J. E. GRAYBILL.

METHOD AND APPARATUS FOR TUBULATING LAMP BULBS.

APPLICATION FILED MAY 17, 1904.

918,669. Patented Apr. 20, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

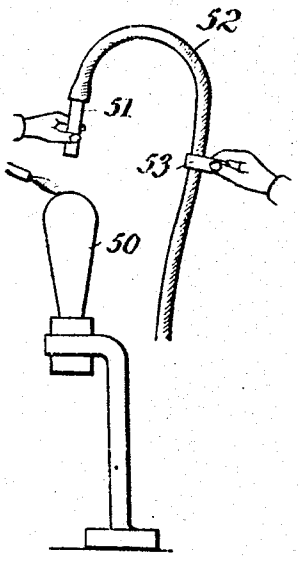
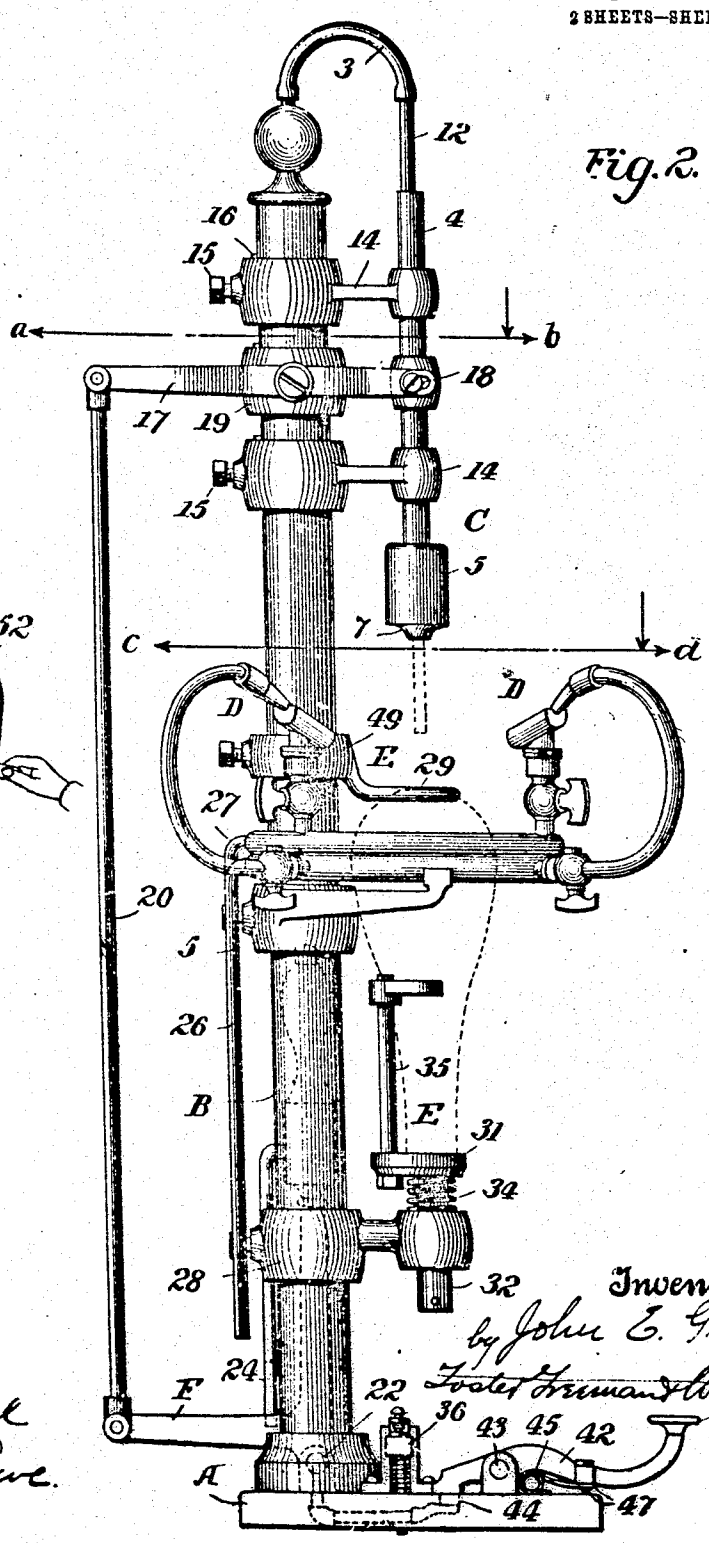


Fig. 2.



Witnesses

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2 SHEETS—SHEET 2.

Fig. 3.

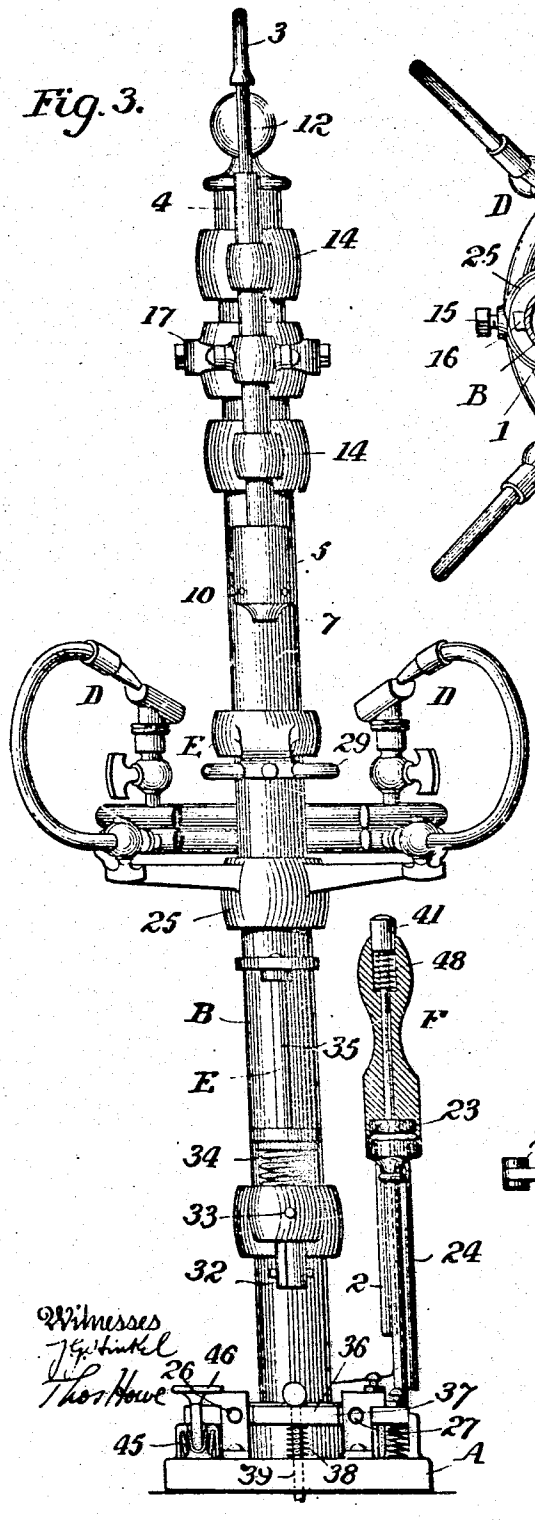
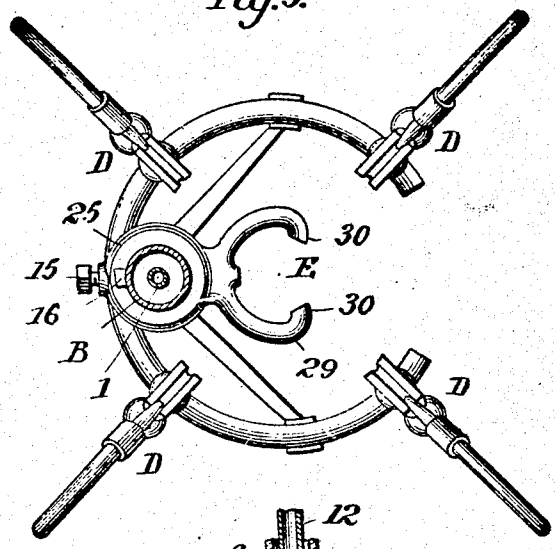


Fig. 5.



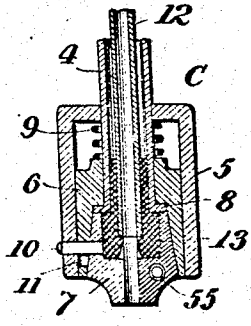


Fig. 7.

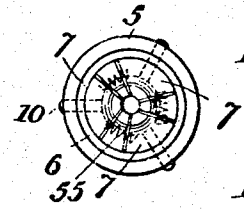


Fig. 6.

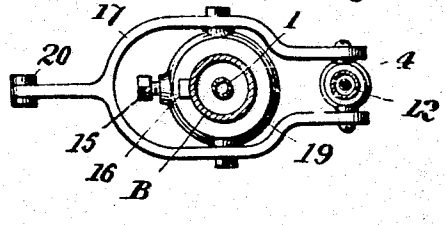


Fig. 4.

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METHOD AND APPARATUS FOR TUBULATING LAMP-BULBS.

No. 918,669. Specification of Letters Patent. Patented April 20, 1909.

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To all whom it may concern:

Be it known that I, JOHN E. GRAYBILL, a citizen of the United States, residing at York, in the county of York and State of Pennsylvania, have invented certain new and useful Improvements in Methods and Apparatus for Tubulating Lamp-Bulbs, of which the following is a specification.

This invention relates to method of and means for fixing the tubes through which the bulbs of incandescent lamps are exhausted, to the bulbs, which operation is known as tubulating.

The object of the invention is to provide a method whereby the tubulating may be effected in a more efficient manner than heretofore.

It is a further object of the invention to provide a machine whereby the method may be advantageously carried out.

In the accompanying drawings, Figure 1 is an illustration showing how the method may be carried out by hand; Fig. 2 is a side elevation of the preferred form of tubulating machine; Fig. 3 is an end elevation of the machine; Fig. 4 is a section on the line *a*—*b* of Fig. 2, looking in the direction of the arrow; Fig. 5 is a section on the line *c*—*d* of Fig. 2, looking in the direction of the arrow and showing a plan view of the bulb holder and burners; Fig. 6 is an end view of the tube holding chuck; and Fig. 7 is a section of the lower end of the tube holder.

An important feature of the method of tubulating according to this invention consists in causing by any suitable means, preferably pneumatic, the entrance of a softened portion of the bulb into the end of the tubulating tube which is to be secured to it, and welding the tube and bulb together. This method secures a lapping over of the edges of the bulb and tube which are secured together, so that a strong joint which is peculiarly free from leakage is obtained. Furthermore, when this method is practiced it will be found unnecessary to puncture the bulb before the application of the tube, it being only necessary to heat that portion of the bulb to which it is desired to secure the tube, and after the application of the tube, the forcing of the softened portion of the bulb within the end of the tube will result in forming the desired hole. A further advantage is realized in the practice of this method in that the care formerly required to accurately center the hole and tube is no longer necessary, for the reason that from the manner of forming the hole it must necessarily be accurately adjusted to the position of the tube.

Having described the essentials of the improved method, details will now be given in connection with a preferred form of machine for carrying it out.

Referring to the drawings, it will be noted that the machine comprises a base A, on which is mounted a standard B which supports a tube holder C, burners D and a bulb holder E. Upon the base is also mounted a handle F for operating the tube holder.

The base A may be of any suitable form, the standard B being preferably of circular cross-section and fixed thereto. Through the standard extends a passage or conduit 1, which at its base communicates with a pipe 2 leading through a controlling valve 23 to a pneumatic device, as a vacuum pump (not shown). At the top of the standard the passage 1 communicates by means of a flexible pipe 3 with the top of the tube holder C. The tube holder comprises a tube 4 which carries at one end a securing means for the tubulating tube, which in this instance is shown as a chuck comprising a sleeve 5 slidable upon the tube 4 and inclosing the jaw guide 6 having an inclined interior face within which the jaws 7 are mounted. A collar 8 fixed to the end of the tube 4 prevents the downward movement of the jaw guide 6, and a spring 9 interposed between the jaw guide 6 and the sleeve 5 operates to normally hold the sleeve in its uppermost position. Each of the jaws 7 is secured to the sleeve 5 by a pin 10 which extends through a slot 11 in the jaw guide 6, so that the jaws and sleeve may have movement independently of the jaw guide.

Within the tube 4 extends a conduit or pipe 12, which at its upper end connects with the flexible pipe 3 and at its lower end is surrounded by a piece 13 of soft rubber or other suitable material which extends between the chuck jaws and is adapted to surround the end of a tubulating tube when the jaws are released, and which is pressed tightly about the tubulating tube by the jaws when they are in securing position. The elasticity of the rubber will usually be sufficient to open the jaws when they are released but to assist this action, springs 55 may be employed.

To secure a tube in the chuck, the sleeve 5

is pressed downwardly against the spring 9, and by means of the pins 10 carries with it the jaws 7 which are thereby released. The tube may now be inserted between the jaws and into the rubber piece 13. The sleeve may then be released, when the spring 9 will return it and its connected jaws to their normal position, and because of the inclined engaging surfaces of the jaws and jaw guide, the jaws will be forced together, thereby compressing the rubber and springs 55 about the tube so that the tube will be secured and a tight joint between the conduit 12 and the tubulating tube will be formed.

The tube 4 of the tube holder is fitted loosely within guides 14 which are slidably mounted upon the standard B. These guides may be fixed in position by means of set screws 15 and may be prevented from rotating about the standard by means of keys 16. The tube holder may be moved vertically in its guides by means of a lever 17 which is pivoted to the tube holder at 18 and to a collar 19 which may be locked in position by means of a set screw similar to the set screws 15. The lever 17 is connected by a link 20 with the handle F which is pivoted to the base at 22.

Upon the handle F is mounted a valve 23 which controls communication between the pipe 2 and a pipe 24. The pipe 2 connects with the passage 1 in the standard, while the pipe 24 connects with the pneumatic source, and it will thus be seen that the flow of fluid in the passage 1 is controlled by means of this valve. The valve may be operated by means of a push button 41 located in the end of the handle F, which when depressed operates to open the valve, and is normally held in elevated position by a spring 48. The advantage of thus arranging the apparatus is of great practical value, as the operator can perform a plurality of operations with one hand without inconvenience while the push button 41 can be controlled very accurately, since it is mounted to slide longitudinally of the handle and is entirely unaffected by the pressure exerted on the handle by the operator in moving the handle back and forth.

The burners D may be mounted upon a bracket 25, slidable upon the standard B and which may be locked in position in a manner similar to that described in connection with the guides 14. Air and gas are delivered to the burners, which may be of any suitable construction, by means of pipes 26 and 27 which are connected with suitable sources of air and gas, not shown. The flow of gas and air to the burners may be controlled by any suitable means, as a pinch-cock 36 applied to flexible sections of the pipes 26 and 27, the movable cross-head 37 of the cock being normally pressed upward against the pipes by a spring 38. A rod 39, connected to the cross-head and terminating in a treadle, furnishes a convenient means for lowering the cross-head against the spring to permit the flow of gas and air through the pipes.

The bulb holder comprises two brackets 49 and 28, which are slidable upon and which may be locked to, the standard in a manner similar to that employed in connection with the guides 14 and the burner bracket 25. One of the bulb holding brackets comprises an arc-shaped portion 29 having internally-projecting prongs 30 which are adapted to receive between them and bear against the upper end of the bulb to be operated upon. The other bracket 28 carries a seat 31 which has a downwardly-projecting shank 32, slidably mounted in the bracket 28 and prevented from turning therein by any suitable means, such as a pin 33 extending into a keyway in the shank. The seat is spring-pressed upwardly by a spring 34. In order that the bulb may be accurately placed upon the seat 31, so that it will be in proper alinement with the holding device carried by the bracket 49 with the minimum amount of care on the part of the operator, a guard 35 may be carried by the seat, so that the bulb may be accurately positioned by placing its base upon the seat 31 and resting its side against the guard 35.

From the foregoing it will be seen that the tube holder and its supporting devices may be adjusted to any desired position upon the standard, and that this is also true of the burner supports and the brackets comprised in the bulb holder. Normally the bulb holder brackets will be fixed with relation to each other in a manner as before described, but in case bulbs of different size are to be accommodated, they can be adjusted to the changed conditions. The burners are also normally fixed with relation to the bulb holder, so that the flames will always play upon the proper point of the bulb, but the support for the burners is so constructed that it may be adjusted so that the flames will come at the right point before it is locked in position. In other words, the parts are mutually adjustable so that they may be accommodated to a certain class of work, but are then locked in position and remain fixed so long as the class of work remains the same, and are not moved with relation to each other at each operation. This produces the desirable result that the operation upon one lamp is precisely the same as that upon another, without care being taken by the operator as to the adjustment of the parts.

The method and operation of the machine may now be described as follows. The parts having been adjusted, a tube placed within the tube holder and an unpunctured bulb in the bulb holder as before described, gas and air may be admitted to the burners by pressing upon the treadle with the foot, when the play of the flames upon the upper end of the

bulb will cause a softening thereof. By unpunctured bulb is intended, a bulb in which the hole opening into the tubulating tube has not been formed. By means of the handle F the link 20 is swung upwardly, thus forcing the tube holder downwardly until the tube is in contact with the bulb at its softened portion. Pressure upon the push button 41 opens the valve 23, when communication will be opened with the pneumatic apparatus before referred to, which is preferably a vacuum pump. The suction thus created within the tubulating tube and holder causes the softened glass of the bulb to be drawn up into the end of the tubulating tube, when further heating of the tube and bulb operates to fuse them together, and upon cooling a firmly welded lapped joint is obtained.

It is desirable to form a contraction in the tube near its joint with the bulb to facilitate the sealing off of the bulb after its exhaustion has taken place. To accomplish this, the tube holder, and with it the tube, is raised to some extent while the tube is still hot, thus producing the desired contraction.

It has been found desirable in order to produce a smooth joint, to prevent the collapsing of the tube while being drawn out, and also to cool the joint, that a current of cool air be forced through the tube and bulb during or immediately succeeding the drawing out of the tube. To accomplish this result a tube connected with a source of compressed air may be connected with the passage 1 in the standard, which tube may be controlled by a lever 42 pivoted at 43 on the base A, the end 44 of this lever operating as a pinch-cock upon a flexible portion of the pipe connecting the compressed air supply with the passage 1. A spring 45 operates to maintain this cock normally closed, and it can be opened by pressure upon the button 46. An adjusting screw 47 regulates the amount of opening of the cock.

The operations having been performed as described, the tubulation will be complete and the tubulated bulb may be removed from the apparatus, when another bulb and tube may be placed in position and the operation repeated.

While a preferred machine for carrying out the method has been described, the method may be carried out by different machines or even by hand as illustrated in Fig. 1, in which 50 indicates a bulb, 51, a tubulating tube, 52, a flexible conduit connected with the tube 51 and a vacuum pump (not shown), the connection with the pump being controlled by a pinch-cock 53.

Although in the performance of the method, the softened portion of the bulb is preferably sucked up into the tubulating tube by means of a vacuum applied to the tube, it is obvious that the same result could be accomplished by blowing the softened portion of the bulb into the tube by pressure from within the bulb.

Without limiting myself to the precise details of construction and arrangement shown and described, I claim:—

1. The method of joining a tubulating tube to a bulb, which consists in applying a tube to an unpunctured bulb, causing a softened portion of the bulb to enter the end of the tube, and welding the bulb and tube together, substantially as described.

2. The method of joining a tubulating tube to a bulb, which consists in applying a tube to an unpunctured bulb, pneumatically causing a softened portion of the bulb to enter the end of the tube, and welding the bulb and tube together, substantially as described.

3. The method of joining a tubulating tube to a bulb, which consists in applying a tube to an unpunctured bulb, reducing the pressure in the tube below the pressure in the bulb, whereby a softened portion of the bulb is drawn into the tube, and welding the tube and bulb together, substantially as described.

4. The method of joining a tubulating tube to a bulb, which consists in heating a portion of an unpunctured bulb, applying a tube to the heated portion, causing a heated portion of the bulb to enter the tube, heating said bulb and tube so that they become fused together, and cooling said bulb and tube, substantially as described.

5. The method of joining a tubulating tube to a bulb, which consists in heating a portion of an unpunctured bulb, applying a tube to the heated portion, reducing the pressure in the tube below the pressure in the bulb whereby a heated portion of the bulb is caused to enter the tube, heating said bulb and tube so that they become fused together, and cooling said bulb and tube, substantially as described.

6. The method of tubulating electric lamp bulbs, consisting in applying one end of a tube against an unpunctured surface of a lamp bulb, and then puncturing the bulb and causing the portion thereof surrounding the puncture to enter said tube, substantially as described.

7. The method of tubulating electric lamp bulbs, consisting in softening a suitable portion of a bulb, applying one end of a tube against said softened portion of the bulb, and then puncturing the bulb in alinement with the tube and forcing into the tube the softened portion of the bulb surrounding the puncture, substantially as described.

8. In a tubulating machine, the combination with a stationary standard, of stationary burners and a stationary bulb holder upon said standard, and a tube holder, flexibly mounted on said standard, substantially as described.

9. In a tubulating machine, the combina-

tion with a stationary standard, of a stationary but adjustable bulb holder, stationary but adjustable burners, said holder and burners being mounted on said standard, and means for locking said holder and burners with relation to each other, substantially as described.

10. In a tubulating machine, the combination with a stationary standard of a bulb holder comprising brackets slidable upon said standard, one of said brackets being constructed to receive one end of the bulb and a spring pressed seat for the other end of said bulb mounted on the other bracket, means for locking said brackets with relation to each other and burners mounted on said standard, substantially as described.

11. In a tubulating machine, the combination with a stationary standard, of a tube holder slidably mounted on said standard, a lever pivoted to said holder and said standard and burners mounted upon said standard, substantially as described.

12. In a tubulating machine, the combination with a stationary standard, of a tube holder slidably mounted thereon a lever pivoted to said standard and holder, a handle for operating said holder, links connecting said lever and handle and burners mounted upon said standard, substantially as described.

13. In a tubulating machine, the combination with a tube holder, of a handle for operating said holder, means for connecting said handle and holder, a passage communicating with said holder, and means mounted on said handle for controlling the flow of fluid through said passage, substantially as described.

14. In a tubulating machine, the combination with a tube holder, of a handle for operating said holder, means connecting said handle and holder, a passage communicating with said holder, and a valve for controlling the flow of fluid through said passage, mounted on said handle, substantially as described.

15. In a tubulating machine, the combination with a suitable standard, of a bulb holder mounted on said standard and adapted to be secured thereto at any desired elevation, burners supported on brackets adjustably connected with the standard, a tube holder supported by the standard above the burners and having an adjustable chuck, and a lever fulcrumed upon the standard and adapted to move said tube holder to and from the bulb holder, substantially as described.

16. In a tubulating machine, the combination of a bulb holder, a tube holder, means for effecting a relative adjustment of said bulb and tube holders including a suitable handle, fluid pressure means for puncturing the bulb, and means on said handle for controlling the operation of said fluid pressure means, substantially as described.

17. In a tubulating machine, the combination of a bulb holder, a tube holder, means for moving the tube holder to and from the bulb holder, including a suitable handle, fluid pressure means for puncturing the bulb, and means on said handle for controlling said fluid pressure devices, substantially as described.

18. In an incandescent lamp making machine, the combination with an adjustable holder, of a pivoted handle connected to said holder, a pipe connected to said holder, a second pipe connected to a fluid pressure device, a controller mounted adjacent the end of said handle in a recess in said handle to move longitudinally thereof and thereby control communication between said pipes.

19. In an incandescent lamp making machine, the combination with an adjustable holder, of a pivoted handle connected to said holder, flexible pipes carried by the handle and connected to said holder and to a fluid pressure device, a valve on the handle for controlling communication between the pipes and a valve actuator adjacent the end of said handle and slidably mounted in a recess in said handle to move longitudinally thereof.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN E. GRAYBILL.

Witnesses:
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RICHD. E. COCHRAN.