Dec. 8, 1942. J. KERN ET AL 2,304,412

ELECTRIC HIGH PRESSURE DISCHARGE LAMP

Filed Sept. 10, 1940

Fig. 1.

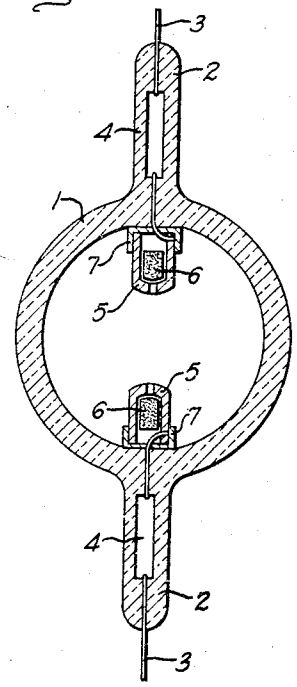


Fig. 2.

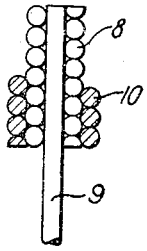


Fig. 3.

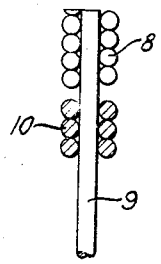


Fig. 4.

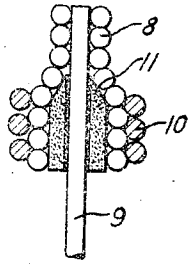


Fig. 6.

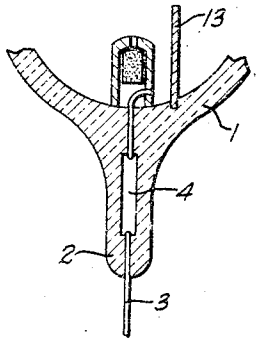
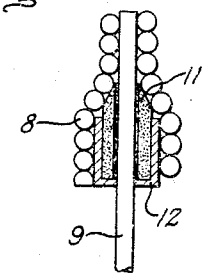


Fig. 5.



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UNITED STATES PATENT OFFICE

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ELECTRIC HIGH PRESSURE DISCHARGE LAMP

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Application September 10, 1940, Serial No. 356,230
In Germany October 4, 1939

6 Claims. (Cl. 176—122)

The invention relates to electric high-pressure lamps with glowing electrodes heated by discharge and an operating pressure exceeding 20 atmospheres, especially to mercury vapour super high pressure lamps, which contain a basic filling of ignition gas and some mercury which completely evaporates during operation. In high-pressure lamps of this type it has been possible recently, chiefly by an improvement of the construction and of the arrangement of glowing electrodes, to more and more reduce the dimensions of the discharge vessel consisting of quartz glass or of another glass possessing a high melting point, this having evidently a favourable effect upon the discharge vessel. The inner surface of the discharge vessel is then generally made so small, depending on the capability of the arc to take up power, that on the average less than 5 mm.^{2} are at disposal for 1 watt power input. In ball-shaped discharge vessels, for instance at little power input inner diameters from 10 to 15 mm. and less can be obtained by calculation, which could be realized only if it were possible to mount the glowing electrode bodies directly on the quartz glass wall or even to embed them in the quartz wall.

Owing to the discharge space which is small relative to the power input of the super high pressure lamps, to the high operating pressures up to 100 atmospheres and more and to the strong stressing of the glowing electrodes heated by the light arc, the construction of these high pressure lamps and especially of their glowing electrodes is submitted to extremely critical conditions. Theoretic considerations are of little use. Only from the behaviour of the finished lamp under life tests can a reliable picture of the suitability of the selected construction be obtained.

The obtention of a sufficiently low preliminary ignition voltage is comparatively easy, because the distance between the glowing electrodes is small and amounts to only a few millimetres. The avoiding of too high losses of light during operation of the lamp causes however serious difficulties owing to the small inner surface of the discharge vessel. Experiments with other materials for electrodes than tungsten, for instance tantalum, were not successful. Also in these small high pressure lamps glowing electrodes of tungsten are best which show a feeble activation from thorium oxide to which if desired some oxide of alkaline earth metal may be added.

Experiments have, however, shown that in these maximum pressure lamps the loss of light occurring in the course of time can be much reduced if, according to the invention, on or at the side of a glowing electrode, or at the side of the light arc, a getter body of tantalum is arranged.

The accommodating of such getter body in the comparatively small discharge vessel is best effected by arranging the getter body of the rear portion of one or of all glowing electrodes, for instance sintered in powder form on the rear portion of the electrode. Owing to high operating temperatures of these glowing electrodes, it can be attained without difficulty, that when the lamp is in operation the tantalum getter body comes to a sufficiently high temperature favourable for the getter effect. The arrangement may be such, that differently high temperatures occur along the getter body. The surface of the tantalum getter body must not be too small; its most favourable size, dependent on the construction of the lamp, can easily be found out by experiments.

A form of construction of the high pressure discharge lamp with an operating pressure of about 50 atmospheres and with a light arc absorbing capability of about 150 watts is shown in section in

Fig. 1 of the accompanying drawing in threefold enlargement.

Figs. 2 to 5 show other forms of construction of the glowing electrodes equipped with the getter bodies of tantalum for such high pressure lamps.

Fig. 6 shows an arrangement of the tantalum body at the side of the glowing electrode.

The high pressure lamp shown in Fig. 1, comprising a fundamental filling of ignition gas and some mercury, consists of a spherical quartz discharge vessel 1 with two outwardly projecting tubular stems 2 in which the molybdenum foils 4 which are connected with current conducting wires 3, are tightly fused.

The glowing electrodes 5 rest on the quartz glass wall and consist of sintered hollow tungsten cylinders with activating body 6 of thorium oxide mounted in the same, a trace of alkaline earth metal oxides being added to the thorium oxide. On the rear portion of the hollow tungsten cylinder a pot or cap 7 of tantalum sheet plate is placed, which during the operation of the lamp is heated by conduction from the glowing electrode to such a high degree, that it reduces by its getter effect the loss of light, lowering of the ignition voltage and of the reignition voltage occurring mostly at the same time.

Figs. 2 to 5 show coiled electrodes of wire. The glowing electrode is in this instance formed by a coiled wire 8 of tungsten, which is placed on the axially conducted current feed or lead-in wire 9

and preferably forced on the same by clamping and terminating in the same plane as the end face of the current feed wire.

In the electrode shown in Fig. 2 a coiled wire of tantalum is applied on the rear portion of this coiled wire 8 of tungsten and serves as getter body.

Fig. 3 shows a glowing electrode, in which one of the coiled wires 10 of tantalum is arranged behind the coiled wire 8 of tungsten and at a short distance from the same on the current feed wire 9. According to Figs. 2 and 3 the coiled wire 8 of tungsten on both electrodes can be activated by dipping into suitable substances or by spraying on or painting on of these suitable substances.

In the glowing electrode shown in Fig. 4 the rear windings of the coiled wire 8 of tungsten are of larger diameter and enclose a sleeve 11 of activating substances, especially thorium oxide, pushed over the current feed wire. Over the rear windings of the coiled wire 8 of tungsten a tantalum wire 10 is wound.

The glowing electrode shown in Fig. 5 differs from that shown in Fig. 4 only in that, instead of the tantalum wire 10, a pot or cap 12 made of tantalum plate is pushed over the current feed wire 9, the activating sintered body 11 being mounted in this pot.

Whereas in all forms of construction shown in Figs. 1 to 5 the tantalum body is fixed on the glowing electrode, Fig. 6 shows a form of construction with a strip 13 of tantalum, which is arranged at the side of the glowing electrode and of the light arc and which is fused alone into the wall of quartz glass.

A high or super high pressure lamp constructed according to the invention may also comprise a mercury bottom body, to which cadmium, zinc or thallium is added for improving the color of the light or for increasing the yield of light. Instead of vapor- or gas-vapor filling a pure gas filling of high pressure may be provided in the lamp. At very high taking up of power a cooling of the lamp vessel, especially a water cooling, is advisable.

We claim:

1. An electric high pressure discharge lamp with glowing electrodes heated by the discharge, having a basic filling of ignition gas and an operating pressure exceeding 20 atmospheres, comprising in combination with the glowing electrode and with the light arc, a getter body of tantalum arranged near one of them.

2. An electric high pressure discharge lamp as specified in claim 1, comprising a glowing electrode consisting of a sintered hollow cylinder of tungsten with thorium oxide mounted in the same, and a getter body of tantalum mounted on the rear portion of the glowing electrode.

3. An electric high pressure discharge lamp as specified in claim 1, comprising in combination with an axially conducted current supply wire, a coiled wire of activated tungsten, and a coiled wire of tantalum wound on the rear windings of said coiled wire of tungsten.

4. An electric high pressure discharge lamp as specified in claim 1, comprising a strip of tantalum mounted so as to be insulated from the glowing electrode and extending near to the light arc.

5. A high pressure gaseous electric discharge lamp with glowing electrodes heated by the discharge and having an operating pressure exceeding 20 atmospheres, at least one of said electrodes comprising an axially arranged coil of tungsten wire and a getter body of coiled tantalum wire arranged at the rear of said coil of tungsten wire.

6. A high pressure gaseous electric discharge lamp with glowing electrodes heated by the discharge, at least one of said electrodes comprising a shell of tungsten containing an activating material, and a getter body of tantalum mounted on the rear of said tungsten shell.

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FRITZ MICHALK.

CERTIFICATE OF CORRECTION.

Patent No. 2,304,412. December 8, 1942.

JOSEF KERN, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 36-37, claim 6, after the word "discharge" and before the comma insert --and having an operating pressure exceeding 20 atmospheres--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 16th day of February, A. D. 1943.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)