Sept. 15, 1959 K. W. REYNOLDS ET AL 2,904,192

LAMP TRANSFER APPARATUS

Filed Nov. 23, 1956 3 Sheets-Sheet 1

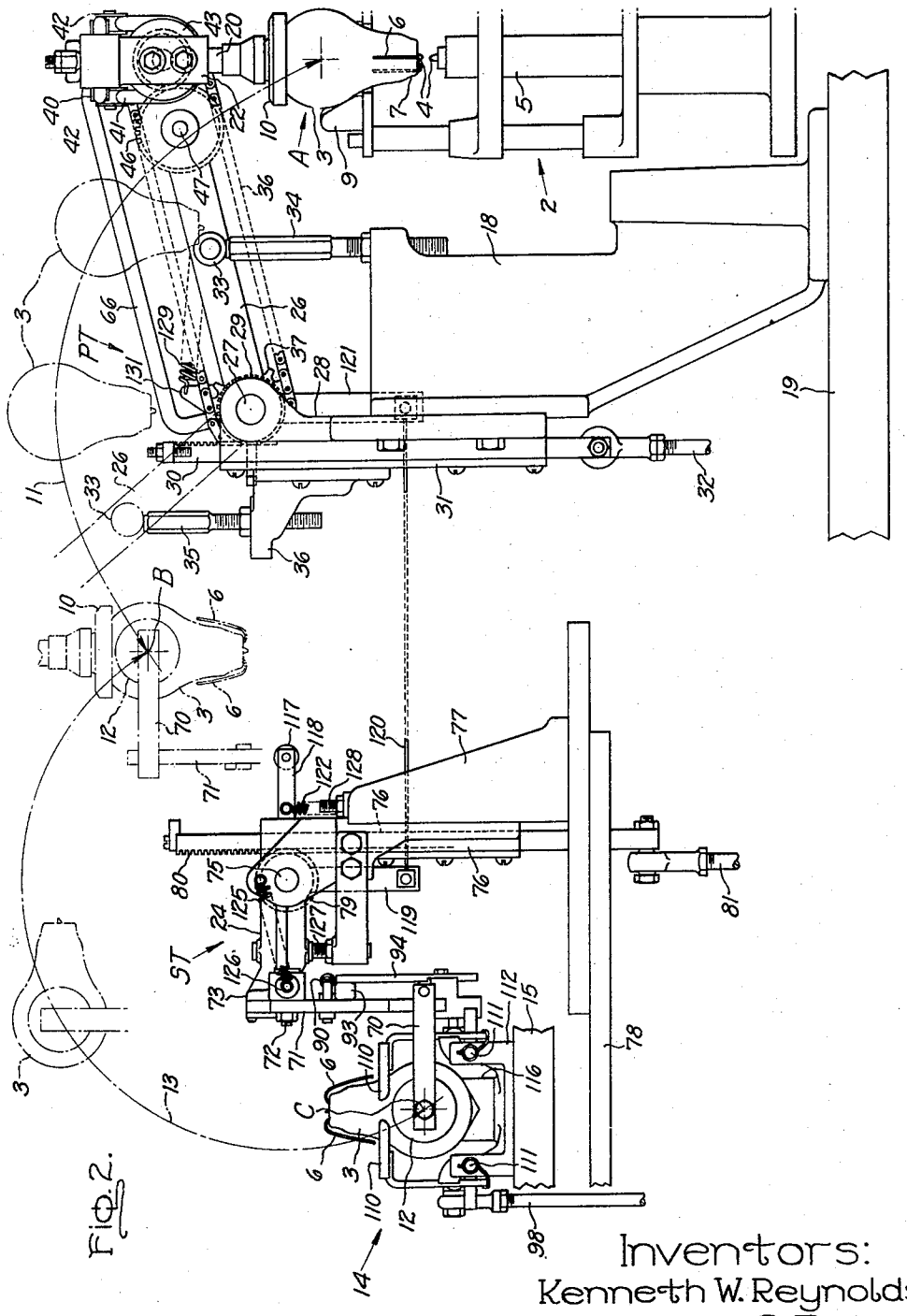


Fig. 2.

Inventors:
Kenneth W. Reynolds,
Clarence S. Terez,
by Otto Richey
Their Attorney.

Sept. 15, 1959 K. W. REYNOLDS ET AL 2,904,192

LAMP TRANSFER APPARATUS

Filed Nov. 23, 1956 3 Sheets-Sheet 2

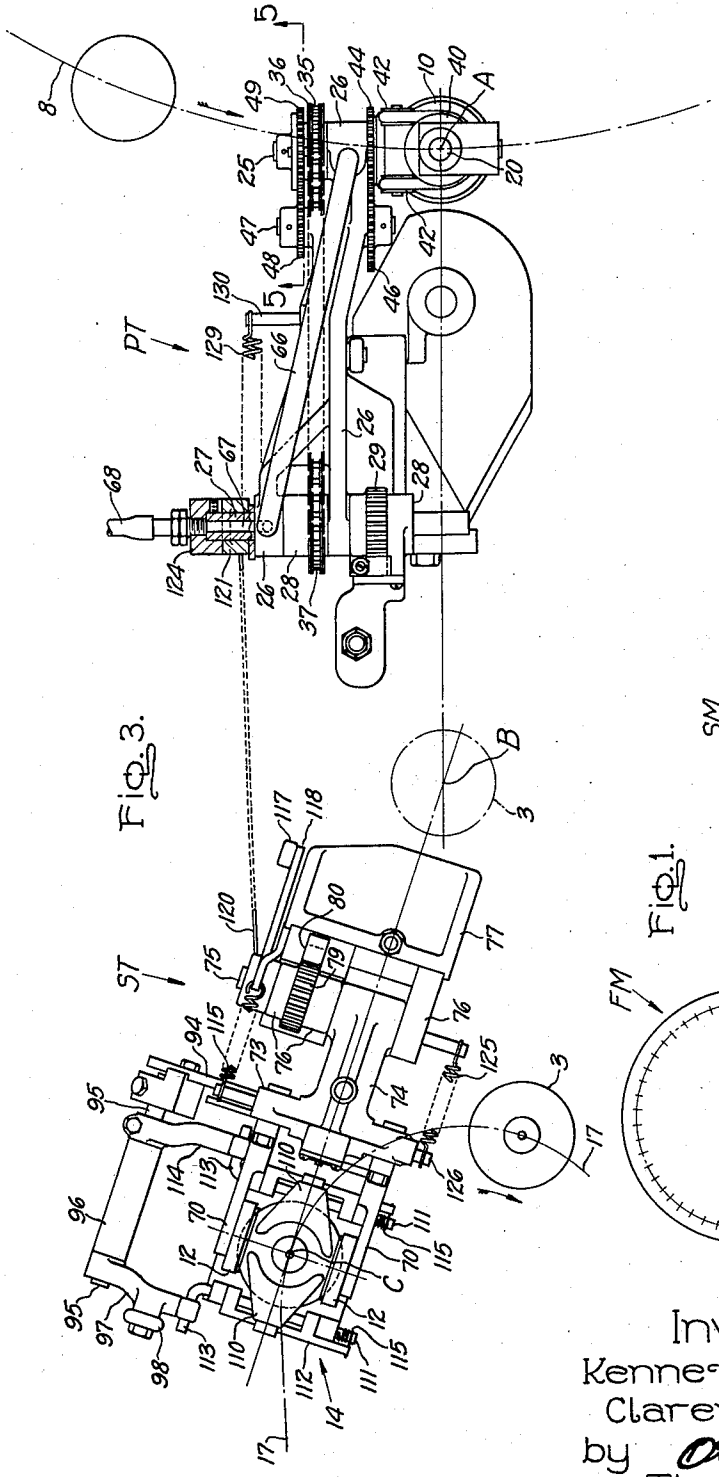


Fig. 3.

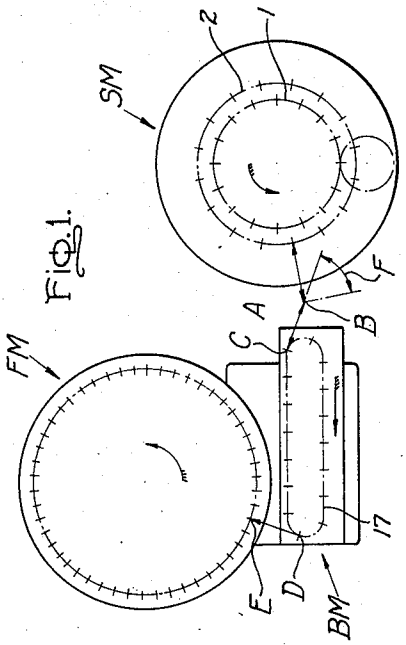


Fig. 1.

Inventors:
Kenneth W. Reynolds,
Clarence S. Terez,
by Otto Richy
Their Attorney.

Sept. 15, 1959 K. W. REYNOLDS ET AL 2,904,192

LAMP TRANSFER APPARATUS

Filed Nov. 23, 1956 3 Sheets-Sheet 3

Fig. 4.

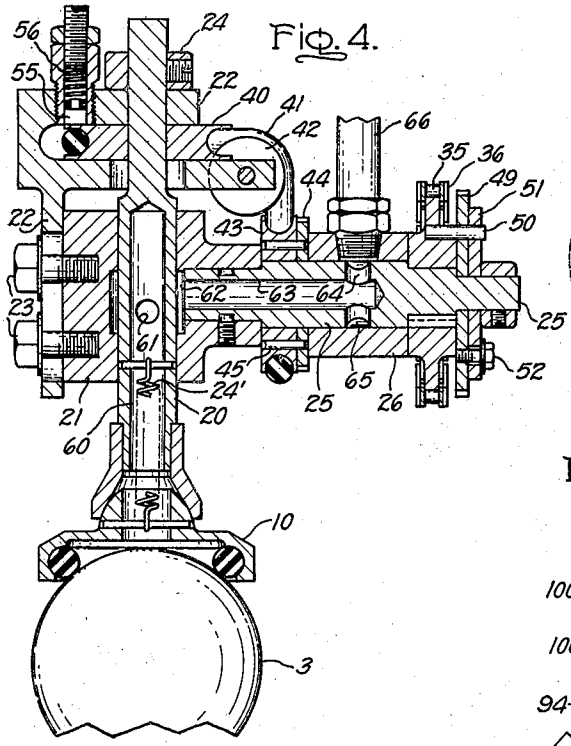


Fig. 5.

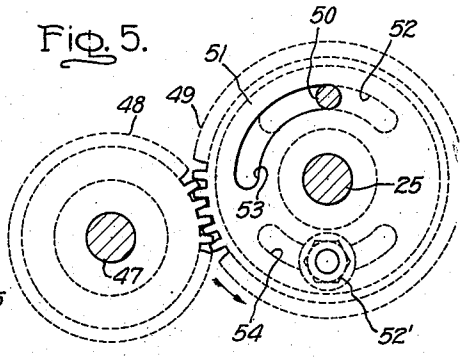


Fig. 6.

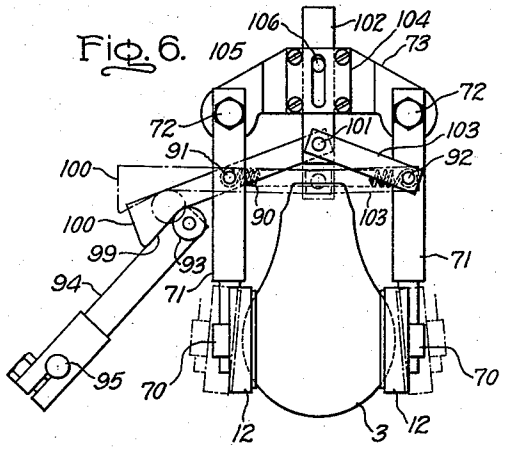
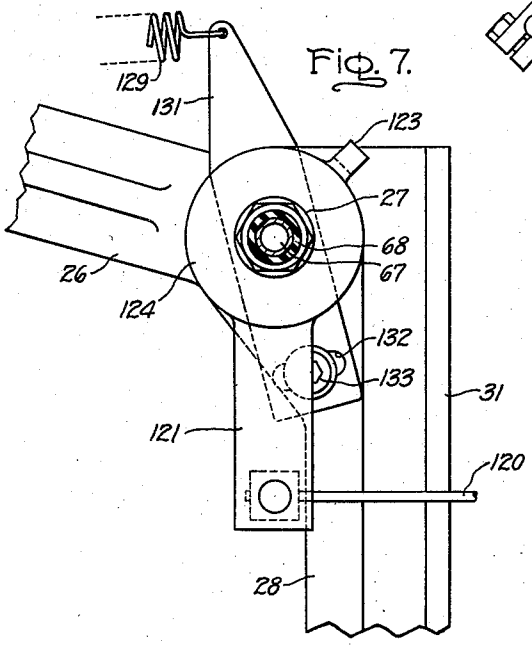


Fig. 7.



Inventors:
Kenneth W. Reynolds,
Clarence S. Terez,
by Otto Ficky
Their Attorney.

United States Patent Office

2,904,192

Patented Sept. 15, 1959

2,904,192

LAMP TRANSFER APPARATUS

Kenneth W. Reynolds, Willoughby, and Clarence S. Terez, Maple Heights, Ohio, assignors to General Electric Company, a corporation of New York

Application November 23, 1956, Serial No. 624,036

1 Claim. (Cl. 214—1)

Our invention relates to transfer apparatus generally and more particularly to transfer apparatus employed in the manufacture of electric lamps and similar devices.

In the manufacture of electric incandescent lamps, a so-called "mount" assembly comprising a glass flare or stem tube, a glass exhaust tube, a pair of lead-in wires and a filament, is sealed into a glass bulb and then exhausted, and usually filled with an inert gas, on a combination sealing and exhaust machine known as "sealex" machine. The sealed lamp bulbs are then transferred to a conveyor on which they travel over an extended path to permit them to cool sufficiently to be handled by an operator. The operator removes the lamps from the conveyor, bends one of the two laterally extending lead-in wires upwardly into alignment with the lamp bulb axis, threads a base over that lead-in wire onto the neck of the bulb and places the lamp in a finishing machine where the base is heated to set the cement contained therein, and the top and side lead wires are trimmed and connected to the base contacts, usually by soldering or welding.

In the course of further mechanization of the lamp assembly operations there has been developed automatic base assembly equipment wherein the lead wires are properly shaped and oriented and a base is automatically threaded over the top (longitudinally extending) lead wire after which the lamp is transferred to the finishing machine. One such base assembly apparatus is disclosed in Patent 2,748,450—J. Flaws, Jr., et al. and another in application Serial No. 492,458, C. S. Terez, filed March 7, 1955, and both assigned to the assignee of the present invention. Such equipment automatically assembles the base with the lamp bulb for delivery to the finishing machine. However, the lamp bulbs are still loaded into the base assembling machine by an operator or by mechanism which loads the bulbs without regard to orientation of the laterally extending lead wires, thereby requiring that the basing machine be provided with special mechanism for properly orienting the lamp, as shown and described in Patent 2,683,521—K. W. Reynolds.

It is therefore an object of our invention to provide improved mechanism for automatically transferring lamp bulbs from the sealex machine (or from the exhaust machine where separate sealing and exhaust machines are employed) to the basing machine. It is a further object to provide mechanism which will retain orientation of the lead wires established on the sealex machine. By maintaining a positive and controlled grip on the lamp bulb throughout the transfer function, the lead wires are not distorted and their orientation is not destroyed.

In accordance with a further feature of our invention, provision is made in the transfer mechanism for a predetermined degree of rotation of the lamp bulb about its axis and proper orientation or positioning of the lead wires in the basing machine. Such rotation of the lamp bulb permits advantageous location of the basing machine in a manner to materially conserve floor space and yet assure proper orientation of the lamp in the basing machine. Moreover, by providing for adjustability in the

degree of rotation of the lamp bulb in the transfer mechanism, the angular relationship or alignment of the basing machine with the sealex machine need not be closely fixed. Furthermore, in a preferred species of the transfer equipment, the transfer is effected in two steps. In one step the bulb is carried from the sealex machine to an intermediate point between the sealex and the basing machines by mechanism which rotates the bulb about its axis while maintaining it in a vertical neck-down position, and in the second step the bulb is inverted to a neck-up position and deposited in the basing machine. The separate steps are preferred in order to permit high operating speeds which are rather difficult to attain with a single member operating over the relatively large distance between the two machines.

Further features and advantages of our invention will appear from the following detailed description of a species thereof and from the drawings wherein:

Fig. 1 is a diagrammatic floor layout of a machine group including a sealex machine, a basing machine and a finishing machine;

Fig. 2 is a side elevation of the transfer apparatus located between the sealex and basing machines and including a primary transfer mechanism at the right and a secondary transfer mechanism at the left, the secondary mechanism being shown, for purposes of simplification, as aligned in the same vertical plane as the primary mechanism although it is preferably at an angle thereto as shown in Fig. 3;

Fig. 3 is a plan view of the transfer mechanisms;

Fig. 4 is an end view, in section, of the transfer arm of the primary transfer mechanism;

Fig. 5 is a fragmentary view, along line 5—5 in Fig. 3, of means on the end of the primary transfer arm for adjusting the degree of rotation of the lamp bulb carried thereby;

Fig. 6 is a front elevation of the clamping jaws of the secondary mechanism; and

Fig. 7 is a fragmentary side view of a portion of the primary transfer arm.

Referring to Fig. 1 of the drawing, the manufacturing group shown therein comprises a sealex machine SM, a basing machine BM and a finishing machine FM having their indexing cycles synchronized. The sealex machine is well known in the art and may be generally of the type shown in Patent 1,662,045—F. W. Patterson and it comprises an inner turret, indicated at 1, on which the filament supporting mount is sealed into the bulb, and a concentric outer turret 2 where the bulb is exhausted, filled with gas, the lead wires bend laterally outward in opposite directions around the bulb neck by suitable mechanism such as that shown in Patent 2,765,002—Reynolds, and the exhaust tube sealed or tipped off. The tipping off occurs at station A of the exhaust turret and the lamp is transferred from that point to a point C where it is deposited in a holder or head on an indexing conveyor of the basing machine BM. The lamp is carried from A to C in two steps, being carried from A to an intermediate point B by a primary transfer mechanism PT (Figs. 2 and 3) and from B to C by a secondary transfer mechanism ST. After the lamp bulb has been provided with a base on the basing machine BM, it is removed therefrom at station D (Fig. 1) and transferred into a head at station E of the finishing machine FM by a suitable transfer mechanism which maintains the orientation of the lamp.

As shown in Fig. 2, the lamp bulb 3 arrives at station A of the exhaust turret 2 in a neck-down position with its exhaust tube 4 extending downward and held in an exhaust port 5 on the turret 2 and with its lead wires 6 bent laterally outward and upward in opposite directions around the bulb neck 7 and located substantially in a ver-

tical plane tangent to the path of travel 8 (Fig. 3) of the exhaust port 5. At said station A the exhaust tube 4 is tipped off or sealed by a conventional tipping torch (not shown) and during that operation the lamp 3 is raised and supported by the jaws or pads 9 of an ejector unit in which the lamp bulb 3 is cradled and supported.

In accordance with the present invention, the lamp 3 is picked up by a holder 10, preferably a suction type holder of the primary transfer mechanism PT which maintains the lamp 3 in a vertical neck-down position throughout its path of travel 11 (Fig. 2) to position B but which rotates the lamp a predetermined amount during said travel. At position B the lamp is gripped by the jaws 12 (Figs. 2, 3 and 6) of the secondary transfer mechanism ST which carries the lamp through a path of travel 13 (Fig. 2) during which the lamp is inverted to a neck-up position and placed in a head 14 at station C on the conveyor 15 of the basing machine BM. The rotation of the lamp about its axis by the primary transfer PT compensates for the difference in angle positions of the respective heads of the sealex machine and the basing machine at stations A and C respectively and assures that the lamp is deposited in the head 14 of the basing machine with its lead wire 6 located in a vertical plane tangent to the path of travel 17 of said head 14.

The primary transfer mechanism PT is supported through a bracket 18 (Fig. 2) from a stationary frame portion 19 of the sealex machine SM. The suction holder 10 thereof is carried by a vertical shaft 20 (Fig. 4) which is mounted to rotate in a block or head 21 and which extends through a bracket 22 secured to the head 21 by bolts 23 and from which it is supported by a collar 24 attached to said shaft. The holder 10 is held on the shaft 20 by a spring 24' mounted on pins in the holder and the shaft. The head 21 is, in turn, fixedly mounted on a horizontal shaft 25 which is rotatably journaled in the free end of transfer arm 26. The other end of arm 26 is fixed to a shaft 27 (Fig. 2) which is journaled in a bracket 28 attached to the bracket 18. The shaft 27 has fixed thereto a gear 29 which meshes with a rack 30 which is slidably supported in the bracket 28 and is reciprocated by a connecting rod 32 which is actuated by a cam on the sealex machine SM to cause the arm 26 to be oscillated in a vertical plane to carry the lamp bulb 3 along the arcuate path 11. The termini of the path of travel 11 are fixed accurately by engagement of a roller stop member 33 on the arm 26 with respective stop studs 34 and 35 respectively mounted on bracket 18 and on a bracket arm 36 attached to the cover plate 31 for the bracket 28.

During the oscillation of the transfer arm 26, the lamp bulb 3 and holder 10 and its shaft 20 are maintained in a vertical position, and the horizontal shaft 25 on the head 21 is prevented from rotating by virtue of a sprocket 35 which is keyed to the shaft 25 and is held against rotation by a chain 36 encircling said sprocket 35 and a stationary sprocket 37 (Fig. 3) which is co-axial with the shaft 27 but is fixed to bracket 28.

The rotation of the lamp 3 about its axis is effected by a pulley 40 which is attached to the vertical shaft 20 carrying the lamp holder 10 and which is driven by a belt 41 which passes over a pair of idler pulleys 42 supported from bracket 22 and around a pulley 43 which is mounted to rotate freely on the horizontal shaft 25. The pulley 43 is driven, upon oscillation of arm 26, by an epicyclic gear train including a gear 44 which is fixed by pins 45 to pulley 43 and which meshes with a gear 46 (Fig. 3) which is fixed to one end of a shaft 47 which is journaled in the arm 26 and to the other end of which is fixed a gear 48 which meshes with and rotates about a gear 49 which is freely rotatable about shaft 25 but is connected to the sprocket 35 by a pin 50 (Fig. 4). During oscillation of the arm 26 the gear 48 is caused to rotate about the gear 49 which causes rotation of gears 46 and 44 to drive the pulley 43 which, through the belt 41, causes rotation of pulley 40, shaft 20, holder 10 and lamp 3.

The degree of rotation of the holder 10 and lamp 3 is made adjustable by virtue of a plate 51 (Figs. 4 and 5) which is rotatably mounted on shaft 25 and which is provided with an arcuate slot 52 through which extends the pin 50. The gear 49 is also provided with an arcuate slot 53 corresponding to slot 52. The plate 51 is thus adjusted angularly about the shaft 25 with respect to the gear 49 and is locked in a desired position by a bolt 52' which extends from gear 49 through an arcuate slot 54 in plate 51.

As shown in Fig. 5, the pin 50 is located at the right hand end of slot 53 in gear 49. During the initial part of the pivotal oscillation of arm 26 away from position A, the gear 44 is locked against rotation about its axis by virtue of a friction shoe member 55 (Fig. 4) which is urged by a spring 56 against the pulley 40 to thereby prevent movement of belt 41 and rotation of pulley 43 and gear 44. Since the gear 44 is locked against rotation about its own axis but is being rotated bodily about the axis of shaft 27 by arm 26, it causes the gear 46 to rotate about its axis around gear 44 which, in turn, causes rotation of gear 48 about its axis which, in turn, causes rotation of gear 49 about its axis until the left hand end of slot 52 engages the pin 50; at this time, since the pin 50 is fixed to sprocket 35 which is positively locked against rotation by chain 36, the gear 49 is thereafter prevented from rotating about its axis so that, upon continued movement of arm 26, the gear 49 now causes gear 48 to rotate which in turn causes rotation of gears 46 and 44 and pulley 43 to thereby drive the belt 41 and rotate the pulley 40 against the friction of shoe 55. It will be apparent that maximum rotation of holder 10 and bulb 3, of about 90° in this case, is obtained when plate 51 is set so that the left hand end of slot 52 is against the pin 50 as well as the right hand end of slot 53 in gear 49; the minimum amount of rotation occurs when the right hand end of slot 52 is against the pin 50 so that slots 52 and 53 are co-extensive. In the particular arrangement of the machines shown in Fig. 1, the holder 10 and lamp 3 are rotated counterclockwise (as viewed from above) through an angle of about 60° corresponding to the angle F.

The suction to holder 10 is supplied through the bore 60 of shaft 20 (Fig. 4), opening 61 in the wall of shaft 20, angular space 62 in head 21, bore 63 of shaft 25, lateral opening 64 in shaft 25, angular groove 65 in shaft 25, pipe or conduit 66, bore 67 of shaft 27 (Fig. 3) and flexible tube 8 which leads to a source of vacuum.

Upon delivery of the lamp 3 to the point B, it is grasped by the jaws 12 of the secondary transfer mechanism ST which carries the lamp along the arcuate path 13 (Fig. 2) to invert it and deposit it in a head 14 of the basing machine BM located at position C.

The secondary transfer mechanism ST may be of a conventional type wherein the jaws 12 are carried by arms 70 which extend laterally from respective arms 71 which are pivoted on studs 72 in the head portion 73 of a T-shaped transfer arm 74 which is fixed to a horizontal shaft 75 journaled in a bracket 76 which is mounted on a bracket 77 carried by the table 78 of the basing machine BM. The shaft 75 and arm 74 are rotated by a gear 79 (Fig. 3) fastened to shaft 75 and driven by a rack 80 which is mounted in bracket 76 and is reciprocated by a connecting rod 81 from a cam on the cam shaft of the basing machine BM.

Upon reaching position B, the jaws 12 close upon the lamp bulb 3 and vacuum to the holder 10 is shut off by a solenoid which is actuated from a cam on the sealex machine SM. The jaws 12 are held in closed position by a spring 90 (Fig. 6) extending between pins 91 and 92 in respective arms 71. Upon reaching position C the jaws 12 are opened by a roller 93 on an arm 94

which is fastened to a shaft **95** (Fig. 3) journaled in a bracket **96** and rotated by an arm **97** which is pivoted by a connecting rod **98** which is actuated by a cam on the cam shaft of the basing machine BM. Upon rotation of the arm **94** (Fig. 6), the roller **93** strikes a cam surface **99** on the extended end of a link **100** which is pivoted on the pin **91** in arm **71** and which is also connected to a pin **101** which is carried by a slide member **102**; the arm **71** is also connected to said slide member **102** by a link **103** which is connected at its ends to pins **101** and **92**. The rotation of arm **94** causes the link **100** to be pivoted to the position shown in dot-dash lines which causes the slide **102** to be moved downward and the link **103** to be also rotated so that the arms **71** are spread apart to open the jaws **12** which are thereafter held open by the spring **90**. The slide member **102** moves in ways in the head **73** of transfer arm **74** and is held therein by a cover plate **104** which is provided with a slot **105** in which rides a pin **106** mounted on the slide **102**. When the pin **106** is at the bottom of slot **105** the links **100** and **103** are in position to hold open the arms **71**, with the center of pin **101** just below the centerline of spring **90**.

Substantially simultaneously with the opening of the jaws **12** at position C the lamp **3** is clamped by jaws **110** of head **14**. The said jaws are fixed to shafts **111** journaled in a base member **112** of head **14**. The shafts **111** have lateral extensions **113** which are engaged, upon entry of the head **14** to station C by the ends of the arm **97** and a corresponding arm **114** on shaft **95** to rotate the shafts **111** in a direction to open the jaws **110**. Upon movement of arms **97** and **114** by connecting rod **98**, the shafts **111** are released and rotated to close the jaws **110** by torsion springs **115** surrounding the ends thereof. The lamp bulb **3** is then held by the jaws **110** while seated on a saddle **116** on the base member **112**.

The closing of the jaws at position B is effected when the link **100** (Fig. 6) is engaged by a roller **117** (Fig. 2) on the arm **118** of a lever which is mounted to freely rotate on shaft **75** and which is provided with another arm **119** which is connected by a cable or link **120** to a downwardly extending arm **121** which is mounted to pivot freely on shaft **27** of the primary transfer PT. The arm **118** is normally held down by a spring **122** extending between the arm and the bracket **77**, but it is rotated when the primary transfer arm **26** approaches the end of its movement to position B. This action takes place when the arm **121** is pivoted due to its engagement by a finger **123** extending laterally from a collar **124** fixed to the shaft **27**, thereby causing the arm **118** to pivot upwardly to strike the end of the link **100** (Fig. 6) on the side opposite the cam surface **99** to thereby pivot the link **100** to the position shown in full lines in Fig. 6.

In order to assist the cam in operating the transfer arm **74** of the secondary transfer ST and smooth the action thereof, we may provide a pair of springs **125** each connected at one end to a pin **126** in the head **73** of arm **74** and each connected at its other end to a fixed point displaced from the axis of shaft **75** such that the springs are extended in the horizontal positions of the arm **74** and are relaxed in the vertical position of said arm **74**. The springs thus act as energy accumulators to assist the arm in starting and stopping. In its respective horizontal position, the position of the arm **74** is accurately fixed by stop lugs **127** and **128** carried by the respective brackets **76** and **77**.

The operation of transfer arm **26** of the primary transfer PT may also be made smoother and its operating cam assisted by provision of a spring **129** (Fig. 7) which is connected at one end to a pin **130** on the arm and at its other end to the upper end of an arm **131** (Fig. 7). The arm **131** is pivoted freely on shaft **27** and has a slot **132** at its lower end engaging a pin **133** mounted on the bracket **28**. The arrangement is such that the spring **129** is extended when the arm **26** approaches the end of its movement toward position A.

What we claim as new and desire to secure by Letters Patent of the United States are:

A transfer mechanism comprising an arm mounted at one end for oscillation about a horizontal axis, a horizontal shaft journalled in the other end of said arm and carrying a support means, a vertical shaft journalled in said support means and carrying holder means at its lower end for gripping an article to be transferred, a sprocket fixed concentrically on said horizontal shaft, means for oscillating said arm between pick-up and delivery positions, means operable to inhibit rotation of said sprocket about its own axis during oscillation of said arm whereby to maintain said vertical shaft in a vertical position during oscillation of said arm, means to rotate said vertical shaft and the holder means carried thereby about its axis comprising a first pulley fixed to said vertical shaft, a second pulley mounted on said horizontal shaft for rotation thereabout and belt means interconnecting said pulleys, and means operable upon oscillation of said arm and coupled to said sprocket for effecting operation of said means to rotate the vertical shaft comprising a first gear mounted for rotation about said horizontal shaft and fixed to said second pulley, a second gear mounted adjacent said sprocket and on said horizontal shaft for rotation relative thereto and having an arcuate slot therein, a pin fixed to said sprocket and engaged in said slot in said second gear, and supplemental gear means journalled on said arm and meshing with said first and second gears to constitute an epicyclic gear train for driving said second pulley upon oscillation of said arm.

References Cited in the file of this patent

UNITED STATES PATENTS

1,869,622	Rowe	Aug. 2, 1932
2,081,580	Diffenderffer	May 25, 1937
2,791,316	Mullan et al.	May 7, 1957