

UNITED STATES PATENT OFFICE.

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PROCESS OF MAKING INCANDESCENT LAMPS.

1,025,499.

Specification of Letters Patent.

Patented May 7, 1912.

No Drawing.

Application filed November 27, 1908. Serial No. 484,551.

To all whom it may concern:

Be it known that I, WILLIS R. WHITNEY, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Processes of Making Incandescent Lamps, of which the following is a specification.

My invention relates to incandescent lamps and similar articles in which a high vacuum must be maintained unchanged throughout the life of the lamp, and its object is to provide a process for securing, in less time than required for the exhaustion of a lamp in the usual manner, a very perfect vacuum which will remain substantially unchanged throughout the life of the lamp.

One of the principal factors tending to limit the life of incandescent lamps is a decrease in the vacuum caused by the gradual liberation from the glass walls of the bulb of gases or water vapor absorbed or occluded by the glass. These gases and the water vapor are liberated as the lamp becomes hot and when liberated, either attack the filament or, by impairing the vacuum, cause electrical discharges from the filament, thereby causing the filament to gradually crumble and resulting in the formation of a light absorbing deposit on the glass walls.

In the process of manufacture usually followed, the bulbs of incandescent lamps are blown in the glass works and after becoming cool are packed in straw or other packing material and shipped to the lamp works. Before the bulbs are used in the lamp works they must be washed to remove the dust and dirt from the interior and during this washing the glass walls absorb considerable water which cannot be entirely removed even by subsequent careful drying in drying furnaces. In the next step in the manufacture, the bulb is provided with a tubulature through which it may be exhausted and the stem on which the filament is mounted is fused into the neck of the bulb in the sealing-in room of the factory. The lamps are then permitted to cool and are stored in trays and in the course of time are taken to the exhausting pump to be exhausted. It is found that while the lamps are in storage the cold walls of the lamp bulb absorb all the elements of atmospheric air, especially vapor of water, and it is customary to drive

out of the bulb as much of the occluded gases and water vapor as possible by heating the lamps while they are on the exhausting pump, but this procedure does not avoid the difficulty because the heating cannot be carried high enough to drive out all of the occluded gases or water vapor, on account of the tendency of the heated bulbs to collapse as the exhaustion proceeds.

In carrying out my invention the lamp which comes from the sealing-in room provided with a tubulature and ready to be exhausted and sealed off is placed in an oven or similar heating device and raised to a temperature higher than the temperature attained by the walls of the lamp when the lamp is in use, while at the same time a stream of carefully dried gas is passed into and out of the bulb. The occluded gas and water vapor are driven out of the walls of the bulb by the heating and are carried away by the stream of dried and heated gas. It is preferable, though not necessary, to carry the heat to the point at which the walls of the bulb begin to soften, which can be done with safety since the bulb is open to the atmosphere and there is no tendency for the walls of the bulb to collapse.

Any suitable gas may be used, but owing to the high temperature attained by the filament and the walls of the bulb, it is necessary to use some inert gas which will not attack either the filament or the glass of the bulb. When my invention is used in connection with lamps having easily oxidizable metallic filaments, the best results are attained by using pure hydrogen, which can easily be obtained in a dry state and which effectually prevents oxidation of the filaments. It has been found that when hydrogen is used and the bulb is made of glass of the kind commonly used in incandescent lamps, the walls of the bulb are attacked and a dark coating is formed if the temperature is carried much above 400° centigrade. But a very perfect vacuum can be obtained if the bulb is heated to a temperature of about 400° centigrade, and that temperature is not exceeded when hydrogen is passed through the bulb.

If the bulb has been maintained at a high temperature and hydrogen or other inert gas has been passed through the hot bulb for a sufficient length of time, it will be found that practically all of the gas and

water vapor occluded on the walls of the bulb have been driven off and carried away by the stream of dried gas. The lamp is then ready to be exhausted and is preferably transferred to the exhausting pump while still hot and is maintained at as high a temperature as is practicable while it is on the exhausting pump, although a temperature of about 300° centigrade cannot be exceeded while the bulb is being exhausted on account of the tendency of the bulb to collapse.

When the walls of the bulb have been entirely freed from occluded gas and water vapor as above described and the bulb is full of dried hydrogen, the bulb may, if desired, be rendered air tight by sealing in any desired way and can then safely be kept for a considerable length of time before it is put on the exhaust pump, because there is no opportunity for air and water vapor to become occluded by the inner walls of the bulb. Since the tubulature is quite small and the diffusion of the hydrogen through the tubulature is not very rapid, the tubulature may be left open, the lamp permitted to cool down to a temperature at which it may be handled easily, and the lamp then transferred to the exhausting pump without any air or water vapor being occluded by the inner walls of the lamp. In all cases, however, it is found advantageous to heat the lamp as high as possible while it is on the exhausting pump, as this heating improves the vacuum and materially shortens the time required to exhaust the bulb.

Where an inert gas is passed through the hot bulb as above described, the time required for exhausting the bulb to produce a perfect vacuum is much less than is required where the lamps are first heated while on the exhaust pump and are exhausted in the ordinary way, since there is no gradual liberation of gases and moisture from the walls of the bulb during the process of exhaustion.

My process of securing a vacuum may be used in exhausting mercury lamps, rectifier tubes and all similar articles, in which a perfect and unchangeable vacuum is required and, since many changes and modifications may be made in the way in which the invention is carried out, I do not desire to be restricted to the precise details herein disclosed, but intend to cover by the appended claims all changes and modifications within the spirit and scope of my invention.

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

1. The process of freeing a glass vessel from occluded gases and moisture, which consists in heating said vessel while open to the atmosphere to a temperature at which the walls of the vessel begin to soften, washing out said vessel by passing a stream of dried gas through said vessel during the time it is above the temperature at which gases or moisture are occluded, and thereafter sealing said vessel air tight before air and moisture are again occluded.

2. The process of removing occluded gases and moisture from the walls of the bulb of an incandescent lamp, which consists in heating the lamp to about 400 degrees centigrade, passing a stream of hydrogen through said bulb while hot enough to prevent occlusion of gases or moisture, and thereafter exhausting said lamp at a temperature of about 300 degrees centigrade.

3. The process of evacuating an incandescent lamp bulb, which consists in heating said lamp bulb while open to the atmosphere to a temperature at which the bulb begins to soften, passing a stream of dried inert gas through the bulb while hot enough to prevent occlusion of gases or moisture, and thereafter evacuating and sealing the bulb before air or moisture is again occluded.

4. The process of producing an evacuated glass vessel free from occluded gases and moisture, which consists in heating said vessel before evacuation to a temperature at which the walls of the vessel begin to soften, washing out said vessel by passing through it at that temperature a stream of dry gas, and thereafter evacuating said vessel at a lower temperature and sealing it before air or moisture is again occluded.

5. The process of producing an evacuated glass vessel free from occluded gases and moisture, which consists in heating said vessel before evacuation to a temperature high enough to prevent occlusion of gas or moisture, freeing said vessel from gases and moisture by passing through it while so heated a stream of gas, and subsequently evacuating and sealing said vessel before gas or moisture is again occluded.

In witness whereof, I have hereunto set my hand this 25th day of November, 1908.

WILLIS R. WHITNEY.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.