Oct. 11, 1938. M. E. McGOWAN 2,132,538

MACHINE FOR SEALING EVACUATED VESSELS

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Fig. 1.

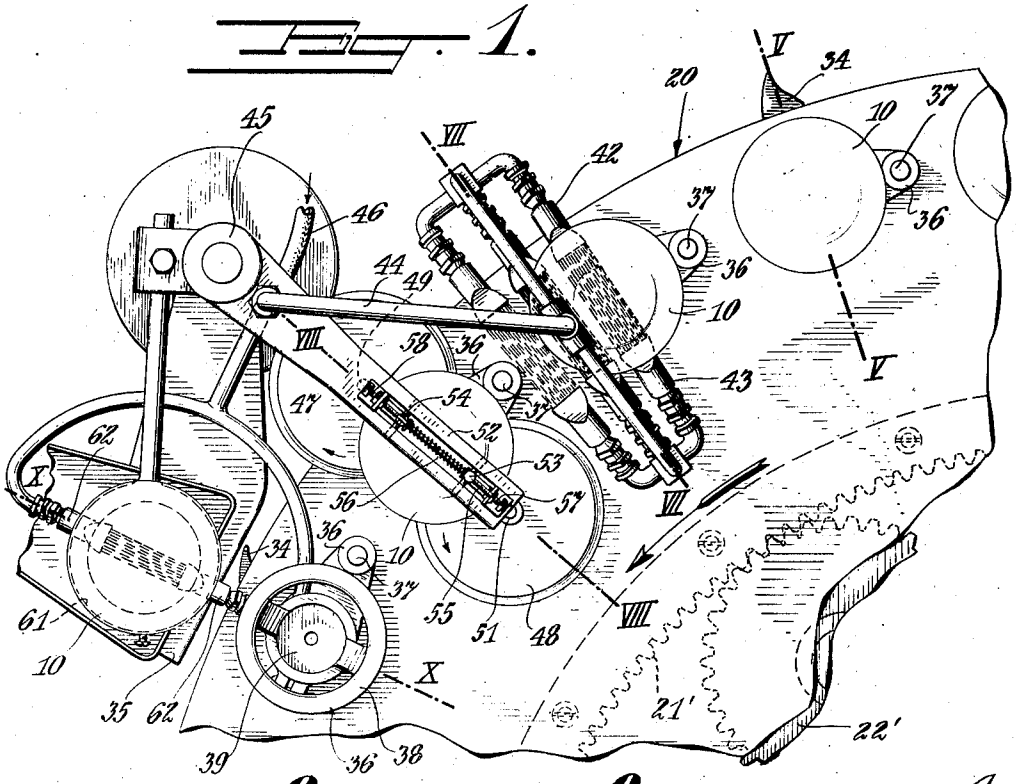


Fig. 2.

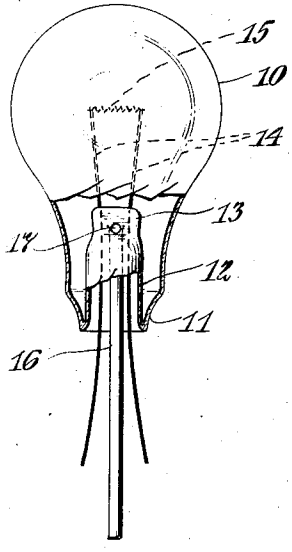


Fig. 3.

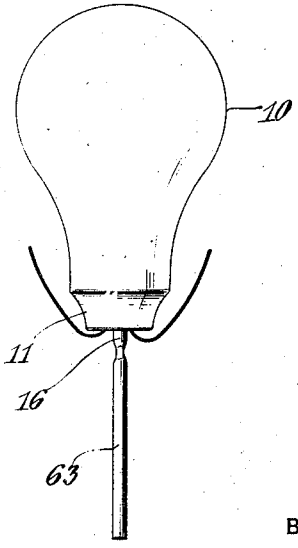
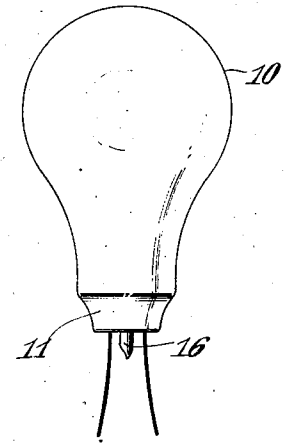


Fig. 4.



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Fig. 5.

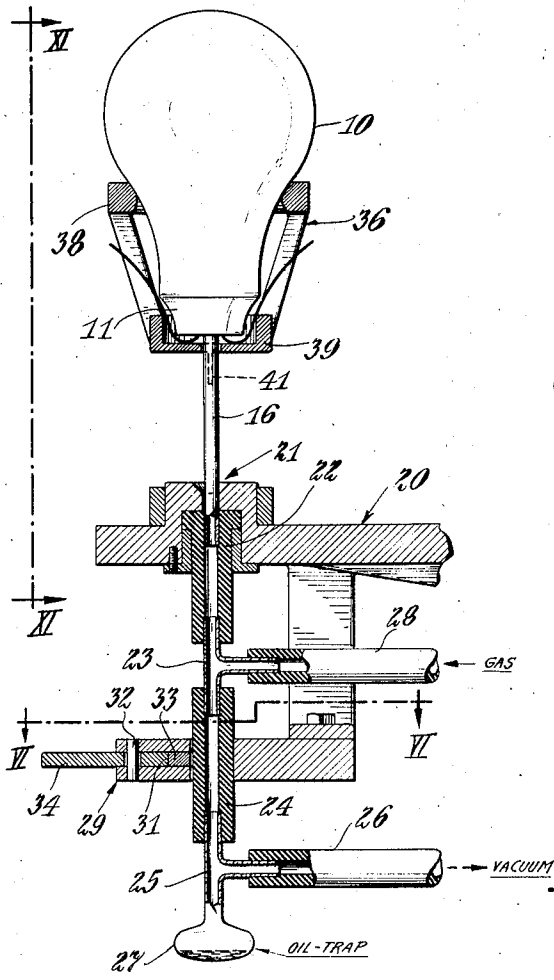


Fig. 10.

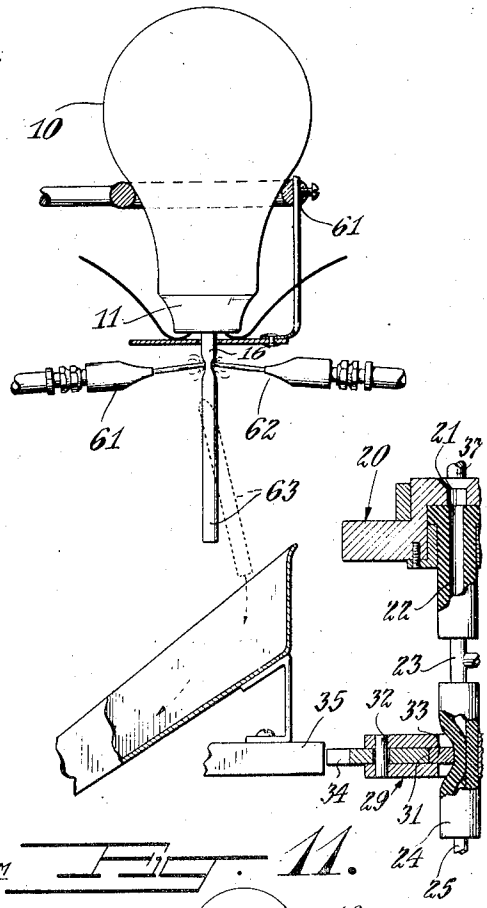


Fig. 6.

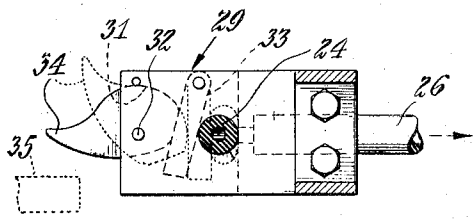
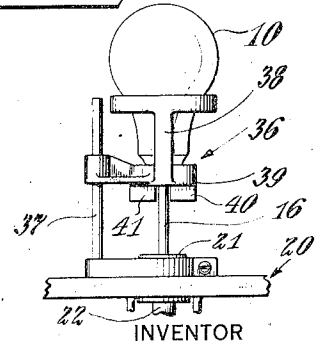


Fig. 11.



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Fig. 7.

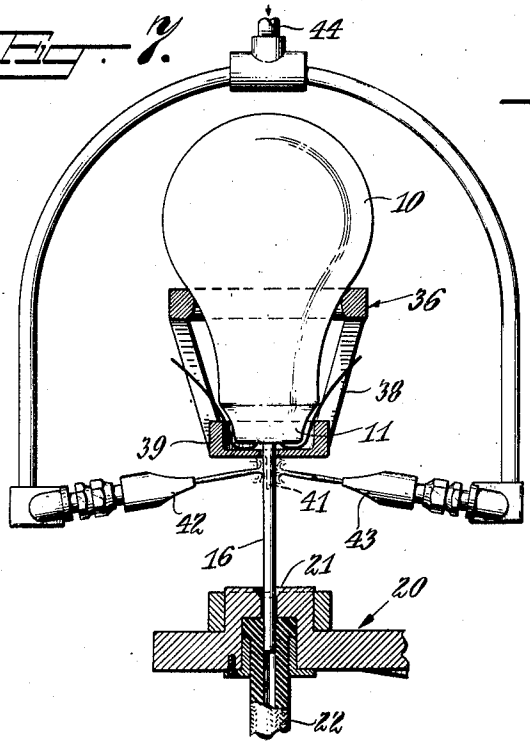


Fig. 12.

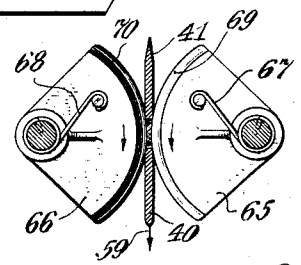


Fig. 8.

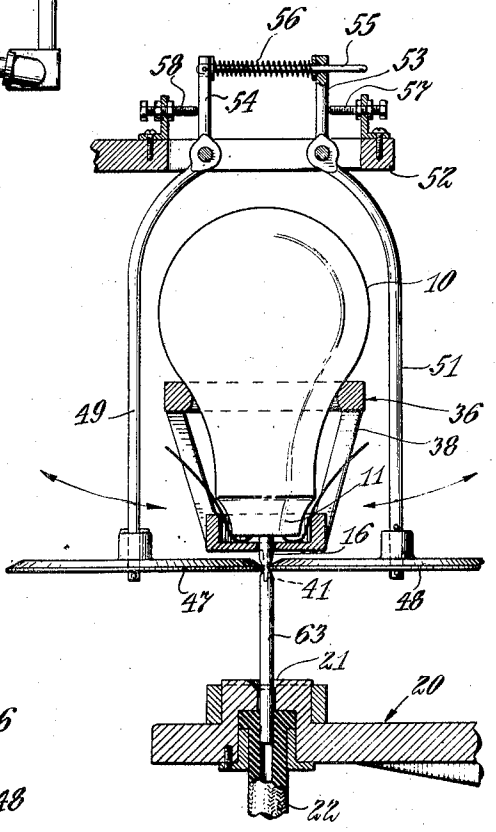
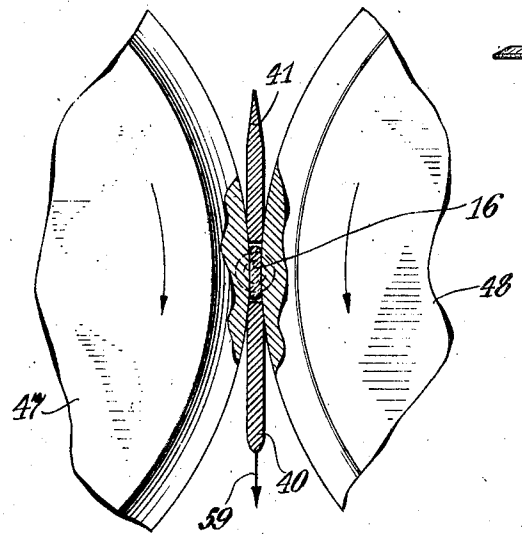


Fig. 9.



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UNITED STATES PATENT OFFICE

2,132,538

MACHINE FOR SEALING EVACUATED VESSELS

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Application August 21, 1935, Serial No. 37,111

12 Claims. (Cl. 176—3)

This invention relates to a machine for compressing the wall of a tubular member and more particularly to one for the manufacture of incandescent electric lamps and other electrical devices.

Incandescent electric lamps as commonly used for general lighting include a glass bulb having a reduced or neck portion into which a so-called stem is sealed. The stem includes what is termed a flare tube one end of which is provided with a flange or flare sealed to the bulb neck and the other end terminates in a flattened portion or press through which conductive lead wires are sealed and onto which a filament is mounted. Within the flare tube and extending downwardly from the press is an exhaust tube leading from an orifice in the press to afford communication with the interior of the bulb for the purpose of filling the bulb with gas or for evacuating the bulb.

It has heretofore been the practice in lamp manufacture to insert the exhaust tube into a port leading to a vacuum pump and after the gas has been extracted from the bulb, to heat the exhaust tube until the wall collapsed and then remove the lower or excess portion of the tube by a pulling or stretching operation. It has also been proposed to heat and compress the tube and shear it by mechanical means. The operation of sealing the bulb after exhaust and in removing the exhaust tube is termed a "tipping off" operation. With methods as hertofore practiced the manufacturing operations were retarded since it was necessary to perform the tipping-off operation during a momentary stopping of a conveyor which carried the bulbs during exhaust and this was accomplished by using an indexing form of mechanism.

It is possible, however, to increase the speed of production by providing a continuously operating machine and this is accomplished, in so far as the tipping-off operation is concerned, by means of the present invention which makes it possible to equip a continuously moving exhaust machine with means whereby the exhaust tube is closed after a bulb has been exhausted, the closing or sealing operation being performed without interrupting the operation of exhausting the other bulbs.

The present invention is also of advantage in the manufacture of lamps in which a gas is employed at a pressure above atmospheric. Ordinarily, when tipping-off such lamps difficulty arises from the fact that, upon heating, the tube will expand and not collapse and seal as it did with low pressure or vacuum.

In accordance with the present invention, therefore, a structure is provided wherein a conveyor moves a bulb while the exhaust tube is in the exhaust port, the evacuation operation is performed, and at final exhaust stage the exhaust tube is heated and compressed to seal the bulb. If desirable, the arrangement and the mechanical elements provided make it possible, as above mentioned, to fill the bulb with a high pressure gas and seal the bulb as the conveyor moves.

Heretofore it has been the practice in tipping-off to remove the bulb leaving the excess portion of the tube in the exhaust port for subsequent removal. In the present machine the exhaust tube is closed but not immediately severed. The lamp and sealed exhaust tube are then removed and the severing operation is performed by a continuously heating and shearing or pinching operation thus eliminating the indexing operation and greatly increasing the rate of speed in manufacture.

An object of the invention is, therefore, to provide a continuously operating exhaust and sealing machine.

Another object of the invention is to provide an apparatus wherein a portion of an exhaust tube of a bulb is heated to a plastic state and compressed during a movement of a conveyor supporting the bulb and tube.

A further object of the invention is to provide an apparatus for sealing an exhaust tube containing gas at a pressure above atmospheric.

A still further object of the invention is to provide means for heating and compressing to seal a traveling exhaust tube operable under the action of the moving tube.

Another object of the invention is to provide a bulb sealing machine of simple and effective construction in which the operating parts perform automatically and with a minimum amount of attention.

The invention will be more fully understood by reference to the accompanying drawings in which:

Fig. 1 is a fragmentary plan view of an exhaust machine showing exhaust tube sealing means constructed in accordance with the present invention;

Fig. 2 is a side elevational view of an incandescent lamp, partly in section, showing an exhaust tube before sealing;

Fig. 3 is a view similar to Fig. 2, but shows the exhaust tube constricted with the walls compressed to seal the bulb;

Fig. 4 is a view similar to Fig. 3, but shows the exhaust tube sealed and tipped off;

Fig. 5 is a fragmentary view of an exhaust machine showing a bulb with the exhaust tube positioned in an exhaust port, the view being taken on line V—V in Fig. 1;

Fig. 6 is a view taken on line VI—VI in Fig. 5;

Fig. 7 is a side elevational view of a lamp positioned in an exhaust port with heating fires in position to soften the exhaust tube, the view shown being taken on line VII—VII in Fig. 1;

Fig. 8 is an elevational view of a lamp with the exhaust tube in an exhaust port and showing rotary presser members for sealing the tube, the view being taken substantially on line VIII—VIII in Fig. 1;

Fig. 9 is an enlarged fragmentary view of the roller members with the exhaust tube compressed therebetween;

Fig. 10 is a view taken on line X—X in Fig. 1;

Fig. 11 is a side elevational view taken as indicated on line XI—XI in Fig. 5; and

Fig. 12 shows a modification of the presser members in the form of segments having opposed arcuate surfaces for compressing a tube.

The selected embodiment of the present invention is directed to the operation of sealing exhausted or gas filled lamps by softening and collapsing the walls of the exhaust tubes. The invention may, however, be utilized in connection with any device in which it is desirable to compress a tubular member, or in which it is desirable to compress and collapse tubular members while moving continuously through a given path.

As shown and described, the invention is applied to an incandescent electric lamp of the type shown for example in Fig. 2. This lamp may comprise a bulb **10** with a reduced neck portion **11** to which one end of what is termed a flare tube **12** is sealed. The other end of the flare tube is formed into what is known as a press **13**, through which lead-in conductors **14** extend and support a filament **15**. Within the flare tube and extending downwardly is an exhaust tube **16**. The exhaust tube is integral with the flare tube and at the press portion thereof terminates in an orifice **17** affording communication to the interior of the bulb for the purpose of removing gases or for introducing gases.

A lamp such as shown in Fig. 2 is in condition from a manufacturing standpoint to be evacuated and for this purpose the exhaust tube **16** is inserted into an exhaust port of an exhaust machine, usually of the rotary type.

As shown in Fig. 1, the reference numeral **20** indicates a conveyor type exhaust machine. Such machines are well known in the art and it is believed that a complete description of the same is unnecessary. Means in the form of an external gear **21'** and a driving gear **22'** may be provided for continuously rotating the conveyor and it has been found that by providing twenty-four exhaust ports and rotating the conveyor in about a forty second cycle, it is practical to exhaust a bulb known as the A—19 type for lamps of about sixty watts.

As shown in Fig. 5, the conveyor **20** is provided with an exhaust port **21**. Any number of these exhaust ports may be provided depending on the desired capacity of the machine and a description of one will answer for all. Each exhaust port is provided with a resilient sleeve **22** into which the exhaust tube **16** is inserted. The sleeve **22** may be connected by T-member **23** to a sleeve **24** which in turn is connected by a T-member **25** to a vacuum line **26**. One end of the T-member **25** may be provided with a receptacle **27** to receive any excess oil that may reach this portion of the line. The T-member **23** is provided with a sleeve **28** leading to a gas supply. In practice as the conveyor moves, the vacuum line progressively and continuously connects with the vacuum pump so that during a given movement of the conveyor the bulb **10** is exhausted to the proper degree and, in the case of a gas-filled lamp, as the conveyor moves after evacuation, a sufficient quantity of gas is supplied to the bulb.

When the conveyor has moved to sufficiently evacuate the bulb, a stop cock **29** is operated to compress the sleeve **24**. The stop cock **29**, as shown in Fig. 6, may comprise a cam **31** movable about a pin **32** and engageable with a rocker arm **33**. An extending lip **34** on the cam engages a suitably positioned stationary arm **35** so that as the conveyor moves the stop cock automatically closes the vacuum line. The gas line **28** is closed by a suitable valve, not shown.

A lamp positioned with its exhaust tube **16** in an exhaust port is supported by a holder **36** (see Fig. 11). This holder may comprise a post or standard **37** which carries a ring-shaped bracket **38** to receive the bulb portion of the lamp. The neck portion of the lamp or bulb is disposed in a cup-shaped member **39** so that the lead wires extend upwardly and away from the heat zone during sealing, the cup-like member also serving to protect the neck seal. At each side of the cup-shaped member and extending downwardly are approximately alined vanes or fins **40** and **41**, the purpose of which will presently be described.

A lamp supported in a holder with its exhaust tube in an exhaust port is moved through a definite exhaust schedule and, as the lamp reaches its final exhaust stage, the exhaust tube is moved into a heat zone created by any suitable means such, for example, as gas burners **42** and **43**. These burners are supported as a unit by means of a gas feed pipe **44** extending from a bracket **45** and connected with a gas feed line **46**. As the conveyor moves the exhaust tube is heated and the heat zone may be so arranged and proportioned as to render the glass sufficiently plastic to be compressed as the lamp reaches the sealing position. The sealing operation is performed by disks or rollers **47** and **48** carried on arms **49** and **51** respectively. The arms are pivotally mounted on an overhead support **52** and the arm **51** is provided with an extension **53** while the arm **49** is provided with an extension member **54**.

A pin **55**, pivotally connected to the member **54**, extends through the member **53** and a helical spring **56** mounted on the rod urges the members **53** and **54** against adjustable stops **57** and **58**. Thus the rollers **47** and **48** are urged toward each other and as the conveyor moves to bring the plastic portion of the exhaust tube between the rollers, the rollers compress the exhaust tube and progressively collapse the wall thereof, thus sealing the bulb. The rollers **47** and **48** rotate freely at the ends of arms **49** and **51** and, as the exhaust tube moves, the rollers rotate and, by reason of their resilient relation, compress the plastic material.

It has been found desirable, however, to control the degree of pressure exerted on the plastic

material, avoid sudden impact between the rollers and exhaust tube, and also to provide means for initiating the rotary movement of the disks prior to their contact with the portion of the tube to be compressed. The conveyor moves in the direction of the arrow **59** (see Fig. 9), and the rollers **47** and **48** first engage the fins **40**.

By reason of the movement of the conveyor in conjunction with the frictional engagement between the rollers and the fins, the rollers start rotating so that by the time the conveyor positions the exhaust tube for contact with the rollers, the latter will be in operation and evenly compress the plastic material without drag. The fin **40** in conjunction with the fin **41** serves to prevent the rollers from exerting too great a pressure on the plastic material. As the conveyor continues to move the exhaust tube will, obviously, be caused to travel away from the rollers **47** and **48** and the bulb will have been sealed.

The exhaust tube, however, will not have been removed and the lamp may then be lifted either by hand or mechanical means into a holder **61** and fires **62** (see Fig. 10) may be caused to heat the constricted portion of the exhaust tube and sever the excess portion **63**. The operation shown for severing the excess portion of the tube is given as an example of how the bulb is completed, as shown in Fig. 4, and ready to receive a base. The completion of the tipping-off operation; that is, the removal of the excess portion of the exhaust tube, may be accomplished by positioning the sealed bulb in a conveyor and causing the excess portion to be removed during the movement of the conveyor to carry out the continuous process.

It will be understood that, although a pair of rollers or disks **47** and **48** are shown, these elements may be modified, for example, as shown in Fig. 12 wherein segments **65** and **66** are provided. Each segment is mounted to rotate about a spindle and springs **67** and **68** serve to hold the segments in a normal position. When a tube to be sealed passes between the arcuate surfaces **69** and **70** of the segments, the fins **40** and **41** serve to rock the segments or initiate their movement. After the tube is sealed and passed from between the segments, the springs **67** and **68** act to return the segments to their normal positions ready to receive another tube.

Although the present invention may include the complete tipping-off operation, it will be evident that it is primarily directed to the operation of sealing a vessel after an exhausting or gas-filling operation.

It is to be understood that by reason of the present invention the heat zone may be so arranged as to bring the exhaust tube to the proper plastic state just prior to the sealing operation and that, by reason of the means employed, a lamp filled with a gas at a pressure above atmospheric pressure may be readily sealed off without difficulty.

Although a preferred embodiment of the invention is shown and described herein, it will be understood that modifications may be made without departing from the spirit and scope of the appended claims.

What is claimed is:

1. A machine for compressing a tubular member comprising means for supporting said member, means for moving the member through a given path, means for compressing said member to collapse it during movement, and means actuated by said second mentioned means for initiating a movement of said third mentioned means.

2. A machine for closing the passage in a tubular member comprising rocker members having opposed arcuate surfaces, means for moving said tubular member between said surfaces and means for causing an opposite rotary movement of said rocker members during passage of said tubular member therebetween to collapse the latter member.

3. A machine for sealing the exhaust tube of a lamp bulb comprising means for moving the bulb and tube through a given path, opposed oscillatory members positioned for the passage of a portion of said exhaust tube therebetween, means for heating said portion of the exhaust tube, and means operating in timed relation to the movement of said tube for actuating said members to compress said heated portion.

4. A machine for sealing an exhaust tube of a lamp bulb comprising a conveyor, a plurality of exhaust ports on said conveyor, holders for supporting bulbs with their exhaust tubes in said ports, a heat zone in the path of travel of said exhaust tubes to render plastic portions of said tubes, and a pair of opposed roller members positioned to compress the plastic portions of said tubes.

5. A machine for sealing a vessel having a tubular member comprising means for supporting the vessel, means for moving the support to cause the tube to travel through a predetermined path, opposed presser members positioned for the passage of said tubular member therebetween, and means actuated by the movement of said support for operating said members to compress the tubular member when disposed between said members.

6. A machine for sealing a vessel having a tubular member comprising means for moving the vessel through a given path, means positioned adjacent to said path for compressing said tubular member and means operated by a movement of said first mentioned means for actuating said second mentioned means.

7. A machine for sealing a vessel having a tubuar projection, means for heating to render plastic a portion of said projection, a pair of spaced presser rollers, means for moving said projection between said rollers and means controlling the degree of pressure applied by said rollers to said plastic portion.

8. A machine for making incandescent electric lamps comprising a conveyor having a port to receive the exhaust tube of a lamp bulb, means for filling said bulb with a gas at a pressure above atmospheric, means for heating a portion of said tube until sufficiently plastic to be compressed, but of sufficient strength to resist pressure within the bulb, and pressure rollers for collapsing said plastic portion to seal said gas in said bulb.

9. A machine for making incandescent electric lamps comprising a conveyor having a port to receive the exhaust tube of a lamp bulb, means for filling said bulb with a gas at a pressure above atmospheric, means for heating a portion of said tube until sufficiently plastic to be compressed, but of sufficient strength to resist pressure within the bulb, and a pair of pressure rollers disposed on opposite sides of the path of movement of said tube with said conveyor to compress said plastic portion of the tube and seal the gas in said bulb.

10. A machine for sealing lamp bulbs, each pro-

vided with an exhaust tube, comprising a holder to receive a bulb, said holder having a lower wall apertured to receive an exhaust tube, an exhaust port for connecting with said tube below said holder, means for causing said holder to carry the bulb through a predetermined path, means for heating said exhaust tube, a pair of sealing disks carried on swinging arms and between which said exhaust tube passes after being heated to sealing temperature, and resilient means acting on said arms for pressing said rollers together, said holder having depending approximately alined fins lying on either side of said exhaust tube aperture, so as to take the impact of engagement with said disks and start them rotating to roll the exhaust tube to sealed position.

11. A machine for making gas-filled electric lamps comprising means for filling lamp bulbs with a gas at a pressure above atmospheric, means for heating portions of exhaust tubes from said bulbs until plastic, and rollers for progressively collapsing said heated portions to seal gas in said bulbs.

12. A machine for making incandescent electric lamps comprising a conveyor for moving a lamp through a given path and having a port to receive the exhaust tube of the bulb thereof, means for filling said bulb with a gas at a pressure above atmospheric, means for heating a portion of said tube until sufficiently plastic to be compressed but of sufficient strength to resist pressure within the bulb, means for compressing the plastic portion of said tube to collapse it during said movement, and means operated by a movement of the conveyor for initiating a movement of said compressing means to collapse the wall of said tube to seal said gas in said bulb.

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