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A. KRATKY
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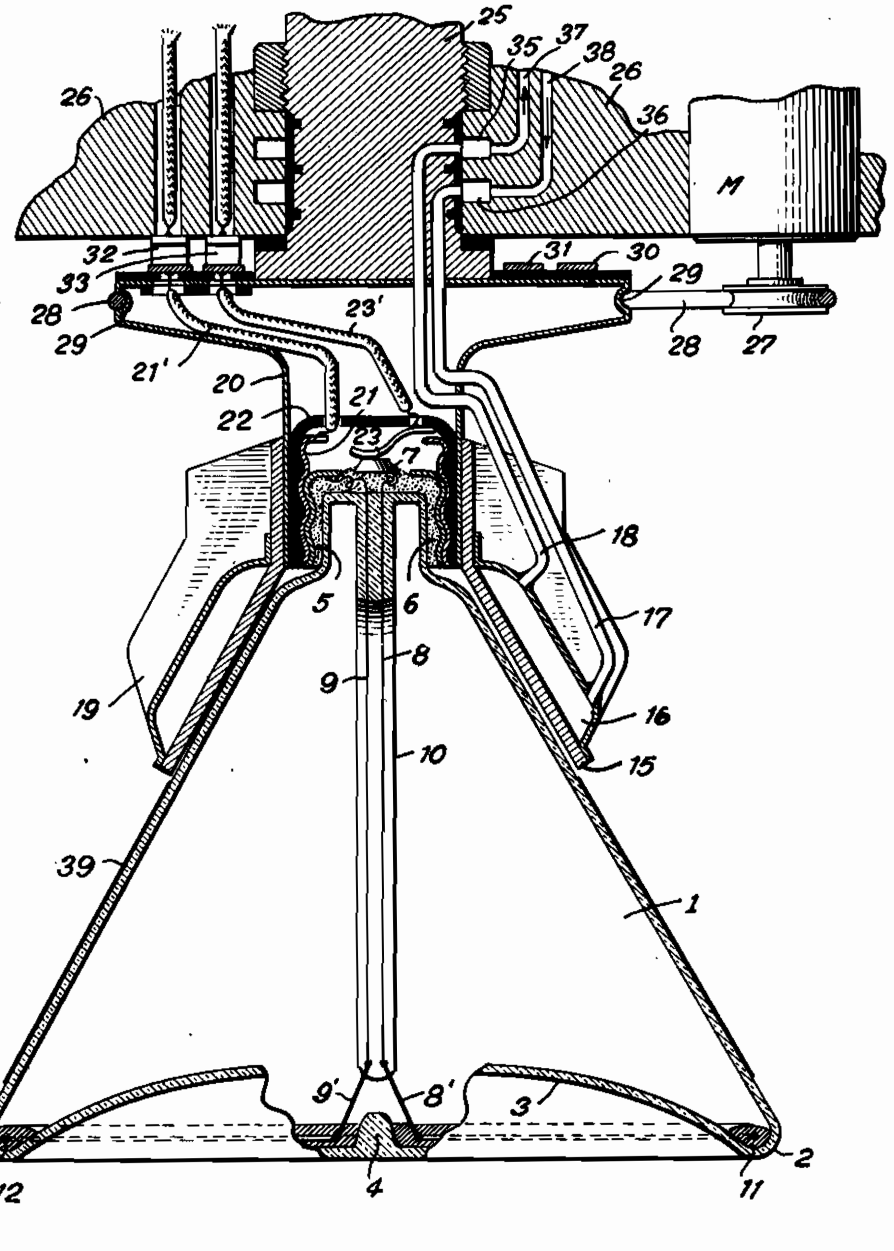
Fig. 1.



INVENTOR
Anton Kratky
BY
Emery Varney Whittemore & Dix
ATTORNEY

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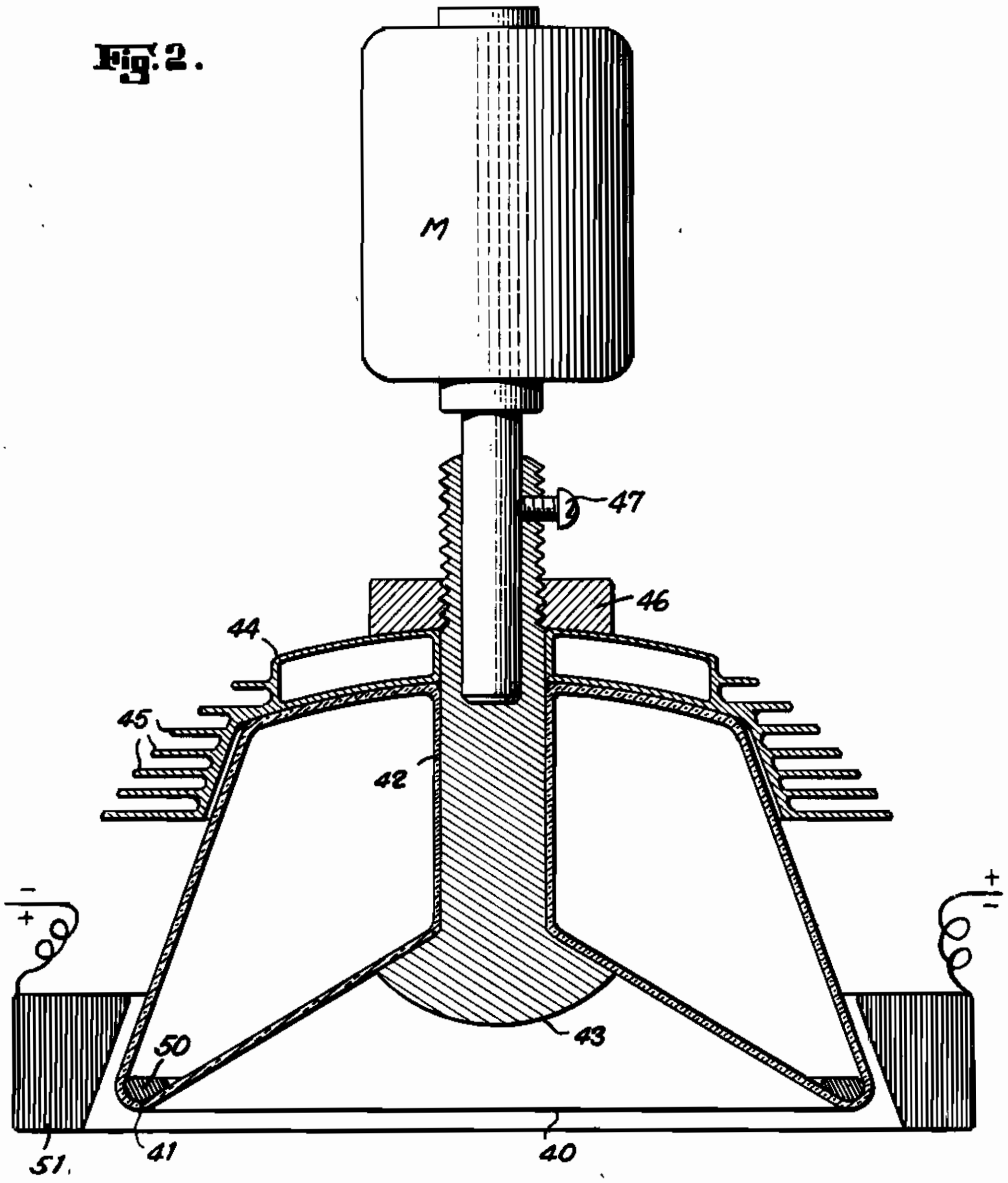
Fig. 2.



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ALIEN PROPERTY CUSTODIAN

ELECTRIC LAMPS

Anton Kratky, Vienna XV, Germany; vested in the Alien Property Custodian

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The present invention relates to electric lamps for illuminating or therapeutic purposes, the object being to provide a lamp wherein a metallic filament in liquid form during the operation of the lamp, constitutes the principal light source of the lamp or the principal source of radiant energy.

In the accompanying drawings Figure 1 is a sectional view of one illustrative embodiment of the invention in semi-diagrammatic form, and Figure 2 is a similar sectional view of another embodiment of the invention, the section of each view being through the vertical axis of the lamp and mounting.

Referring to Figure 1, a transparent lamp body 1 which may be generally conical in shape is provided with an annular groove 2 at the point of greatest diameter which, if the lamp is used in a vertical position, will coincide with the base of the lamp body. The bottom 3 of the lamp body is domed slightly and at one point in the groove 2 a barrier 4 may be formed as shown. The groove 2 is adapted to receive a body of a metal, or of an alloy of metals, which will be liquid at all times, or which will easily become liquid during operation of the lamp. For example, the groove may contain a body of mercury, sodium or potassium, or a suitable alloy of these or similar metals. In the further description of the invention it will be assumed that mercury is employed and that other suitable metals may be substituted therefor.

The lamp body may be provided with the usual threaded shell 5 attached to the transparent material of the lamp body by non-conducting cement 6 which also carries a terminal 7 to which one of the wires 8 of the lamp circuit is attached, the other wire 9 being attached to the shell 5. The two wires 8 and 9 may extend into the lamp body through a tube 10 lying along one wall of the lamp body and terminating near the groove 2, the said wires projecting through the end of this tube to form terminals 8' and 9' extending into the groove 2. If the barrier 4 is used the terminals 8' and 9' will be positioned as shown, one on each side of the barrier 4 where they dip into a body of mercury 11 carried in this groove. Where the wires 8 and 9 pass through the end of the tube 10 they are sealed in the usual manner. In case the barrier 4 is omitted the terminals 8' and 9' should be arranged to dip into the mercury at substantially diametrically opposed points in the ring of mercury. If desired in connection with the arrangement shown in Figure 1, a high resistance wire 12 of tungsten or other suitable material may be placed in the groove and connected at its ends with the terminals 8' and 9' in order to form a closed circuit as an auxiliary conductor.

The interior of the lamp body may be evacuated or may be filled with a reducing or neutral gas at relatively low pressure. For this pressure hydrogen or nitrogen may be used and if it is desired to modify the color of the light neon, argon or crypton inividually or in suitable combinations may be used.

Assuming that the lamp is to be operated in the vertical position shown in Figure 1 and that a suitable direct or alternating current is supplied through the wires 8 and 9, the mercury within the groove 2 will become very highly heated. When the temperature has been increased sufficiently mercury will vaporize and mercury vapor will tend to fill the interior of the lamp body. The vaporization of mercury will diminish the supply of mercury in the groove 2, thus increasing the resistance in the lamp circuit. As the mass of liquid mercury decreases it will tend to divide itself into separate particles and a number of minute arcs may be formed between adjacent particles. The high resistance wire 12 when used will prevent the electrical circuit from becoming entirely broken.

In order to prevent undesirable fluctuations in the lamp circuit, should they occur, a line series resistance or ballast may be connected into the lamp circuit exteriorly of the lamp.

According to the present invention the liquid metallic filament is maintained or restored continuously by the condensation of the mercury vapor upon the conical sides of the lamp body and by returning the liquid mercury to the groove 2. Thus the supply of mercury in this groove is replenished and maintained so that the electrical circuit through the mercury is not completely interrupted.

As will later be described, means are provided to facilitate the condensation of mercury vapor by conducting heat away from the lamp body, particularly from the upper conical part. The cycle of operation consisting of the vaporization of the mercury and the condensation and return thereof to the groove, prevents the building up of unduly high pressure within the lamp body.

The lamp body may be of glass having a melting point of about 1000° C., or quartz glass having a melting point of about 1500° C., and in order to protect the material of the lamp body from the high temperature developed in the groove **2** this groove may be provided with a lining **2'** of an oxide having a still higher melting point such, for example, as magnesia or thorium oxide.

The means above referred to for cooling the upper part of the lamp body may consist of a conical shell **15** lying in close proximity to the walls of the lamp body and adapted to receive heat therefrom. This heat may be absorbed by a cooling fluid circulating within a chamber **16** and supplied thereto by a tube **17** and carried away by a tube **18** or may be radiated to the surrounding air by a number of fins **19** attached to the shell **15** or by both.

The shell **15** is conveniently formed as a part of or attached to a supporting member **20** in which an internally threaded socket **21** is mounted and separated from the supporting member **20** by an insulating member **22**, which in turn carries a contact member **23**, the socket **21** and the contact member **23** constituting terminals for the lead wires **21'** and **23'**, which when the lamp is in place connect respectively with the wires **9** and **8**.

When in operation in a vertical position as shown in the drawings, gravity may be relied upon to return the condensed mercury vapor to the groove **2**, but if the lamp is to be operated in any other position or if it is not desired to rely entirely upon the force of gravity to return the condensed mercury to the groove **2**, the entire lamp body and its mounting may be rotated so that centrifugal force will act to return the condensed mercury vapor rapidly to the groove **2** in the lamp body.

For this purpose the lamp mounting **20** may be carried upon a shaft **25** journaled in a fixed member **26** and arranged for rotation in any suitable manner as by a motor M carrying a pulley **27** which is connected by belt **28** with a belt groove **29** formed in the mounting **20**.

In order to effect an electrical connection between the conductors of the rotatable mounting **20** and fixed member **26**, the mounting **20** may be provided with commutator rings **30** and **31** against which brushes **32** and **33** are arranged to bear. These brushes **32** and **33** may be connected to a suitable source of electrical energy, either alternating or direct current at suitable potential, which may be 110 or 220 volts either direct or alternating current.

If it is desired to operate the lamp upon a three-phase alternating current a third lead, brush, commutator ring and lead-in wire may be provided in a readily understood manner, and in such case three terminals, instead of the two terminals, **8'** and **9'** as shown, will be positioned equi distant from each other in the groove **2** of the lamp body.

In order to supply a cooling fluid to the cooling chamber **16** when the lamp housing is rotated, the tubes **17** and **18** may be extended through the shaft **25** and arranged to open into channels **35** and **36** formed in the member **26**, these channels being in turn connected through passages **37** and **38** with a suitable source of cooling fluid which may be caused to circulate through the cooling system in any suitable manner as by a pump or by gravity.

The radiant energy developed within the lamp body may be used alone or partly or entirely for the stimulation of a florescent coating which in turn will then produce desirable light rays. For this purpose the lamp body may be provided at suitable places, for example, upon the outside of the conical section, with a florescent film or coating **39** of known material. A suitable florescent coating may consist of one part each of beryllium oxide, zinc oxide, and silicon dioxide with which there is incorporated $\frac{3}{10}$ of 1% of thorium oxide.

The modification of the invention shown in Figure 2 operates upon the same principle and in much the same manner as the form of the invention shown in Figure 1, except for the fact that the heating of the liquid metallic filament within the lamp body is effected by an electrical current induced therein by a coil located in close proximity thereto.

Referring to Figure 2, a lamp body **40** generally frustro conical in shape, is provided and a circular groove or channel **41** formed at the lower and outer edge. An axial passage **42** may be provided through the lamp body for a mounting member **43** which, as shown, is adapted to be fastened to the shaft of a motor M.

Means are provided adjacent the upper part of the lamp body for conducting away heat and may conveniently take the form of a metallic shell **44** provided with heat radiating fins **45**. The lamp may be held on the mounting member **43** in any convenient manner as by a nut **46** threaded on the mounting member **43** and the mounting member **43** may be suitably keyed or fastened to the shaft of the motor as by a set screw **47**.

If it is desired to use this lamp in the vertical position as shown, the force of gravity may be relied upon to return the condensed mercury vapor to channel **41**, as previously explained in connection with Figure 1, but if it is desired to augment gravity by centrifugal force or if the lamp is to be operated in any position other than the one shown, it may be rotated upon the shaft of the motor M.

The heating of the liquid metallic filament **50** within the groove **41** is effected according to well known principles by placing in close proximity to the lamp a coil **51** through which a suitable alternating current is passed to induce a current in the ring of mercury, or other suitable metal, lying in the groove **41** within the lamp body **40**. The coil **51** may be so designed and energized as to induce within the liquid metallic filament a current of relatively low voltage, say from 10 to 20 volts, but of an amperage sufficiently high to heat the mercury beyond the vaporization point. This arrangement will permit the use within the groove **41** of a mercury filament of greater cross sectional diameter and of the generation of a greater light output for the lamp than in the arrangement illustrated in Figure 1. As previously described, the lamp body may be coated with a florescent material and the groove **41** may be filled with suitable metals other than mercury.

In lamps constructed in accordance with the present invention it is possible to obtain very high temperatures approaching 2900° C. instead of the maximum temperature hitherto possible in the neighborhood of 2200° C. Inasmuch as the light rays emitted do not, in accordance with well known laws, increase proportionately with the temperature but according to the fourth power of the temperature, very considerable economy and efficiency will be secured by lamps made according to the present invention.

The utilization of metals in liquid form as the filament of a lamp in accordance with the present invention, permits the heating of the filament to a point not hitherto attained. The degree of heat which may be imparted to solid metallic filaments is limited by the temperatures at which such filaments will soften, melt or vaporize, the maximum filament temperature possible in such lamps ranging from 2000 to 2400° C. Where an electrical current is passed through vaporized metal less light will be generated than when the same current is passed through the same metal in a solid or liquid state. According to the present invention the metallic filament in liquid form may be heated above its vaporizing temperature and maintained at a very high temperature because the vaporized metal is continuously condensed and returned to its liquid form and again becomes a part of the electrical circuit.

ANTON KRATKY.