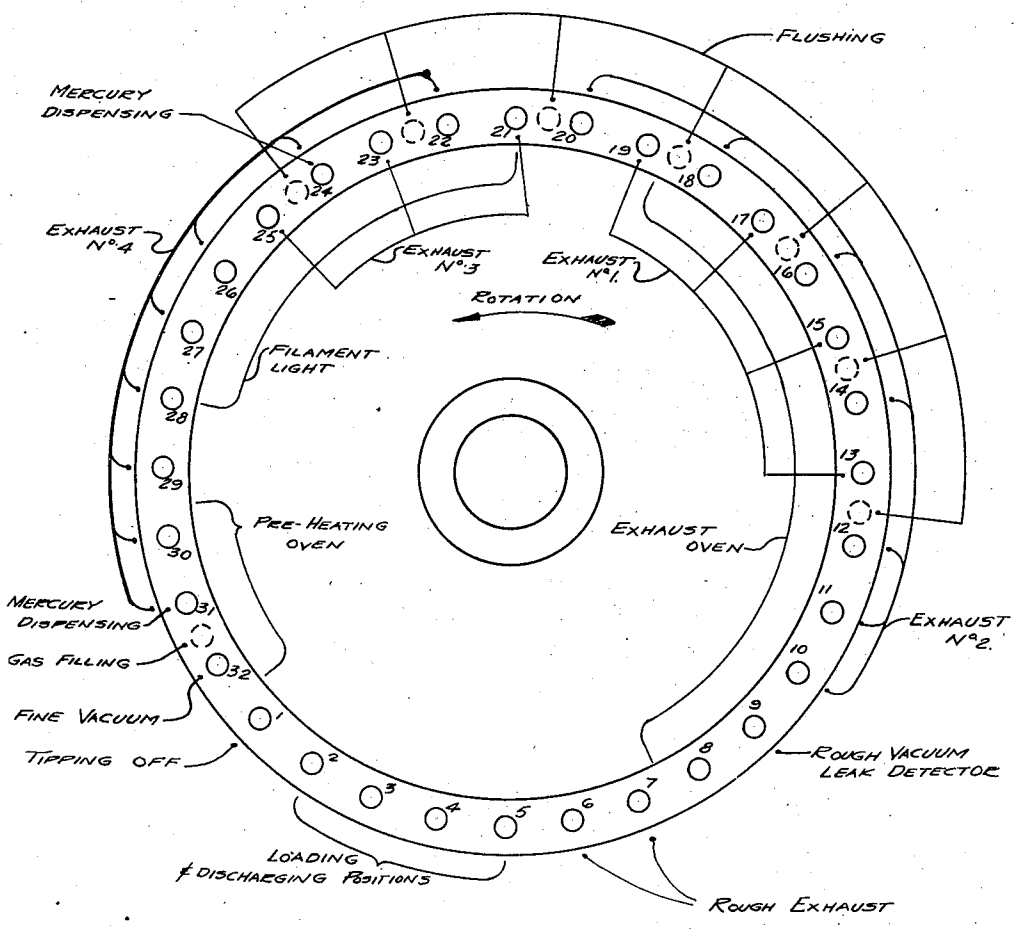
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APPARATUS FOR LAMP MANUFACTURE

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## APPARATUS FOR LAMP MANUFACTURE

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2 Claims. (Cl. 176—2)

This invention refers to an exhaust machine for electric gaseous discharge lamps and more particularly to an exhaust schedule for such a machine.

An object of this invention is to provide an exhaust cycle that will properly and adequately exhaust fluorescent lamps.

Another object is to provide an exhaust cycle to which a heating oven for aiding the exhaust may be readily adapted.

A further object is to provide an exhaust cycle in which several separate exhaust lines are used, thereby obtaining a higher purity atmosphere in the lamp when it is being exhausted.

Another object is to obtain an exhaust cycle which will provide for an adequate "cathode break-down."

Another object is to provide an exhaust cycle to which a means for testing the lamps before they are tipped off may be readily adapted.

Another object is to provide an exhaust cycle to which a mercury dispensing means may be readily adapted.

Another object is to provide an exhaust cycle to which a means for controlling the pressure of the gas filling may be readily adapted.

Another object is to provide an exhaust cycle to which a means for tipping off the lamps may be readily adapted.

Further objects and advantages of this invention will be apparent from the specifications which follow taken in conjunction with the accompanying drawing.

The accompanying schematic diagram shows the desired arrangement of the steps and processes through which the lamp goes during the exhaust cycle. These steps or processes are accomplished through a circular series of thirty-two heads. The function of each individual head is determined in accordance with its position in relation to the preferred order of the steps and processes which the lamp should undergo.

Positions 2, 3, 4, and 5 are loading and discharging positions, i. e., they may be used for either purpose. Lamps to be exhausted may be loaded on to the machine at positions 3, 4, and 5, and the exhausted lamps may be withdrawn at position 2. When a lamp reaches the positions 6 and 7 it is exhausted, by a preliminary or rough vacuum. Position 8 is plugged. This position is plugged in order to provide an interval of time between the rough vacuum and the leak detecting position to allow air to seep into the lamp if it is leaky. Position 9 is the leak detecting position. Here a leaky lamp may be detected and shut off from the exhaust line by some suitable pinching or clamping means.

When a lamp indexes from station 7 to station 8, it enters the exhaust oven which completely envelops the lamp while it is in positions 8 to 18 inclusive. By causing the lamp to pass through this oven during several of the flushing and exhausting operations, a high purity atmosphere is obtained. An oven similar to that described in the application of Gardner and Allen, filed July 20, 1940, Serial No. 346,618 may be used.

While the lamp is in positions 10, 11 and 12, it is exhausted through an exhaust line termed on the drawing as exhaust No. 2. After these three exhausting positions, the machine indexes to position 13 where the lamp is connected to exhaust No. 1. However, before the lamp reaches the position 13, yet after it leaves position 12, it establishes contact with another position shown in dotted lines between positions 12 and 13. Although the machine is indexing at the time, still the connection between the lamp and this auxiliary position is of sufficient duration to allow flushing with some inert gas, for example argon, at a relatively low mercury pressure, for example about 10 m. m. At position 13, the lamp establishes connection with exhaust No. 1 which pumps out the argon. While at position 14, the lamp is evacuated through exhaust No. 2.

Similar flushing and evacuating steps are taken on the several succeeding positions. Between 14 and 15, there is another flushing, similar to the first, with some inert gas, preferably argon, at a relatively low mercury pressure, for example about 10 m. m. At station 15, the lamp is evacuated through exhaust No. 1, and at station 16, through exhaust No. 2. Between 16 and 17 there is an argon flush. At 17 there is an evacuation through exhaust No. 1 and at 18 there is an evacuation through exhaust No. 2. Between 18 and 19 there is an argon flush. At 19 there is an evacuation through exhaust No. 1 and at 20 there is an evacuation through exhaust No. 2. Between 20 and 21 there is another argon flush.

At position 21, the lamp is evacuated through the exhaust No. 3 and at position 22, through the exhaust No. 4. Between 22 and 23, there is an argon flush. At 23, there is an evacuation through exhaust No. 3 and at 24, through exhaust No. 4. Between 24 and 25, there is an argon flush. At 25, there is an evacuation through exhaust No. 3 and at 26, there is an evacuation through exhaust No. 4.

Evacuation through exhaust No. 4 takes place

thereafter at positions 27, 28, 29, 30 and 31. After this continuous evacuation at these five positions, the lamp has been sufficiently evacuated to receive its final filling of gas.

When the lamp reaches position 21 after the several exhausting and flushing operations and the period spent in the exhaust oven, it is ready for the filament lighting or "cathode breakdown" as it is more commonly called.

The purpose of this "cathode breake-down" is to obtain a cathode with high emission qualities. Since one or more of the alkaline earth oxides may be used for this purpose, it has been found that barium and strontium oxide is desirable. Since it is advantageous to use a barium and strontium carbonate and lacquer solution, when coating the coiled wire, usually of tungsten, which forms the surface on which the barium and strontium oxide is desired, the barium and strontium carbonate and lacquer must be "broken down" so as to leave an active barium strontium oxide with high emissive properties.

This "break-down" is accomplished by a series of filament heating steps in which a current flows through the electrodes. The heat generated thereby in the filament will result in the reduction of the barium and strontium carbonates to their respective oxides. Carbon dioxide and decomposition products of lacquer will be drawn off in the gaseous state through exhaust No. 3 and exhaust No. 4.

The filament heating is accomplished by passing current through a series of incandescent lamps which act as a ballast limiting the current through the electrodes of the discharge lamp. The wattage and voltage of these incandescent lamps serving as a ballast will be governed by the purpose for which the filament lighting process was instituted. Since the purpose of this process is to obtain a cathode with high emissive properties, the cathode must be sufficiently "broken down" at the end of the filament lighting process to obtain this result. It is desirable to pass a current through the cathodes that will heat them sufficiently to result in the reduction of the barium and strontium carbonates to their respective oxides and yet this current should not be such that the heat generated thereby will cause the tungsten wire to break or the walls of the lamp to discolor. The voltage must also be kept below the point where the cathode coating would break up and chip off.

It has been found that for a 40 watt fluorescent lamp, the cathode will be adequately broken down if a schedule similar to the following is used for the incandescent lamps in series:

| Position | Lamp | |
|---|---|---|
| | Watts | Volts |
| 21 | 100 | 130 |
| 22 | 100 | 130 |
| 23 | 100 | 125 |
| 24 | 100 | 125 |
| 25 | 100 | 120 |
| 26 and 27 | (1) | (1) |
| 28 | 100 | 120 |

[1] 300 volt flash.

After the lamp has passed through the first three filament lighting positions, it is flushed with a small quantity of mercury introduced therein at position 24. This mercury dispensing means may be similar to that described in the copending application of Gardner and Allen filed June 26, 1940, Serial No. 342,472. Although the lamp is being evacuated at each position during the entire filament lighting process, a sufficient amount of mercury remains in the lamp so that, at positions 26 and 27, the lamp may be tested to see whether or not the filament is properly broken down. This is done by providing equipment, such as a step-up transformer, connected to these positions, that is suitable to flash the lamps at 300 volts. One end of the filaments is connected to the line in one of the flashing positions and the other end of the filaments is connected to the line in the other flashing position.

This equipment may be similar to the regular starting equipment employed when the lamps are actually in use. This flashing, which also helps to "break down" the cathode, consists of a voltage across the cathodes sufficient to start the discharge across the lamp. If the discharge does not occur, the lamp is faulty. This flashing at positions 26 and 27 also serves to test the emission qualities of the barium strontium oxide on the filament. Following these two flashing positions, there is one more lighting position, position 28, where an incandescent lamp ballast of 110 watts—120 volts—is used.

The upper section of the lamp passes through a preheating oven when it moves through positions 30 to 32, inclusive. This preheating oven is provided to heat the upper part of the lamp and particularly the seal joining the bulb neck to the mount in order to prevent strains from occurring in the glass of the lamp when it comes in contact with the metal of the tipping torch located at position 1. The oven may be of a construction similar to that described in the copending application of Gardner and Allen, filed July 20, 1940, Serial No. 346,618 except that, inasmuch as it only encloses the upper section of the lamp, there is no oven floor or doors.

The lamp is now ready to receive a small amount of mercury that is desirable for the proper operation of an electric gaseous discharge lamp. The mercury may be introduced at position 31 by a mercury dispensing device such as, for example, the one described in the copending application of Gardner and Allen, filed June 26, 1940, Serial No. 342,472.

As the machine indexes from position 31 to position 32, an atmosphere of an inert gas, such as argon, is introduced at a mercury pressure of from 4 to 11 m. m. When the lamp reaches position 32, it undergoes evacuation through a pressure controlling device similar, for example, to that described in the copending application of Gardner, filed May 18, 1940, Serial No. 335,979. Thus the desired pressure usually about 2 m. m. is accurately obtained. The lamp then moves to position 1 where it is tipped off by a lamp sealing device similar, for example, to that described in the copending application of Gardner and Allen, filed June 28, 1940, Serial No. 342,968.

Although this exhaust cycle has been described as having several distinct flushings with an inert gas, the number of flushing operations may be varied without departing from the essence of the invention.

Furthermore, different valve construction may be used without departing from this exhaust cycle. For example, one might employ the actual indexing positions to flush the lamps with an inert gas instead of flushing between positions. Although this would result in a decrease in the number of times flushing and evacuating took place, it would not depart from the spirit of the invention.

It may be noted that different exhaust lines are employed at different stages during the exhaust cycle. This is done to obtain an efficient evacuating system and consequently a high purity atmosphere in the lamp. It will be noted from a study of the accompanying drawing and the above specifications that exhaust No. 1 is only used directly after an argon flush. Thus the greater part of the argon flush is confined to one line, exhaust No. 1. Exhaust No. 2 is used before there is any flushing at all and thereafter, after most of the argon has been evacuated through exhaust No. 1. Thus exhaust No. 1 is used for the most part to draw off the argon flush. Exhaust No. 2 is used to draw off the air present in the lamp after it passes the leak detector, and thereafter to draw off the gases given off by the glass and the fluorescent material while the lamp is passing through the exhaust oven.

Once the cathode "break-down" starts, a different set of exhaust lines are used because these lines will be employed for different purposes than exhaust No. 1 and exhaust No. 2. Exhaust No. 3 is used directly after such argon flushes as take place during the filament lighting period. Thus this line will draw off the argon used in flushing and the carbon dioxide and decomposition products of lacquer given off during the cathode "break-down." Exhaust No. 4 is used mainly to evacuate the carbon dioxide and decomposition products of the lacquer. Thus, by using four different exhaust lines a maximum efficiency is obtained in attaining a high purity atmosphere in the lamp.

Although there are but four different exhaust lines employed in this invention, more lines and pumps may be used to speed up the exhausting process or to adequately exhaust these lamps with a greater cubical content than the specific example given herein.

What we claim is:

1. A process for exhausting discharge lamps having filamentary electrodes, said process comprising the following steps: exhausting the lamp to a rough vacuum, baking the lamp in an oven, exhausting the lamp to a finer degree of vacuum, flushing with an inert gas, exhausting again on a different pump, lighting the filamentary electrode, placing some mercury in the lamp, filling the lamp with an inert gas, exhausting the lamp again, extinguishing the filament, further exhausting the lamp, heating the lamp again, placing some mercury in the lamp again, adding an excess pressure of inert gas, evacuating the excess of the inert gas, sealing off the lamp, and removing it from the machine.

2. A process for exhausting discharge lamps having filamentary electrodes, said process comprising the following steps: exhausting the lamp to a rough vacuum, placing the lamp in an oven, exhausting the lamp to a finer degree of vacuum, flushing with an inert gas at low pressure, then exhausting on a different pump, removing the lamp from the oven, lighting the filamentary electrode, exhausting the lamp on a third pump separate from the other two pumps, placing some mercury in the lamp, flushing with an inert gas at low pressure, exhausting on a fourth pump separate from the others, placing the lamp in an oven during the last part of the latter exhausting step, placing some mercury in the lamp, filling with a pressure of inert gas in excess of that desired in the finished lamp, exhausting said excess, removing the lamp from the oven, sealing off the lamp and removing it from the machine.

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