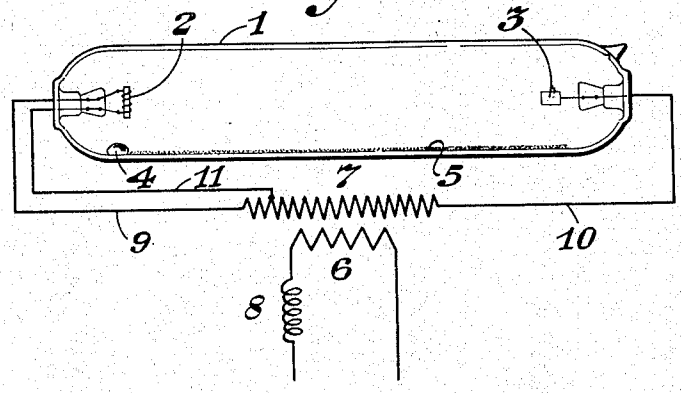


Fig. 2

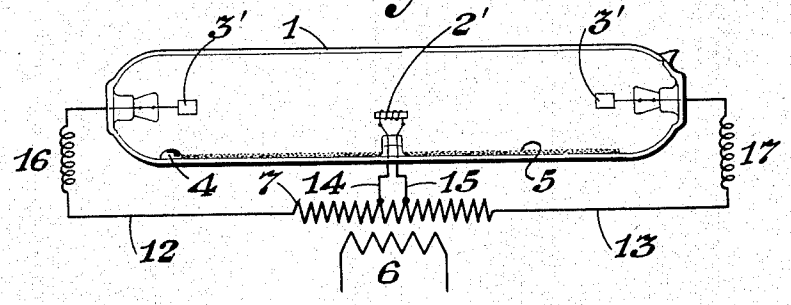


Fig. 3

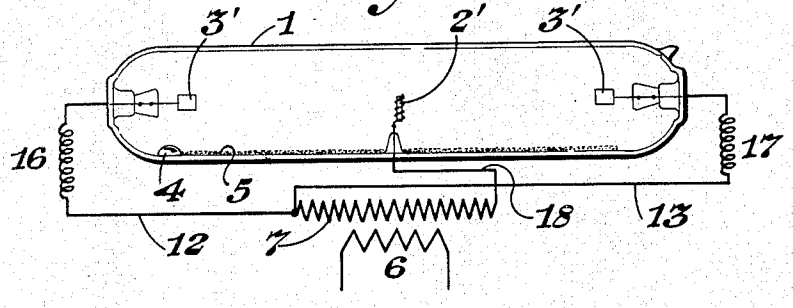
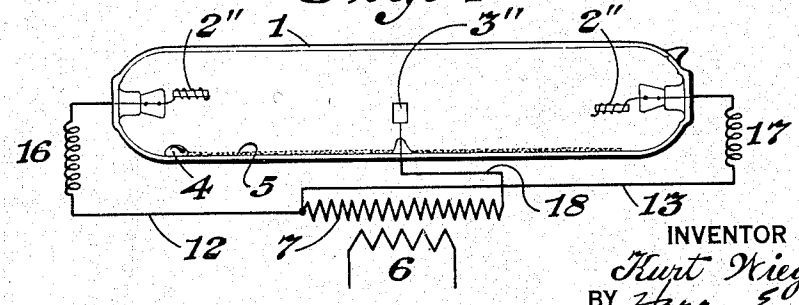


Fig. 4



INVENTOR
Kurt Wiegand
BY Harry E. Dunham
ATTORNEY

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GASEOUS ELECTRIC DISCHARGE LAMP

Kurt Wiegand, Berlin-Neu-Tempelhof, Germany, assignor to General Electric Company, a corporation of New York

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3 Claims. (Cl. 176—124)

The present invention relates to gaseous electric discharge lamps generally and more particularly the invention relates to such lamps having a luminescent material associated therewith to complement or supplement the light emitted by the luminous gaseous electric discharge therein.

When such lamps have a body of phosphorescent material associated therewith it is possible to operate the discharge intermittently at a frequency such that during the periods when the discharge is non-luminous the phosphorescent material gives off light and the lamp emits light continually in spite of the intermittent operation of the luminous discharge. This improves the efficiency of such a lamp, that is, the quantity of light emitted per unit of energy consumed is greater. When a time switch is connected into the lamp circuit to effect the intermittent operation of the luminous discharge the increased efficiency of the lamp itself is partially or wholly off-set by the energy consumed in operating the time switch so that the overall efficiency of the lamp outfit is little or no greater than it would be if the luminous discharge were operated continuously and the phosphorescent material were omitted. The time switch also increases the cost of the outfit and is not a very reliable discharge regulator, particularly over a long life.

The object of the present invention is to provide an apparatus comprising a gaseous electric discharge lamp having phosphorescent material associated therewith which is an efficient, reliable light source. Another object of the invention is to provide an inexpensive apparatus of this type. Still further objects and advantages attaching to the device and to its use and operation will be apparent to those skilled in the art from the following particular description.

In accordance with these objects the new and novel lamp outfit comprises a gaseous electric discharge lamp having phosphorescent material in or on the walls of the container thereof and having electrodes sealed therein. At least one of said electrodes is a thermionic electrode and at least another of said electrodes is a cold, sheet metal electrode. The lamp is connected across the terminals of an alternating current source, such as a transformer. The lamp thus operates on the rectifier principle and the discharge incident at the cold electrode operates and is luminous only during one-half of each cycle of said alternating current source. During the other half-cycle, when the luminous discharge is not operating, the light emitted by the lamp comes from the phosphorescent material. The lamp thus appears to be continually luminous.

In one embodiment of the invention a thermionic electrode is mounted at one end of an elongated, tubular lamp container and a cold electrode is mounted at the other end thereof. The lamp is connected across the terminals of an alternating current source and the operation thereof is as described above. In another embodiment of the invention a thermionic electrode is mounted in the center of a similar container and a cold electrode is mounted at each end of the container. In still another embodiment of the invention a cold electrode is mounted in the center of a similar container and a thermionic electrode is mounted at each end of the container. In these last two embodiments the electrodes are connected to the terminals of the current source in such manner (described later herein) that a discharge takes place in each half of the lamp on each cycle of the alternating current source and on one half cycle a discharge takes place in one half of the lamp and on the other half cycle the discharge takes place in the other half of the lamp. Each half of the tube then emits light from the luminous discharge therein during one half of each cycle and from the phosphorescent material during the other half of each cycle. A discharge thus takes place in said lamp on each half cycle of said alternating current source, even though said discharge extends over one half the length of said lamp. The discharge in one half of the lamp facilitates the restarting of the discharge in the other half of the lamp on the next half-cycle. This particular operation of the lamp is also favorable since the light from the discharge in one-half of the tube strongly excites the phosphorescent material in the other half of the lamp which gives off a more intense light than it would otherwise which increases the efficiency of the lamp.

In the drawing accompanying and forming part of this specification several embodiments of the invention are shown in which

Fig. 1 illustrates an apparatus embodying the invention and is a side elevational view of a gaseous electric discharge lamp and a wiring diagram of a circuit thereof,

Fig. 2 illustrates another apparatus embodying the invention and is a similar view of another lamp and a wiring diagram of a circuit thereof.

Fig. 3 illustrates still another apparatus embodying the invention and is a similar view of

another lamp embodying the invention and a wiring diagram of a circuit therefor, and

Fig. 4 illustrates still another apparatus embodying the invention and is a similar view of another lamp embodying the invention and a wiring diagram of a circuit therefor.

Like numbers denote like parts in all the figures.

Referring to Fig. 1 of the drawing the new and novel lamp comprises an elongated tubular container 1 having a thermionic electrode 2 sealed into one end thereof and a cold, sheet metal electrode 3 sealed into the other end thereof. Said electrode 2 consists of rod of electron emitting material, such as a rod of barium oxide, and a heating filament, such as a tungsten filament, wrapped around said rod. Said container 1 has a starting, rare gas therein, such as argon, neon, or krypton, and a quantity 4 of vaporizable material, such as mercury, the vapor of which when excited by the passage of an electric discharge between said electrodes 2 and 3 emits ultra-violet as well as visible light rays. Said container 1 has a layer or coating 5 of phosphorescent material, such as zinc sulphide, calcium tungstate, magnesium molybdate, zinc-cadmium sulphide, cadmium tungstate, or zinc silicate, thereon. The phosphorescent material 5 is made light emitting by the rays emitted by the discharge in the gaseous atmosphere and continues to emit light for a time after the discharge is extinguished.

Each of said electrodes 2 and 3 is connected by the leads 9 and 10 respectively to a terminal of the secondary coil 7 of the transformer 6, 7. The primary coil 6 of said transformer is connected across the terminals of an alternating current source. A choke-coil 8 is connected to the primary side of said transformer 6, 7. The electrode 2 is connected by the lead 11 and said lead 9 across several turns of said transformer secondary 7 which furnishes the heater current for said electrode 2.

When current is applied to the above described circuit a discharge takes place between the electrodes 2 and 3 in the container 1. The discharge occurs on that half cycle during which the thermionic electrode 2 is negative. During the other half cycle no discharge takes place between said electrodes 2 and 3. The lamp thus operates as a rectifier. The rays emitted by the discharge excites the phosphorescent material 5 to a light emitting condition which condition persists after the discharge has been extinguished. Thus the lamp emits light during the half cycle when the discharge is not operating as well as during the half cycle when the discharge is operating.

The embodiment of the invention illustrated in Fig. 2 of the drawing is the same as that illustrated in Fig. 1 except that in this embodiment the thermionic electrode 2' is mounted in the middle of the container 1 and a cold, sheet metal electrode 3' is mounted at each end of the container 1. Each of said electrodes 3' is connected by leads 12 and 13 to the ends of the secondary 7. The thermionic electrode 2' is connected across several turns of wire on either side of the midpoint of said secondary 7 by current leads 14 and 15. In this embodiment two choke coils 16 and 17 are connected into the leads 12 and 13 respectively of said electrodes 3'. When desired, a larger choke-coil is connected into one of the leads of the primary 6 and the choke-coils 16 and 17 are omitted.

In this embodiment of the invention the thermionic electrode 2' is negative on each half-cycle of the alternating current source and the electrodes 3' are positive alternately, one on each half-cycle. A discharge thus takes place in said container 1 on each half-cycle of said current source; during one-half cycle the discharge takes place in one half of the container 1 and during the other half-cycle in the other half of said container 1. The period during which no discharge takes place in one half of the lamp is not noticeable to the eye since the phosphorescent material emits light during this period as in the embodiment of Fig. 1. However, in this embodiment the phosphorescent material emits a more intense light during this period, since the rays from the discharge in the other half of the lamp excite the material, and the discharge in this half of the tube starts earlier in the cycle and therefore persists longer during the half-cycle since the starting thereof is facilitated by the discharge in the other half of the lamp. This embodiment of the invention therefore is even more efficient than the embodiment illustrated in Fig. 1.

The embodiment of the invention illustrated in Fig. 3 of the drawing is similar to that shown in Fig. 2 except that in this embodiment the electrodes 3' are connected to the same terminal of said secondary 7 by said leads 12 and 13 and thermionic electrode 2' is connected to the other terminal of said secondary 7 by lead 18. In this embodiment the electrode 2' consists of a filament wrapped around a bar of electron emitting material and is heated to its electron emitting temperature by the discharge incident thereat. The operation of this embodiment of the invention, however, is the same as illustrated in Fig. 1, that is, a discharge takes place in each half of the container 1 on each half-cycle of said current source and no discharge takes place in said lamp on the other half-cycle.

The embodiment of the invention illustrated in Fig. 4 is the same as that illustrated in Fig. 3 except that in this embodiment a cold electrode 3'', such as a metal, a metal carbide, or graphite electrode, is mounted in the middle of the container 1 and a thermionic electrode 2'', similar to the electrode 2' of Fig. 3 is mounted at each end of said container 1. As in the embodiment of Fig. 3 the end electrodes 2'' are connected to one terminal of the transformer secondary 7 by leads 12 and 13 having choke-coils 16 and 17 connected therein respectively and the middle electrode 3'' is connected to the other terminal of said transformer secondary 7 by lead 18. The operation of this embodiment is the same as that of the embodiment shown in Fig. 3, that is, a discharge takes place in both halves of said container 1 on the same half-cycle of the alternating current source and no discharge takes place in said container 1 on the other half-cycle.

While I have shown and described and have pointed out in the annexed claims certain novel features of the invention, it will be understood that various omissions, substitutions and changes in the forms and details of the device illustrated and in its use and operation may be made by those skilled in the art without departing from the broad spirit and scope of the invention, for example, the container 1 is made of a phosphorescent glass, when desired, in which case the layer of phosphorescent material is omitted when desired, the layer of phosphorescent material is applied to the outer wall of said container 1, or is incorporated in the walls thereof in which case the container 1 is made of an

ultraviolet transmitting material. Other types of thermionic electrodes are used in place of those shown and described, such as the Hull electrode or the Pirani electrode, when desired.

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

1. A lamp unit comprising in combination a gaseous electric discharge lamp comprising a container, electrodes sealed therein, a gaseous atmosphere therein and a phosphorescent material associated with said container, two of said electrodes being cold electrodes, another of said electrodes being a thermionic electrode, said cold electrodes being mounted on opposite sides of and at equal distances from said thermionic electrode, the rays emitted by said gaseous atmosphere, when excited by the passage of a discharge between said electrodes, causing said phosphorescent material to emit light and an alternating current source for said lamp, said current source being a transformer, said thermionic electrode being connected to the mid-point of said transformer and said cold electrodes being connected to opposite ends of said transformer.

2. A lamp unit comprising in combination a gaseous electric discharge lamp comprising a container, electrodes sealed therein, a gaseous atmosphere therein and a phosphorescent material associated with said container, two of said electrodes being cold electrodes, another of said electrodes being a thermionic electrode, said cold electrodes being mounted on opposite sides of and at equal distances from said thermionic electrode, the rays emitted by said gaseous atmosphere, when excited by the passage of a discharge between said electrodes, causing said phosphorescent material to emit light and an alternating current source for said lamp, said thermionic electrode being connected to one terminal of said current source and said cold electrodes being connected to the other terminal of said source.

3. A lamp unit comprising in combination a gaseous electric discharge lamp comprising a container, electrodes sealed therein, a gaseous atmosphere therein and a phosphorescent material associated with said container, two of said electrodes being thermionic electrodes, another of said electrodes being a cold electrode, said thermionic electrodes being mounted on opposite sides of and at equal distances from said cold electrode, the rays emitted by said gaseous atmosphere, when excited by the passage of a discharge between said electrodes, causing said phosphorescent material to emit light and an alternating current source for said lamp, said cold electrode being connected to one terminal of said current source and said thermionic electrodes being connected to the other terminal of said source.

KURT WIEGAND.