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F. L. O. WADSWORTH.

METHOD OF EXHAUSTING INCANDESCENT LAMP BULBS.

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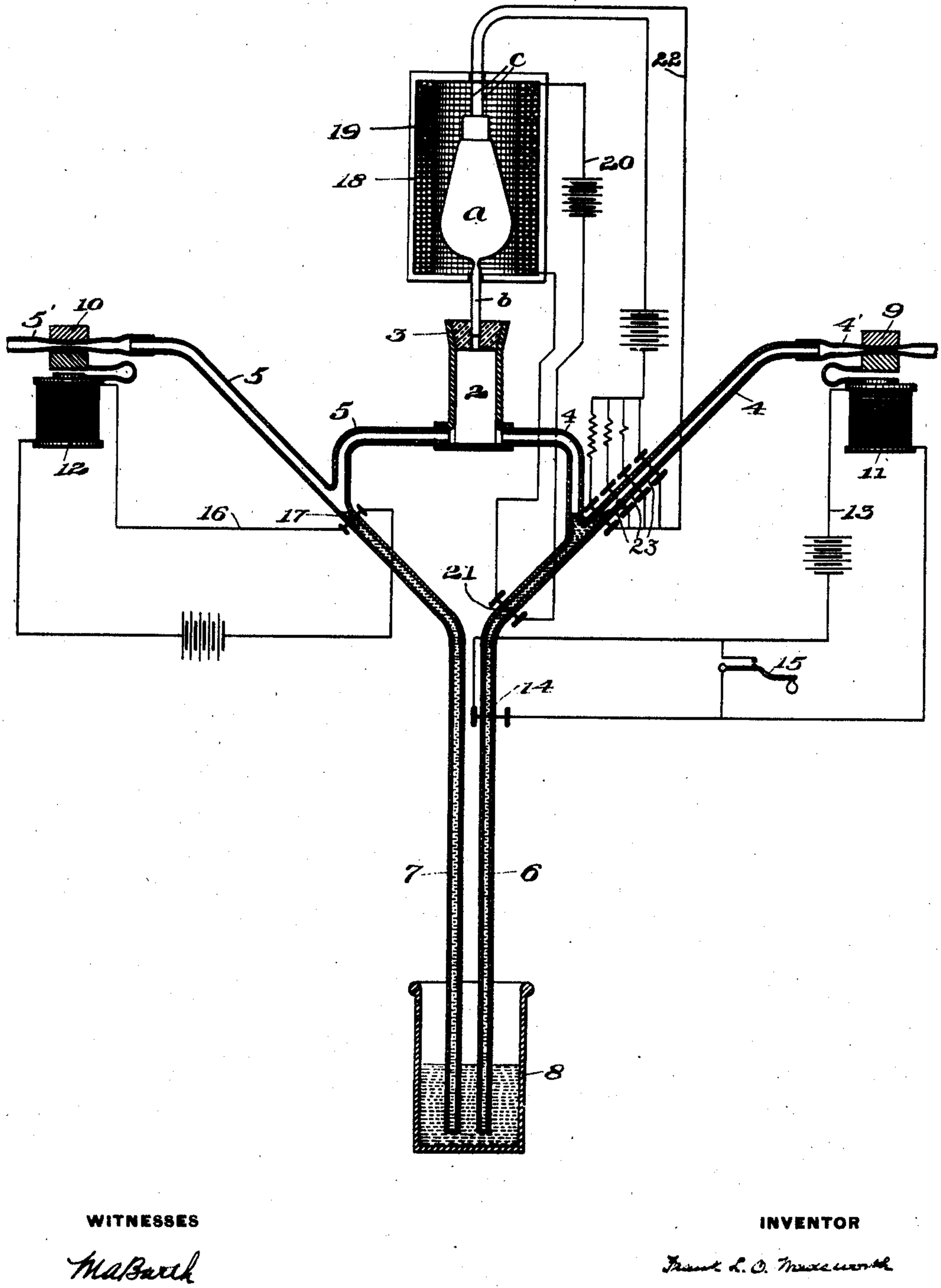

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METHOD OF EXHAUSTING INCANDESCENT-LAMP BULBS.

No. 866,751. Specification of Letters Patent. Patented Sept. 24, 1907.

Application filed February 28, 1906. Serial No. 303,396.

To all whom it may concern:

Be it known that I, FRANK L. O. WADSWORTH, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Method of Exhausting Incandescent-Lamp Bulbs, of which the following is a full, clear, and exact description.

My invention relates to a method of exhausting incandescent lamp bulbs, and it consists in employing the flow of a fluid to control the successive steps or operations during the process of exhaustion.

I will now describe my invention so that others skilled in the art to which it appertains, may employ the same, reference being had to the accompanying drawing forming part of this specification, which is a vertical sectional view of a simple form of apparatus which may be employed in carrying on the various steps or operations of my improved method.

In the practice of my invention it is necessary to first mechanically exhaust the air or gases which may be in the bulb of the lamp and at the same time to heat the bulb by exteriorly applied heat for the purpose of eliminating the moisture which exists to a greater or less degree mingled with the atmosphere and clinging to the interior surface of the lamp bulb. To properly exhaust the lamp bulb it is desirable that the bulk of the atmosphere be removed by a primary or roughing pump at the same time that the bulb is being heated, and after a certain definite exhaustion has been produced, to automatically close the connection with the primary pump and to open a connection with a secondary or fining pump, and at the same time to shut off the exterior heat to the bulb and bring the filament of the lamp bulb to incandescence for the purpose of generating and driving off vapors from the filament and joints, and for the purpose of aiding in the elimination of these gases as well as the rarefied oxygen contained in the bulb. To this end I employ a fluid contained in a suitable column or conduit subject to atmospheric or other pressure by means of which the varying pressures existing in the lamp bulb during the process of exhaustion may be indicated, and by the flow of fluid in the column or conduit, heat may be supplied to and shut off from the exterior of the bulb, the communication between the primary pump and the lamp bulb may be broken, communication between the lamp bulb and the secondary pump may be opened, and the filament of the lamp bulb may be brought to varying degrees of incandescence.

In the drawing I have shown, more or less diagrammatically, a pump chamber 2, the mouth of which is provided with a perforated rubber cork 3. Leading from the pump chamber 2 are the branch tubes 4, 5, the tube 4 leading to the primary or roughing pump and the tube 5 leading to the secondary or fining pump. Communicating with the tubes 4 and 5 are the barometric columns 6 and 7, the lower ends of which open into a vessel of mercury or other liquid, 8. The connection between the tubes 4 and 6 and 5 and 7 is preferably in the form of a Y, thus permitting the rise of the liquid in the tubes 6 and 7 to close, first, communication between the two arms of the tube 4 of the roughing pump, and after that closing communication between the two parts of the tube 5 leading to the small or fining pump, the Y's of the two tubes being on different levels. A portion 4′ of the tube 4 and a portion 5′ of the tube 5 are formed of rubber tubing adapted to be normally pinched and closed by the clamps 9, 10. The lower portions of the clamps 9, 10 form armatures of electric magnets 11, 12. The magnet 11 is connected with an electric circuit 13 which is provided with contact points 14 in the barometric column 6 and with a switch 15, which may be operated by a button or lever. The magnet 12 is connected with an electric circuit 16 which is provided with contact points 17 in the barometric column 7. Situated above the socket of the pump chamber 2 is a heating box 18 having an electric heating coil 19, which is connected with an electric circuit 20 which leads to contact points 21 in the barometric column 6. This box is adapted to receive the lamp bulb *a*, the tubulature *b* of the lamp bulb extending from the bottom of the box into the rubber cork 3 and the leading-in wires *c* of the lamp bulb being connected at the top of the box with the electric circuit 22, which is connected with the contact points 23 in the barometric column 6.

In exhausting the lamp bulb it is first placed in the heating box 18, the tubulature *b* fitting in the rubber cork 3, and the leading-in wire *c* being connected with the circuit 22. By closing the switch 15, the magnet 11 is energized and draws down the armature of the clamp 9, thus releasing and opening the rubber tube 4′. This opens connection between the bulb *a* and the primary or roughing pump, which at once begins to exhaust the air from the bulb and also from the barometric column 6, causing the mercury or other fluid to rise in the column until the fluid reaches the contact points 14, which closes the circuit 13 irrespective of the action of the switch 15. As the exhaustion continues the mercury rises in the column until it reaches the contact points 21 and closes the circuit 20, which allows the current to flow through the heating coil 19, generating heat in the box 18 and exteriorly heating the bulb *a* within the box. This contact point 21 is arranged at such point in the barometric column 6 that the lamp shall be heated either about the commencement of the process of exhaustion or at a point of such reduction of pressure within the bulb as may be deemed advisable. As the mercury in the columns 6 and 7 rises, for the mercury in the column 7 will rise with the mercury in the column 6, the mercury will reach the contact

points 17 in the column 7 and close the circuit 16, which energizes the magnet 12, draws down the armature of the clamp 10 and releases and opens the rubber tubing 5′, thus opening communication between the pump chamber 2 and the small or fining pump. Just as this is done, and as soon as the communication between the lamp bulb and the small pump is established, the mercury in the column 6 will close the Y of the tube 4, shutting off communication between the primary pump and the pump chamber 2. At or about the same time the mercury closes the contact points 23 in the circuit 22, thus bringing the filament of the lamp bulb to incandescence. By having several contact points 23 arranged in series, one after the other, each provided with a resistance less than the preceding resistance, the filament may be brought gradually from a low to an intensive incandescence by the continued rise of the mercury in the column. I may, however, employ a single set of contacts 23, and dispense with the resistances, thus bringing the filament immediately to intensive incandescence. When the desired degree of exhaustion is produced in the lamp bulb, the liquid will have risen in the column 7 above the Y of the tube 7, thus cutting off the smaller or secondary pump. The tubulature *b* is then sealed off by the application of heat or where a chemical exhaust is required, the chemical in the tubulature *b* may be heated by suitable means either before or after the closing of communication with the small pump. When the tubulature *b* is removed from the cork 3, the mercury will immediately fall below the contact point 17, thus immediately closing the clamp 10, the magnet 12 being deënergized, and the clamp 9 will be closed in a similar manner by the fall of the liquid below the contacts 14. The same result would follow should the lamp *a* be broken, or if from any other cause, air should enter the socket 2.

Although I have described the use of mercury and a particular form of barometric column, I do not desire to limit myself thereto, nor do I desire to limit my invention to a plurality of pumps, or to the mechanism shown in the drawing.

By the use of my invention the operation of exhausting incandescent lamp bulbs may be carried on automatically. The various steps and operations of the process must follow each other in succession at proper intervals, not of time, but according to the degree of exhaustion which has been produced in the lamp bulb. The process, therefore, may be carried on with mathematical certainty, instead of being left to the mere conjecture of an operator.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. The method for controlling the successive operations in exhausting electric lamp bulbs by the flow of a liquid under the action of pressure; substantially as specified.

2. The method of exhausting lamp bulbs, which, consists in causing the flow of a liquid under the action of pressure to control the successive steps in the operation.

3. The method of exhausting lamp bulbs, which consists in causing the flow of a liquid under the action of pressure to control in succession the several steps in the operation.

In testimony whereof, I have hereunto set my hand.

FRANK L. O. WADSWORTH.

Witnesses:
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