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DEVICE FOR VAPOR-COATING SELECTED AREAS OF AN INTERNAL SURFACE

Filed Sept. 13, 1963

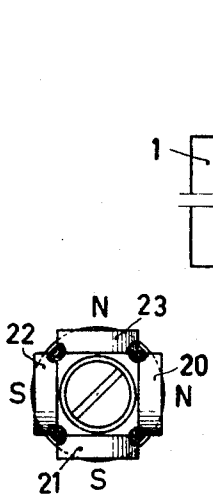

FIG.2

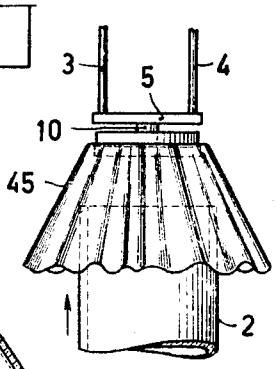

FIG.3

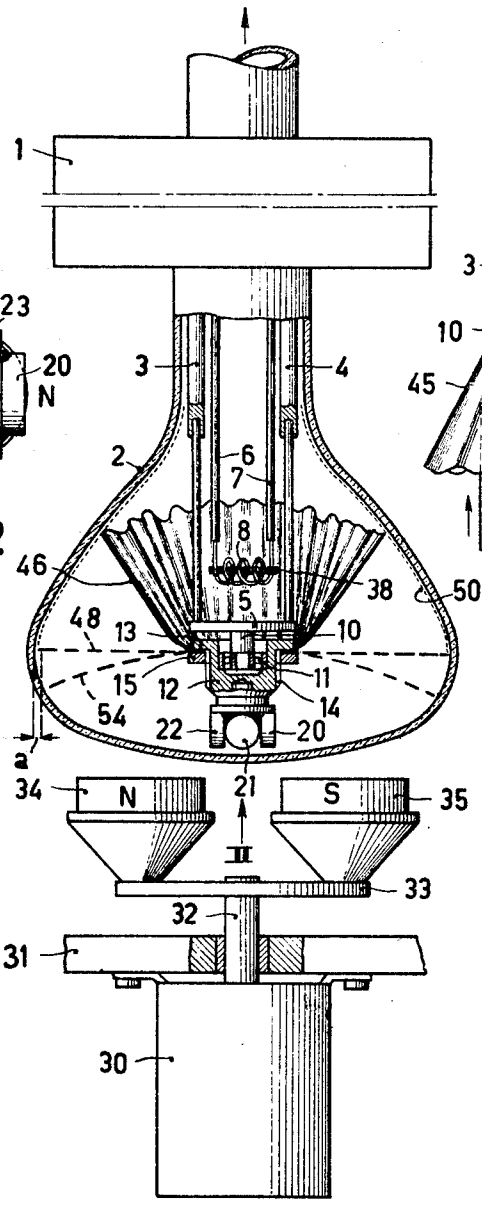

FIG.1

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DEVICE FOR VAPOR-COATING SELECTED AREAS OF AN INTERNAL SURFACE

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Claims priority, application Netherlands, Sept. 28, 1962, 283,791
5 Claims. (Cl. 118—49.1)

The invention relates to apparatus for coating a limited inner area of the inner wall of bulbs for filament lamps, discharge tubes and the like with a layer of metal by vapor deposition.

Apparatus for this purpose is known.

In the known apparatus the screening member consists of a number of flexible laminations which are passed through the neck aperture of the bulb to be coated in a contracted condition. Inside the bulb they engage the wall of the bulb opopsite to the neck aperture and are bent by that wall of the bulb and spread in the manner of a fan. In the subsequent vapor disposition of a metal layer, these laminations cover part of the wall of the bulb as a mask.

The known apparatus has some disadvantages. First of all, a guiding box which surrounds the laminations so that they can be inserted through the neck of the bulb is indispensable. In addition, the known apparatus can damage the wall of the bulb.

The apparatus according to the invention mitigates these disadvantages and is characterized in that in the rest condition of the apparatus the screening member comprises a skirt positioned around the shaft of a carrier which can be passed through the neck aperture of a bulb, and in addition means are provided for rotating the skirt within the bulb. The outer circumference of the skirt which, when spread as a result of rotation, does not engage the inner wall of the bulb as in the prior art apparatus. By ensuring that during the vapor deposition the rotating skirt does not touch the inner wall of the bulb, a rather sharp transition can be obtained between the covered and uncovered parts of the wall of the bulb.

In principle, the skirt may consist of a number of hinged laminations. However, in such an arangement the laminations slide on each other as a result of which metal particles may be scratched off which are hard to remove from the bulb. However, such a construction would furthermore be far from simple. Therefore, in the presently preferred embodiment of the device according to the invention the shield is constituted of a pleated skirt consisting of a flexible material which is stretched by rotation. This skirt, in the folded condition, can be brought into and out of the bulb and preferably consists of a material which is so flexible that the vapor deposited metal layer is not damaged when the skirt is removed from the bulb; a skirt, for example, of polytetrafluoroethylene, gives good results. A skirt of such material is also very suitable because it does not give off gas under vacuum conditions.

During the vapor deposition of a metal layer a high vacuum must be maintained in the bulb, which means that a spindle for rotating the skirt has to be sealed at the point where it passes through the neck of the bulb. In addition, there is little room for a rotating spindle in the neck of the bulb, since the carrier for the skirt and a filament suitable for vapor deposition as well as a number of electrical connections have to be passed through said neck. Therefore, according to the present invention, the skirt is connected to a rotatable head piece provided with magnets, rotation being obtained by a rotating magnetic field which is produced and maintained outside the bulb.

In order that the invention may readily be carried into effect, the apparatus according to the invention will now be described more fully with reference to a presently preferred embodiment.

In the drawing, FIGURE 1 shows the principal parts of the apparatus according to the invention which includes a screening member consisting of a pleated skirt. FIGURE 2 is a plan view, looking along the arrow II of FIGURE 1, of the four magnets of the rotatable head piece. FIGURE 3 shows the shape of the skirt just before it is passed into the bulb.

Apparatus according to the invention consists of a holder **1** for holding a glass bulb **2** so that a high vacuum can be produced within the bulb **2** through a pipe connected to a vacuum pump (not shown).

A carrier, constituted by a set of supports **3**, **4** and a transverse rod **5** as well as a set of electrodes **6** and **7**, extends through the holder. A tungsten filament **8** is positioned between the electrodes. A shaft **10** is connected to the transverse rod **5**. A ball bearing **11** is located on shaft **10** for rotatably supporting a head piece **12**. The rotatable head piece **12** is provided with a screw thread **14** and has a flange **13** as shown. A nut **15** threaded on the head **12**, clamps a skirt or screening member **45** (FIGURE 3) between the nut and the flange. This screening member is manufactured from a flexible substance, for example polytetrafluoroethylene. The rotatable headpiece **12** further includes the four cylindrical magnets **20**, **21**, **22**, **23**.

Outside the bulb **2** an electric motor **30** is connected to a movable plate **31**. A flange **33** is connected to the motor shaft **32** on the circumference of which flange magnets **34** and **35** are provided.

The operation is as follows:

First, the holder **1** and the plate **31** are spaced apart and a metal rod **38** to be evaporated is placed in the filament **8**. Then the neck of the bulb **2** is passed over the screening member folded as a pleated skirt **45** (FIGURE 3), as a result of which the skirt assumes the inverted position **46** shown in FIGURE 1 inside the bulb. During or after evacuation of the bulb electric motor **30** is brought into position and switched on, as a result of which the magnets **34**, **35** start rotating and a rotating magnetic field is produced. The magnets **20** to **23** within the bulb will also start rotating, so that the head piece **12** and consequently the skirt **46** are rotated. The skirt **46** is stretched and opens into a disc as a result of the centrifugal action which is indicated by reference numeral **48**. In this position the outer circumference of the skirt does not touch the inner wall of the bulb **2**. Then the filament **8** is heated to glowing in the high vacuum inside the bulb which has been produced. As a result of this, a metal layer will be deposited on the part of the wall of the bulb indicated by **50**. The stretched skirt or disc **48** serves as a shadow screen, as a result of which the part of the bulb below the skirt **48** is not provided with a metal layer. By making the free distance *a* between the disc **48** and the inner wall of the bulb small with respect to the diameter of the bulb, the transition between the coated and uncoated parts of the inner wall of the bulb are very sharp.

Finally, the electric motor **30** is again switched off. In the rest condition the skirt assumes the position indicated by **54**. When the holder **1** and the plate **31** are moved apart, this skirt will again assume the shape of a pleated skirt of a smaller diameter which can easily be taken out through the neck aperture of the bulb.

What is claimed is:

1. In a device for coating a limited interior area of a hollow body; the improvement comprising a flexible,

foldable fabric like mask element having a central portion; rotatable means, and means for securing said mask element on said rotatable means at said central portion thereby forming a pleated skirt; said rotatable means being adapted to be received within said body whereby said central portion of said skirt lies in substantially the plane of a demarcation-line within said bulb of the areas to be coated and uncoated; means for rotating said rotatable means at a speed whereby centrifugal forces are developed which influence said skirt to assume a substantially planar disc form, said skirt being dimensioned so that the outer periphery thereof in said disc form lies in contiguous spaced relation with said body at said demarcation-line.

2. In a device according to claim **1**, wherein said rotatable means comprises a carrier having a rotatable head piece at one end, said means for securing said mask element being connected with said rotatable head piece; and means connected with said carrier for closing and evacuating said body; permanent magnets connected with said head piece and means defining a rotatable magnetic field for driving said head piece.

3. In a device according to claim **1** wherein said skirt

consists of a flexible material such as, f.i., polytetrafluoroethylene.

4. In a device according to claim **2** wherein said means comprises a pair of rotatably mounted permanent magnets, and means defining a rotatable magnetic field for rotating said magnets.

5. In a device according to claim **2**, of the addition with said carrier means of a pair of electrides having a tungsten filament therebetween intermediate and rotatable head piece and said means for closing said body.

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MORRIS KAPLAN, *Primary Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,277,864 October 11, 1966

Anthonius Petrus Cornelis Hopstaken

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 1, strike out "f.i."; line 7, strike out "of the addition"; lines 8 to 10, strike out "with said carrier means of a pair of electrides having a tungsten filament therebetween intermediate and rotatable head piece and said means for closing said body." and insert instead -- further characterized by a pair of electrodes disposed within said hollow body and depending from the means for closing said body; and a tungsten filament connected across end portions of said electrodes remote from the means for closing; whereby electric current may be passed through said filament to evaporate coating material supported thereon. --.

Signed and sealed this 5th day of September 1967.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents