Dec. 17, 1935. T. P. KOUVALLIS 2,024,529

GASEOUS CONDUCTION LAMP

Filed Feb. 16, 1934 2 Sheets-Sheet 1

Fig. 1

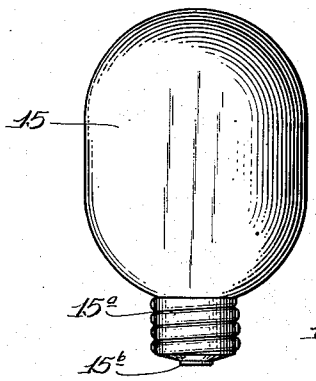


Fig. 2

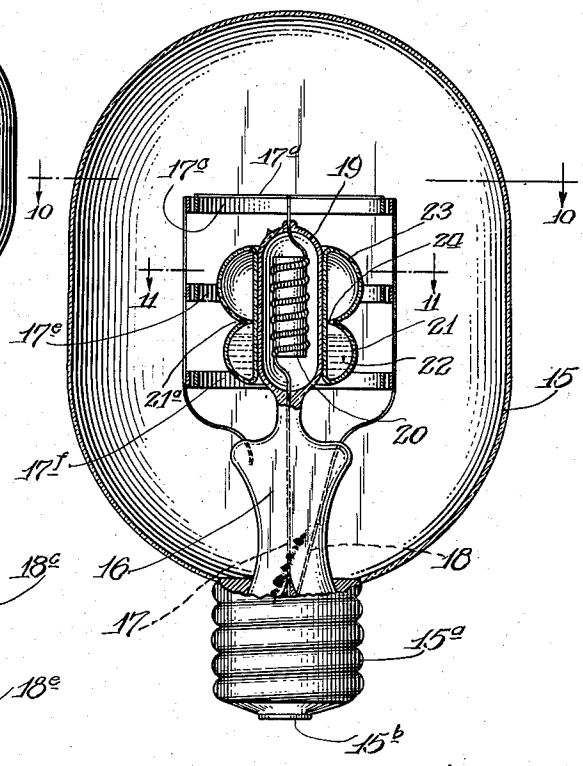


Fig. 3

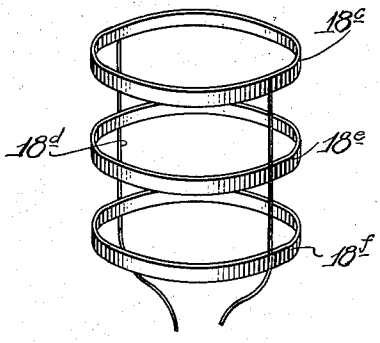


Fig. 4

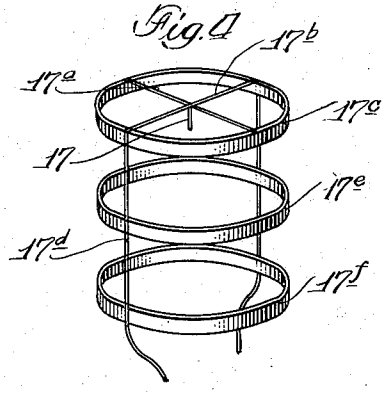


Fig. 5

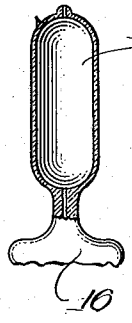
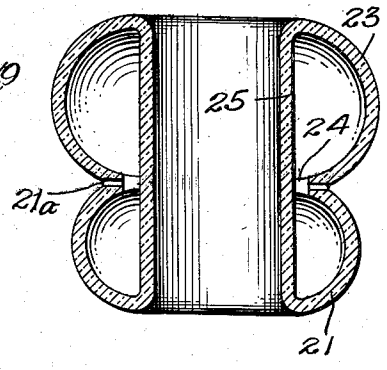


Fig. 6.



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Fig. 7

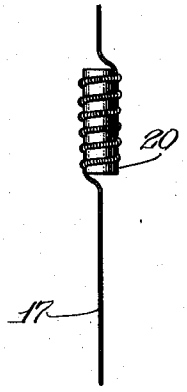


Fig. 8

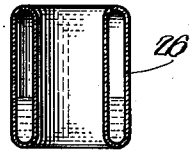


Fig. 9

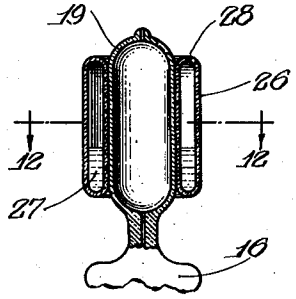


Fig. 10

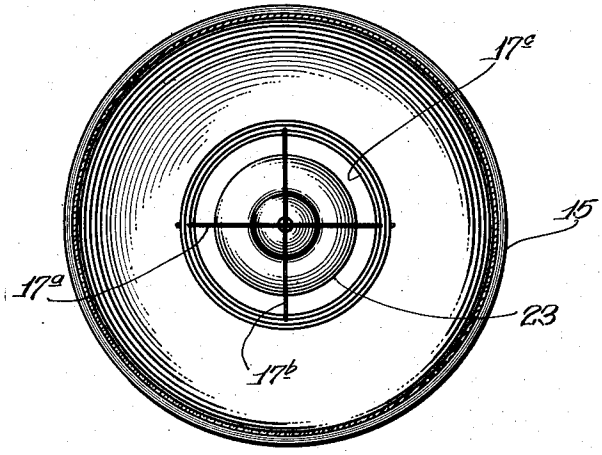


Fig. 11

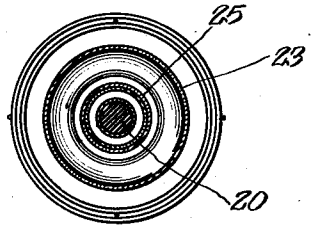
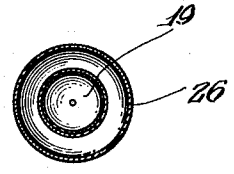


Fig. 12



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UNITED STATES PATENT OFFICE

2,024,529

GASEOUS CONDUCTION LAMP

Theodore P. Kouvallis, Argo, Ill.

Application February 16, 1934, Serial No. 711,589

17 Claims. (Cl. 176—122)

My invention relates to gaseous conduction lamps, and my main object is to provide a novel lamp of this kind which is designed to operate on the lower voltage without flickering or other unstable characteristics.

A further object of the invention is to design the novel lamp with a peculiar structure arrangement which augments the zone of illumination to such an extent that a much brighter light is obtainable than in other lamps of the same size.

Another object of the invention is to so construct the novel lamp that it may be made in all sizes to function without the usual ionizing transformer, whatever the supply of voltage may be.

An additional object of the invention is to design a lamp of the above type which combines in a compact zone coactive electrodes of maximum effective area, conducive to high efficiency.

A significant object of the invention is to provide a novel heater in connection with a chamber containing a vaporable metal as a simple means for incorporating an incandescent medium in the gaseous content of the lamp.

With the above objects in view and any others that may suggest themselves from the specification and claims to follow, a better understanding of the invention may be had by reference to the accompanying drawings, in which—

Fig. 1 is an elevation of one form of the novel lamp;

Fig. 2 is a vertical section;

Fig. 3 is a perspective view of the anode element;

Fig. 4 is a perspective view of the cathode element in vertical alinement with the showing in Fig. 3;

Fig. 5 is a section of a heater bulb;

Fig. 6 is a section of a vaporizing chamber;

Fig. 7 is an elevation of a heater;

Fig. 8 is a section of a modified vaporizing chamber;

Fig. 9 is a section of the heater bulb of Fig. 5 assembled with the vaporized chamber of Fig. 8;

Figs. 10 and 11 are sections taken respectively on the lines 10—10 and 11—11 of Fig. 2; and

Fig. 12 is a section taken on the line 12—12 of Fig. 9.

Referring specifically to the drawings, it is noted that the novel lamp is of conventional form, having a glass envelope 15 of any suitable design, and the usual stem 15*a* and tip 15*b* as terminals.

Inside the lamp is the usual glass base 16 for the active elements, leads 17 and 18 extending through the base from terminals 15*a* and 15*b*.

The base 16 rises to form a cylindrical bulb 19 in the center of the lamp, the lead 17 entering this bulb below and rising in coiled resistance form about a core 20 of refractory material. The lead then issues from the bulb in an upward direction.

About the bulb 19 is disposed a chamber 21 having annular divisions in superimposed relation. Thus, the lower division 21 is partly filled with mercury 22 and communicates with the upper division 23 by way of a space 24 about the internal wall 25 of the chamber. The division 21 has a fine perforation at 21*a* which permits the passage of metallic vapor but not of the metal itself. In this connection, it may be said that the object of the double chamber 21—23 is to provide a passage and extra chamber for the fluid metal in case the lamp is inverted or when it is tilted or positioned on its side with the perforation 21*a* at the bottom. In the latter case, the perforation is sufficiently high in the partition between the divisions to be clear of the comparatively low level of the fluid as distributed in the two divisions, it being essential that the chamber have an outlet at all times for vapor generated therein. It may also be said that the chamber 21—23, which is of glass, need not be applied precisely in the manner shown to the bulb 19, as standard methods of fusing or joining glass may dictate some different way of joining the chamber with the bulb, the present showing being purely a matter of example or illustration.

The lead 17 emerging upwardly from the bulb 19 is developed to form the cathode of the lamp, in the manner more clearly indicated in Fig. 4. It is seen that the lead is formed with crossed branches 17*a* and 17*b* spanning a horizontal band or ring 17*c*. The branch 17*b* is continued from the latter with downward leads 17*d* which form supports for a second and third band 17*e* and 17*f* disposed in spaced succession below the band 17*c*, the leads 17*d* then converging to be embedded in the glass base 16 for support. Similarly, the anode is formed by the assembly of the vertical series of bands 18*c*, 18*e* and 18*f* joined by side wires 18*d*, one of these being a continuation of the terminal lead 18 and the other entering the base 16 to be embedded therein and serve with the companion wire to support the anode. The latter and the cathode are disposed with their correspondingly located bands in concentrically spaced relation, as shown in Fig. 2.

In the operation of the lamp, the ordinary service current, such as 110 volts or 220 volts, is sufficient by the relation of the cathode to the anode and the operation of the resistance coil in the cathode lead 17 to cause a discharge between the cathode and the anode and operate the lamp by the ionization of its gas content. This presupposes that the lamp envelope and the bulb 18 have been evacuated, which condition also applies to the chamber 21—23 because of the communication thereof with the lamp envelope. The resistance in circuit with the lead 17 also operates as a heater for the mercury or other vaporable substance in the chamber, so that the vapor therefrom fills the lamp and is rendered incandescent by the electronic action therein. In the action of the lamp the initial gaseous pressure is such, with relation to the spacing and co-acting areas of the anode and cathode, that sufficient current may be conducted between said electrode through the gaseous medium, such current passing through the heater. Owing to the uniform discharge area between the related bands of the electrodes, the ionizing action in the lamp is evenly distributed and spaced off into the three zones of the bands, this causing the incandescent vapor to assume an even glow within the envelope. Further, with the ample area of activity between the electrodes, a maximum performance is made possible, rendering the lamp highly efficient.

The material for the electrodes may be tungsten, nickel or molybdenum, and the gas used in the lamp may be neon, helium, argon or other suitable medium. As in other gaseous conduction lamps, the color of the light may be varied according to the compounding of the gases; and the efficient operation of the lamp will depend upon the accuracy in the spacing of the electrode bands.

In practice it is desirable to space the adjacent opposed electrode bands relatively close, the exact degree of the spacing being determined by the gaseous pressure introduced into the evacuated envelope. In any event, the spacing should be so close with respect to the pressure and the applied voltage that the mean path of the free electrons will not gain sufficient velocity to collide with the molecules of gas located in a direct path between the electrodes.

The chamber indicated at 26 is more suitable for the use of sodium or other vaporable metal 27 instead of mercury. As such metal is non-fluid, it may be deposited in the chamber by any suitable method, and the perforation from the chamber made at the top, as indicated at 28. The present construction within the lamp is very adaptable for the use of metals like sodium, and experiments have produced a high degree of illumination with a rise in temperature which is entirely within safe limits. Thus, a temperature of but 250° C. which is but little higher than in the case of mercury lamps, is involved in the use of the novel lamp with sodium.

In conclusion, it will be apparent that I have produced a lamp which follows standard form and use, yet contains an arrangement of elements which is unique and productive of high efficiency.

While I have referred to the elements 18c and 17c as cathode and anode, respectively, the present lamp is operable directly across commercial alternating current supply circuits, and when so connected the illumination rises and falls as the impressed line voltage varies from one half-cycle to another.

I claim:—

1. A gaseous vapor lamp comprising, an envelope; heater, cathode and anode elements within said envelope; a gas within the latter; said anode and cathode being disposed in closely spaced relation to provide an electron discharge path therebetween through said gas; an inner envelope and a metal therein rendered vaporable by said heater; and means for rendering said heater operable to vaporize said metal by the current passing through said discharge path between the anode and cathode.

2. A device of the character described comprising an envelope and a re-entrant stem sealed therein; a plurality of elements supported by said stem and comprising a centrally disposed heater; a non-metallic closure surrounding said heater and made integrally with said stem; a chamber containing a vaporable medium disposed in thermal relation to said heater; cathode and anode elements surrounding said chamber; a rarefied gas within said envelope providing a discharge path therein between said cathode and anode whereby a current may be passed therebetween; electrical circuit connections within said envelope whereby said discharge-path current is passed through said heater for operating the latter to vaporize the medium within said chamber and permit the thus-formed vapor to combine with the gas in said discharge path; and an opening in said chamber in communication with said vessel for permitting the thus formed vapor to enter the same.

3. A device of the character described, a sealed envelope having a re-entrant stem therein; a plurality of concentrically disposed elements supported by said stem and comprising a centrally disposed heater; a closure for said heater; a plurality of inter-communicating chambers surrounding said closure in thermal-relation thereto; at least one of said chambers containing a vaporable metal; an opening for rendering said chambers in communication with said vessel; and anode and cathode elements surrounding said chambers and heating elements.

4. In a gaseous conduction lamp; an envelope containing a heater, a cathode and an anode; a pair of leads extending into said envelope; an ionizable medium within said envelope comprising a gaseous conduction path between said anode and cathode; a vitreous vessel surrounding said heater within said anode and cathode, said heater being connected in series with said gaseous conductor; and said series-connected elements terminating in respective connection with said leads.

5. In a gaseous conduction lamp; an envelope containing a heater, a cathode and an anode; a pair of leads extending into said envelope; an ionizable medium within said envelope comprising a gaseous conduction path between said anode and cathode; said heater being connected within said envelope in series with said gaseous conductor; a reservoir containing a vaporable metal disposed in thermal relation to said heater and being in communication with said envelope; and said series-connected elements terminating in respective connection with said leads.

6. In a gaseous conduction lamp; an envelope containing a heater, a cathode and an anode; a pair of leads extending into said envelope; an ionizable medium within said envelope compris-

ing a gaseous conduction path between said anode and cathode; said heater being connected within said envelope in series with said gaseous conductor; a plurality of inter-connecting reservoirs containing a vaporable metal disposed in thermal relation to said heater and being in communication with said envelope; and said series-connected elements terminating in respective connection with said leads.

7. In a gaseous conduction lamp; an envelope containing a heater, a cathode and an anode; a pair of leads extending into said envelope; an ionizable medium within said envelope comprising a gaseous conduction path between said anode and cathode; said heater being connected in series with said gaseous conductor; a plurality of inter-connected reservoirs containing a vaporable medium, said reservoirs being concentrically disposed about said heater; a small opening in said reservoirs connecting the latter with said vessel; and said series-connected elements terminating in respective connection with said leads.

8. A gas-filled envelope containing an anode and a cathode disposed in closely spaced relation to provide a discharge path therebetween commensurate with the mean-free-path of the electrons due to the gaseous pressure within said envelope; a vitreous reservoir within said envelope containing a vaporable medium; and means for heating the vaporable medium through the walls of said reservoir.

9. A gas-filled envelope containing an anode and a cathode disposed in closely spaced relation to provide a discharge path therebetween commensurate with the mean-free-path of the electrons due to the gaseous pressure within said envelope; a vitreous reservoir within said envelope containing a vaporable medium; and a heater element within said envelope disposed to vaporize said medium by thermal conduction through the walls of said reservoir.

10. A gas-filled envelope containing an anode and a cathode disposed in closely spaced relation to provide a discharge path therebetween commensurate with the mean-free-path of the electrons due to the gaseous pressure within said envelope; a vitreous reservoir within said envelope containing a vaporable medium; a heater element within said envelope disposed to vaporize said medium by thermal conduction through the walls of said reservoir; and means in said reservoir for permitting only the vaporized medium to enter said vessel.

11. A gaseous discharge lamp comprising a heater, a cathode and an anode element; a reservoir therein comprising an upper and a lower chamber; a vaporable medium in said lower chamber; said heater being disposed to heat said reservoir to vaporize the medium therein; means for permitting only the vaporized medium to enter the upper chamber; a rarefied gaseous atmosphere within said envelope adapted to provide a discharge path between said anode and cathode; and electrical circuit means connecting said gaseous discharge path in series with said heater.

12. In a gaseous conduction lamp; an envelope containing a heater, an annular cathode and an anode therefore; a pair of leads extending into said envelope; an ionizable medium within said envelope comprising a gaseous conduction path between said anode and cathode; a vessel within said envelope and surrounding said heater within said anode and cathode, said heater being connected in series with said gaseous conductor; and said series-connected elements terminating in respective connection with said leads.

13. In a gaseous conduction lamp; an envelope containing a heater, an annular cathode and an anode therefor; a pair of leads extending into said envelope; an ionizable medium within said envelope comprising a gaseous conduction path between said anode and cathode; a pair of intercommunicating vessels within said envelope and surrounding said heater within said anode and cathode, said heater being connected in series with said gaseous conductor; and said series-connected elements terminating in respective connection with said leads.

14. The structure of claim 7, said reservoirs being joined mouth-to-mouth and with their joining line constricted to lead the adjoining wall sections of the reservoirs inwardly, and said opening being adjacent to said joining line.

15. The structure of claim 7, said reservoirs being annular and communicatively joined end-to-end, and with their external joining line constricted to lead the adjoining wall sections of the reservoirs inwardly, and said opening being adjacent to said joining line.

16. The structure of claim 7, said reservoirs being annular and with their outer walls of substantially semi-circular cross-section, the reservoirs being communicatively joined end-to-end and with said opening adjacent to the joining line of the outer walls.

17. A gaseous vapor lamp comprising, an envelope; heater, cathode and anode elements within said envelope; a gas within the latter; said anode and cathode being disposed in closely spaced relation to provide an electron discharge path therebetween through said gas; an inner envelope and a metal therein rendered vaporable by said heater, said inner envelope surrounding the latter; and means for rendering said heater operable to vaporize said metal by the current passing through said discharge path between the anode and the cathode.

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