To all whom it may concern:

Be it known that we, HARRY D. MADDEN, a citizen of the United States, and a resident of Irvington, in the county of Essex and State of New Jersey, and JOHN J. HIGGINS, a citizen of the United States, and a resident of East Orange, in the county of Essex and State of New Jersey, have invented a new and useful Improvement in Methods of and Apparatus for Manufacturing Incandescent Lamps, of which the following is a specification.

This invention relates to the manufacture of incandescent electric lamps and, more particularly, to lamps of the so-called gas-filled type, and it has for its object the provision of a method of, and a machine for, exhausting and sealing-in lamp mounts in such manner as to eliminate a considerable number of separate operations heretofore considered necessary.

According to the present practice of performing certain operations in the manufacture of incandescent lamps, the bulb is first tubulated, the mount is then sealed within the bulb, and the sealed bulb is then exhausted and, if desired, an inert gaseous filling is introduced within the bulb, simultaneously with the exhausting operation.

These several operations require special apparatus in the working of the glass parts involved and necessitate the performance of a large number of sequential operations which not only require expert operatives but occasion a considerable loss, due to defective lamp parts and commonly termed shrinkage.

Furthermore, all operations performed with a view to sealing-in the lamp mount and exhausting the bulb are attended by the application of heat, which is something to be avoided as much as possible on account of strains produced in the glass by the heating and cooling of the same.

Also, certain of the above mentioned operations have inherent manufacturing troubles which are a constant source of annoyance and would be avoided if the total number of operations could be materially reduced. For example, in tubulating a bulb preparatory to exhausting, glass troubles are encountered if the wall thickness of the bulb varies beyond definite limits. This is something, therefore, that requires attention in the blowing of the bulbs, which might be disregarded if the lamp were exhausted without tubulating the bulb. There are many other similar factory problems inherent in the present exhausting and sealing-in operations which, if avoided, would improve the efficiency and mechanical appearance of the finished lamp, besides reducing the cost of manufacture thereof.

The invention contemplates the minimizing of the difficulties mentioned above by omitting some of these operations and by combining others. It is obvious that each operation performed not only adds to the cost of the lamp by a direct labor charge for accomplishing the same, but carries with it such cost items as materials used, investment in equipment, floor space, shrinkage and other overhead charges which must be taken into account in fixing the price of the finished lamp sold to the consumer.

As a result of the invention, several of these cost items, if not eliminated, are considerably reduced.

According to the present invention the number of operations for sealing-in and exhausting an incandescent lamp is reduced, which result is principally effected by a change in the sequence of performing the operations and by doing a greater number thereof on a single machine. Briefly stated, the manufacturing steps included in our process and regarded as necessary to effect the consolidation of the mount with the bulb and to admit a gas filling, if desired, after exhausting, are to suitably support the mount within the bulb, regard being had for centering the same; making a gas-tight seal at the neck of the bulb; applying heat to the exterior of the bulb for the purpose of sealing-in the mount and assisting in the exhausting of airtherefrom; introducing nitrogen or other inert gas; sealing-in and drawing down the mount, and annealing the glass parts previously subjected to heat.

Any machine, which will accomplish the objects contemplated by our invention by overcoming the manufacturing difficulties above enumerated, must embody means for performing the various process steps just recited and will be within the scope of the invention.

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Throughout the several views of the drawings, similar reference characters refer to like parts.

In the accompanying drawings Fig. 1 is a sectional elevation of a machine head and associated apparatus for practicing our invention; Fig. 2 is a similar view showing, in detail, the bulb-supporting means and illustrating one of the steps performed in the sealing-in operation; Fig. 3 is a side elevation of a partially completed lamp and certain of the devices utilized in practicing our invention; Fig. 4 is a view similar to Fig. 3, illustrating a bulb and its mount after having been drawn down, and Fig. 5 is a plan view of cam members shown in Fig. 1.

Referring to Fig. 1 of the drawings, a machine for practicing our invention may be provided with one or more heads each of which is supported by a base upright frame member 1, having arms extending laterally therefrom and terminating in bearing sleeves 2 and 3 for supporting movable parts of the head mechanism reciprocally mounted therein, including a plunger rod or shaft 4 partially enclosed within a tube 5. Surrounding a portion of the tube 5 is a sleeve 8 having a screw-threaded lower end constituting part of a stuffing box 9, and having, at its upper end, reduced portions to receive parts to be hereinafter described. A sleeve 10 encloses the sleeve 8 and is provided with a feather 12 that engages a suitable keyway 12a formed in the bearing sleeve 2. Mounted adjacent to the upper end of the sleeve 10 is a gear wheel 13 that is slidable secured, by means of a suitable key 14, to the sleeve 8. The stuffing box 9 includes packing material that is confined in a recess in a collar 15 by the lower end of the sleeve 8. The ends of the bearing sleeve 3 are provided with recesses containing suitable packing material that is held therein by means of glands 16, 17 to constitute stuffing boxes.

Bell-crank levers 17 and 18 are pivoted to a supporting block 11 by means of stud screws 19, 19. The arm 20 of the bell-crank lever 17 terminates in a bifurcated portion provided with studs or projecting portions adapted to fit a grooved collar 21 that is secured to the tube 5. The other arm 23 of the lever 17 has a roller 24 secured to its end in position to be actuated by a cam 25 having a plurality of cam surfaces as shown in Fig. 5 and hereinafter more fully described. In a similar manner, arm 26 of the bell-crank lever 18 cooperates with the collar 15, and a roller 27a on the arm 27 of the said lever engages a cam 28. A bifurcated lever 29, pivoted to the support 1 by means of a boss and stud screw, as shown, has its forked end engaging oppositely disposed pins 30 that are secured to, or are formed integrally with, a gear casing 31, while its opposite end is attached to an operating rod 32.

The upper end of the rod 4 is bifurcated to receive the lower end of a member 33, the latter being pivotally mounted in the tube 5, and the former being provided with a pin 4a to engage a diagonal slot 33a in said member 33. A member 34 is pivotally mounted in the tube 5 in position to cooperate with the member 33, and its free end projects through a slot in the tube 5. The upper end of the member 33 and the adjacent lower end of the member 34 are provided with cooperating gripping edge surfaces which function in a manner to be hereinafter described.

Seated on the lowermost reduced portion of the sleeve 8 is block 35 having its opposite ends bifurcated to receive and pivotally support gripping members 36. The gripping members 36 are biased inwardly by helical springs 37 that are supported upon stud pins with which the sleeve 8 is provided. A collar 38 is located above the block 35 and is frictionally held upon the sleeve 8 to retain the block in position. A truncated rubber gasket 39 is forced over a shoulder 40 and is adapted to fit snugly between the shoulder and the collar 38. An asbestos collar 41, that is frictionally mounted on the opposite side of the collar 40, serves to prevent undue heating of the parts immediately below it.

The gear casing 31 is adapted to receive the gear wheel 13 and a pinion 42 which causes the gear wheel 13 to rotate by power transmitted through an enclosed gear wheel 43. A suitable cover plate 44 is provided for the teeth of the gear wheel 13. Upwardly extending rods 45 have their lower ends secured to the casing 31 and carry, at their upper ends, a rotatable bulb-supporting means comprising a gear housing 46, a gear wheel 47, and a cover plate 48. Bearing balls 47a are interposed between the members 46 and 47 and the teeth of the latter mesh with those of a pinion 50, which is rotated synchronously with the pinion 42 by means of a connecting shaft 50a therebetween.

Supported on the housing 46 is a bulb holder 51 having five prongs or contact points so related to one another as to support the bulb 61 in a vertical position, with its neck projecting downwardly. The lower portion of the neck of the bulb 61 is adapted to be heated by means of a burner 52, preferably annular in form and provided with a plurality of nozzles 52a designed to intensify and localize the gas flames, as much as possible, upon a given portion of the neck of the bulb. The burner 52 is supported by a rod 53 fastened to the member 1 and is connected to a suitable supply of gas and air.
by pipes, such as 40. A heat chamber or oven 54, having an annular burner 55 mounted therein, is provided for heating the bulb, as is common in exhaust operations. The oven 54 is provided with suitable means for raising and lowering it in a vertical direction, and the lower portion thereof is slotted so that its lower edge may rest upon the upper surface of the burner 52.

It will be noted that the rod 4 may be independently reciprocated and may be maintained in an upward position by means of a helical spring 66 held, under compression, in the bearing sleeve 3. A gas and a vacuum line 57 and 58, respectively, may be connected at this point by means of a connector 59 and a three-way cock 60. Communication is established between the bulb 61 and the connector 59 by means of a longitudinal passage in the side of the rod 4, and illustrated in the drawing by a broken line. A key 22, carried by the rod 4, is adapted to travel in keyways formed in the tube 5 and the sleeve 8 and functions to cause the said members to rotate in unison, and, at the same time to permit longitudinal reciprocation independently of each other. It will be noted that, by means of the lever 29, the complete bulb-supporting and holding means may be reciprocated independently of the burners 52 and 55. This is possible since practically the entire supporting structure for the bulb is a unit capable of vertical or reciprocating movement by actuation of the lever 29. The contour of the cam 28 and the length of the gear wheel 45 is such as to permit the desired movement to take place.

The operation of the machine may be described as follows: A mount 65 is first placed upon the reduced end portion of the tube 5, the flame of the mount abutting upon a suitable shoulder formed at this point on the tube. The leading-in wires 66 are inserted in the end of the tube 5 and are gripped between the jaws of members 33 and 34 which are opened by moving the rod 4 downwardly and are caused to close upon the leading-in wires by the upward movement of this rod, under the action of the spring 56. The rod 4 may be actuated in any suitable manner either automatically or manually. On account of variations which are likely to occur in the internal diameters of the cylindrical portions of mounts, the lever member 34 is provided, and its outward bias, produced by the spring 56, functions to firmly hold the mount in position. The bulb 61 is next placed over the mount and is supported by the bulb holder 51. The rubber gasket 39 constitutes a gas-tight seal for the mouth of the bulb which is engaged and held thereon by the gripping members 36. The gas oven 54 may then be drawn down, and heat the bulb 61 by the burner 55. Simultaneously, the intensity of the flames from the burner 52 may be increased from a mere pilot light to provide a sufficient temperature to render the neck of the bulb plastic. Upon the application of the heat, the bulb and its mount are rotated by the mechanism previously described. During the application of the heat, the bulb, with its supporting means, is continuously rotated and slowly moved up and down by operation of the lever 29. This construction affords a satisfactory means of applying the heat over any desired area of the neck of the bulb 61 and partially assists in evacuating the bulb by causing the air therein to expand.

As the neck of the bulb to which the heat is applied gradually becomes plastic, the cam 28 may be rotated to produce an outward movement of the arm 27 and thereby effect a downward movement of the collar 15 and the sleeve 8, whereby causing a slight pulling down of the bulb neck and constricting the opening between the flared portion of the mount 65 and the wall of the bulb neck. This operation is shown as completed in Fig. 2. The speed at which the cam members 25 and 28 are caused to rotate is very slow and may be intermittent, if desired, the essential feature being the provision of sufficient intervals between the active surfaces to permit of the performance of certain operations between the functioning periods of the cams. At this stage, the bulb 61 is connected to the vacuum line 58 and may be preliminarily exhausted, after which a filling gas, such as nitrogen, argon, or the like, may be admitted through the line 57. This gas may then be exhausted and the same gas admitted a second time. By repeating this operation, the air may be more completely exhausted and the purity of the admitted gas improved. It is obvious that, in a vacuum-type lamp, the exhausting operation would consist of merely connecting the exhaust line to the bulb, and, by heating the bulb, a satisfactory commercial vacuum would be obtained.

After the gaseous filling has been introduced in the bulb 61, the sealing-in operation is completed by consolidating the flare of the mount 65 with the adjacent wall of the bulb. In performing this operation, considerable care and skill are required in applying the proper amount of heat to make the seal. The best results are obtained by so positioning the flames of the burner 52 that as much heat as possible will be prevented from striking the portion of the glass above the point at which the seal is made. This may be partly accomplished by adjusting the flames to a fine point and causing them to strike immediately below the flared portion of the mount 65.

It will be seen that by applying the flame below the seal there will be no danger of atmospheric pressure collapsing the walls of
the neck of the bulb above the seal, but that the glass below the seal will be drawn or rolled upwardly to reinforce the seal against pressure inwardly or outwardly. A true tipless lamp is thus formed as no exhaust tube which requires tipping off, is employed as the neck of the bulb is used for that purpose.

To promote success in the performing of the sealing-in operation, it is important that the internal pressure of the bulb shall be substantially equal to the external or atmospheric pressure. In the case of a gas-filled lamp, the expansion of the gaseous filling, due to the heat applied to the exterior of the bulb, will increase the pressure thereof appreciably above what the pressure of the gas will be at normal temperature. It is obvious that, when there is a difference between the external and internal pressures — the glass being in a plastic condition, which is necessary to make the seal between the mount and the bulb — difficulty may be encountered which will be manifested by either a blowing-out or a sucking-in of the glass that is plastic, depending upon whether the internal pressure is greater or less than the external pressure. It, therefore, follows that, in a vacuum-type lamp, the glass should be worked as cold as possible, and greater skill is required in making the seal, but it is, in no sense, a physical impossibility, inasmuch as a skilled operator is capable of performing this step in the operation of a machine for practicing our process.

The seal between the mount and the bulb is completed by a final operation of applying intense heat for a short period of time, accompanied by a further pulling down of the sleeve 8, which results in the removal of the cutlet 68 as illustrated in Fig. 3. The removal of the cutlet may be effected by operating the bell-crank lever 18 through the agency of a second active surface on the cam 28, in a manner similar to that previously described. The cam 28 is effective in maintaining the parts controlled by the bell-crank lever 18 in a down position until the bell-crank lever 17 has had an opportunity of functioning by drawing down the tube 5, through the medium of the cam 25. This operation effects the pulling down of the mount 65, which is a standard operation performed by present methods of manufacturing for the purpose of reinforcing the seal effected between the bulb and the mount, and is shown in Fig. 4 as having been performed.

From the foregoing description, it will be apparent that our invention has features for taking care of manufacturing problems which must be overcome to make it a success. We refer particularly to the desirability of maintaining the internal and external pressures of a gas-filled lamp at substantial equilibrium during the making of the seal between the mount and the bulb. As previously pointed out, if the lamp is of the vacuum type, the seal must be made with the glass at as low a temperature as is practicable to permit its being worked in order to avoid a sucking-in of the glass around the seal, due to the external atmospheric pressure. It may be found advisable to use any expedient which will have a tendency to prevent any large area of the bulb neck from becoming heated to the stage of plasticity, as by regulating the fires to a hot point and adjusting the angle at which they are permitted to strike the glass. Similar precautions will suggest themselves to those skilled in the art.

While we have herein shown and particularly described a preferred embodiment of our invention, we do not wish to be limited to the precise details of construction illustrated, as changes may be readily made without departing from the spirit and scope of the invention.

What is claimed is:

1. A step in the method of combining the exhausting and sealing-in operations in the manufacture of an incandescent lamp of the gas-filled type which consists in hermetically sealing said lamp by uniting the mount with the bulb while maintaining the internal and external gas pressures substantially equal.

2. The method of combining the exhausting and sealing-in operations in the manufacture of an incandescent lamp of the gas filled type, which comprises applying heatexternally of the bulb and exhausting the air from within said bulb simultaneously therewith, introducing and maintaining a gas under pressure substantially equal to that of the surrounding atmosphere and simultaneously therewith hermetically sealing said lamp by fusing the mount within the bulb.

3. The method of combining the exhausting and sealing-in operations in the manufacture of an incandescent lamp of the gas-filled type, which comprises applying heat externally of the bulb and exhausting the air simultaneously therewith, continuing the application of heat and introducing an inert gas under pressure, partly produced by expansion under the influence of the heat, until the external and internal pressures are substantially equal, and hermetically sealing the lamp by fusing the mount within the bulb.

4. The method of combining the exhausting and sealing-in operations in the manufacture of an incandescent lamp, which comprises centrally supporting a mount within a bulb, making the mouth of the bulb gastight and exhausting the bulb therethrough.
simultaneously with the application of heat to the exterior of the bulb and hermatically sealing the lamp by fusing the mount and the bulb together.

5. The method of combining the exhausting and sealing-in operations in the manufacture of incandescent lamps, which comprises centrally supporting a mount within a bulb, making the mouth of the bulb gas-tight, applying heat upon the exterior of the bulb and simultaneously exhausting the same, introducing a gaseous filling under a pressure substantially equal to the atmospheric pressure, fusing the mouth to the bulb and drawing down the mount while the seal is still plastic.

6. The method of combining the exhausting and sealing-in operations in the manufacture of an incandescent lamp, which comprises centrally supporting a mount within a bulb, making the mouth of the bulb gas-tight, reducing the space between the neck of the bulb and the flare of the mount by rendering the former plastic, exhausting the bulb through said constricted opening, consolidating the mount with the bulb, and drawing down the mount while the seal is still plastic.

7. The method of combining the exhausting and sealing-in operations in the manufacture of an incandescent lamp, which comprises centrally supporting a mount within a bulb, making the mouth of the bulb gas-tight, reducing the space between the neck of the bulb and the flare of the mount by rendering the former plastic, exhausting and introducing a gaseous filling through said constricted opening, equalizing the internal and external gas pressures upon the bulb partly by the application of heat, consolidating the mount with the bulb, and drawing down the mount while the seal is still plastic.

8. The method of combining the exhausting and sealing-in operations in the manufacture of an incandescent lamp, which comprises centrally supporting a mount within a bulb, securing the mount to its support by means of the leading-in wires, closing the mouth of the bulb with a gas-tight seal, gripping the bulb neck exteriorly of the seal, reducing the space between the neck of the bulb and the flare of the mount by rendering the former plastic and pulling it down while in this condition, exhausting the bulb through said constricted opening, consolidating the mount with the bulb, and drawing down the mount while the seal formed between the bulb neck and the mount is still plastic.

9. The method of combining the exhausting and sealing-in operations in the manufacture of an incandescent lamp, which comprises centrally supporting a mount within a bulb, securing the mount to its support by means of the leading-in wires, closing the mouth of the bulb with a gas-tight seal, gripping the bulb neck exteriorly of the seal, reducing the space between the neck of the bulb and the flare of the mount by rendering the former plastic and pulling it down while in this condition, exhausting the bulb through said constricted opening, consolidating the mount with the bulb, and drawing down the mount while the seal formed between the bulb neck and the mount is still plastic.

10. The method of combining the exhausting and sealing-in operations in the manufacture of an incandescent lamp, which comprises centrally supporting a mount within a bulb, making the mouth of the bulb gas-tight, applying heat at different areas of the bulb and simultaneously therewith synchronously rotating the bulb and the mount while independently reciprocating the bulb, relatively moving the heated areas of the bulb with respect to each other to cause the bulb to be constricted adjacent its lower end, exhausting the bulb, filling the same with a gaseous atmosphere, fusing the mount within the bulb, and drawing down the mount while the glass is still plastic.

11. The method of combining the exhausting and sealing-in operations in the manufacture of an incandescent lamp, which comprises centrally supporting a mount within a bulb, making the mouth of the bulb gas-tight, applying heat at different areas of the bulb and simultaneously therewith synchronously rotating the bulb and the mount while independently reciprocating the bulb, relatively moving the heated areas of the bulb with respect to each other to cause the bulb adjacent its mouth, exhausting the bulb through the neck and applying intense heat immediately below the flare of the mount to fuse the mount to the bulb and hermatically seal the lamp.

12. The method of combining the exhausting and sealing-in operations in the manufacture of an incandescent lamp, which comprises centrally supporting a mount within a bulb, making the mouth of the bulb gas-tight, applying heat at different areas of the bulb and simultaneously therewith synchronously rotating the bulb and the mount while independently reciprocating the bulb, relatively moving the heated areas of the bulb with respect to each other to cause the bulb adjacent its mouth, exhausting the bulb through the neck, applying intense heat immediately below the flare of the mount to fuse the mount to the bulb and hermatically seal the lamp, and drawing down the mount.

13. The method of manufacturing tipless incandescent lamps which comprises exhausting the lamps through the neck of the
14. The method of manufacturing incandescent lamps, which comprises assembling a bulb and a mount, evacuating the bulb and thereafter sealing the mount within the bulb.

15. The method of manufacturing incandescent lamps, which comprises assembling a bulb and a mount, evacuating the bulb, filling the bulb with an inert gas and thereafter sealing the mount within the bulb.

16. The method of manufacturing incandescent lamps, which comprises assembling a bulb and a mount, evacuating the bulb and thereafter sealing the mount within the bulb and simultaneously hermetically sealing the lamp.

17. The method of manufacturing incandescent lamps, which comprises assembling a bulb and a mount, evacuating the bulb, filling the bulb with an inert gas and thereafter sealing the mount within the bulb and simultaneously hermetically sealing the lamp.

18. The method of manufacturing incandescent lamps, which comprises assembling a bulb and a mount, evacuating the bulb through the neck thereof, and thereafter sealing the mount within the bulb.

19. The method of manufacturing incandescent lamps, which comprises assembling a bulb and a mount, evacuating the bulb through the neck thereof, thereafter sealing the mount within the bulb and simultaneously hermetically sealing the lamp.

20. The method of manufacturing incandescent lamps, which comprises assembling a bulb and a mount, evacuating the bulb through the neck thereof, filling the bulb with an inert gas, and thereafter sealing the mount within the bulb.

21. The method of manufacturing incandescent lamps, which comprises assembling a bulb and a mount, evacuating the bulb through the neck thereof, filling the bulb with an inert gas, thereafter sealing the mount within the bulb and simultaneously hermetically sealing the lamp.

22. The method of manufacturing incandescent lamps, which comprises assembling a bulb and a mount, heating the neck of the bulb, relatively moving the enlarged part of the bulb with respect to the mouth to cause the neck to be constricted adjacent the flare of the mount, evacuating the bulb while heating the same, thereafter sealing the mount within the bulb and simultaneously hermetically sealing the lamp.

23. The method of manufacturing incandescent lamps, which comprises assembling a bulb and a mount, heating the neck of the bulb, relatively moving the enlarged part of the bulb with respect to the mouth to cause the neck to be constricted adjacent the flare of the mount, evacuating the bulb while heating the same, thereafter sealing the mount within the bulb and simultaneously hermetically sealing the lamp.

24. The method of manufacturing incandescent lamps, which comprises assembling a bulb and a mount, heating the neck of the bulb adjacent the mouth, relatively moving the closed end of the bulb with respect to the open end to produce a constriction adjacent the flare of the mount, evacuating the bulb and then filling the same with an inert gas through the opening between the flare and the neck of the bulb, heating the neck of the bulb below the flare to seal the mount within the bulb and to hermetically seal the lamp.

25. The method of manufacturing an incandescent lamp, which comprises exhausting a bulb through the neck and sealing a mount within the bulb by intense heating of the bulb immediately below the flare of the mount.

26. The method of manufacturing an incandescent lamp, which comprises exhausting a bulb through the neck, filling the bulb with an inert, gaseous atmosphere, and sealing a mount within the bulb by intense heating of the bulb immediately below the flare of the mount.

27. The method of making lamps free from tubulatures, comprising assembling a bulb and a mount, exhausting the air from within the bulb through the neck thereof and joining the flare of the mount to the neck of the bulb.

28. The method of forming tipless lamps, comprising assembling a bulb and a mount, exhausting the air from within the bulb through the neck thereof and joining the flare of the mount to the neck of the bulb by applying heat to the neck of the bulb below the seal.

29. The method of making lamps free from tubulatures consisting of assembling a bulb and a mount, heating the neck of the bulb adjacent the flare on the mount, forming a constriction therein adjacent the flare, creating a vacuum in the bulb by exhausting the air from within through the space between the flare and the constriction and applying heat to the neck of the bulb below the flare to cause the glass to roll or be drawn up and close the space between the flare and the constriction in the neck of the bulb.

30. The combination in an incandescent lamp-making machine of means for exhausting a bulb and means operating subsequently thereto for sealing a mount within the bulb.

31. The combination in an incandescent lamp-making machine of means for supporting a bulb, means for supporting a mount, means for exhausting said bulb, and means operating subsequently to said last named
means for sealing the mount within said bulb.

32. The combination in an incandescent lamp-making machine of means for exhausting a bulb, means for filling the bulb with a gaseous atmosphere, and means operating subsequently to said last mentioned means for sealing a mount within the bulb.

33. The combination in an incandescent lamp-making machine of means for supporting a bulb and means for supporting a mount, means for exhausting the bulb, means for filling said bulb with a gaseous atmosphere and means for sealing the mount within said bulb, all of said means operating in the sequential order stated.

34. The combination in an incandescent lamp-making machine, of means for supporting a bulb, means for supporting a mount, means for rotating the bulb and the mount in unison, means for heating said bulb and simultaneously therewith exhausting the bulb, and means for fusing the mount to the bulb subsequent to the exhausting operation.

35. The combination in an incandescent lamp-making machine of means for supporting a bulb including means for making the neck of the bulb gas-tight, means for supporting a mount, means for heating the bulb adjacent its upper end, means for heating the bulb adjacent its mouth, means for rotating the bulb and the mount during heating thereof, means for moving the upper and lower parts of the bulb with respect to each other to produce a constriction in the neck of the bulb adjacent the mouth thereof, means for evacuating the bulb through the mount support and the neck of the bulb between the constriction and the flare of the mount, means for sealing the mount within the bulb and means for drawing down the mount.

36. In a lamp-making machine the combination of bulb-supporting means, mount-supporting means, means for rotating said bulb and mount-supporting means in unison while permitting independent reciprocatory movement therebetween, means for heating the bulb at different areas, means for neck-downing the bulb, means for exhausting the bulb and means for pulling down the mount.

37. In a lamp-making machine, the combination of a bulb-supporting means, a mount-supporting means, a seal for making the neck of the bulb gas-tight, means for rotating the bulb and the mount in unison, means for independently reciprocating the bulb and the mount, means for exhausting the bulb, and means for effecting a seal between the neck of the bulb and the flare of the mount.

38. In a lamp-making machine, the combination of a bulb-supporting means, a mount-supporting means, a seal for fusing the bulb neck and the mount, means for exhausting the bulb, and means for effecting a seal between the neck of the bulb and the mount.

39. In a lamp-making machine, the combination of a bulb-supporting means, a mount-supporting means, a seal for making the neck of the bulb gas-tight, means for rotating the bulb and the mount in unison, means for applying heat to the bulb at different areas, means for constricting the opening between the bulb neck and the mount, means for exhausting the bulb, means for completing the seal between the bulb and the mount, and means for drawing down the mount.

40. A commercially unfinished incandescent electric lamp having a mount fused therein and also being free from tips.

41. A commercially unfinished incandescent electric lamp having a mount fused therein and its exterior contour free from protuberances.

In testimony whereof, we have hereunto subscribed our names this twenty-sixth day of March, 1919.

HARRY D. MADDEN.
JOHN J. HIGGINS.