W. R. BURROWS.

MACHINE FOR HANDLING INCANDESCENT LAMP BULBS.

APPLICATION FILED SEPT. 10, 1908.

1,045,943. **Patented Dec. 3, 1912.**

5 SHEETS—SHEET 1.

Fig. 1.

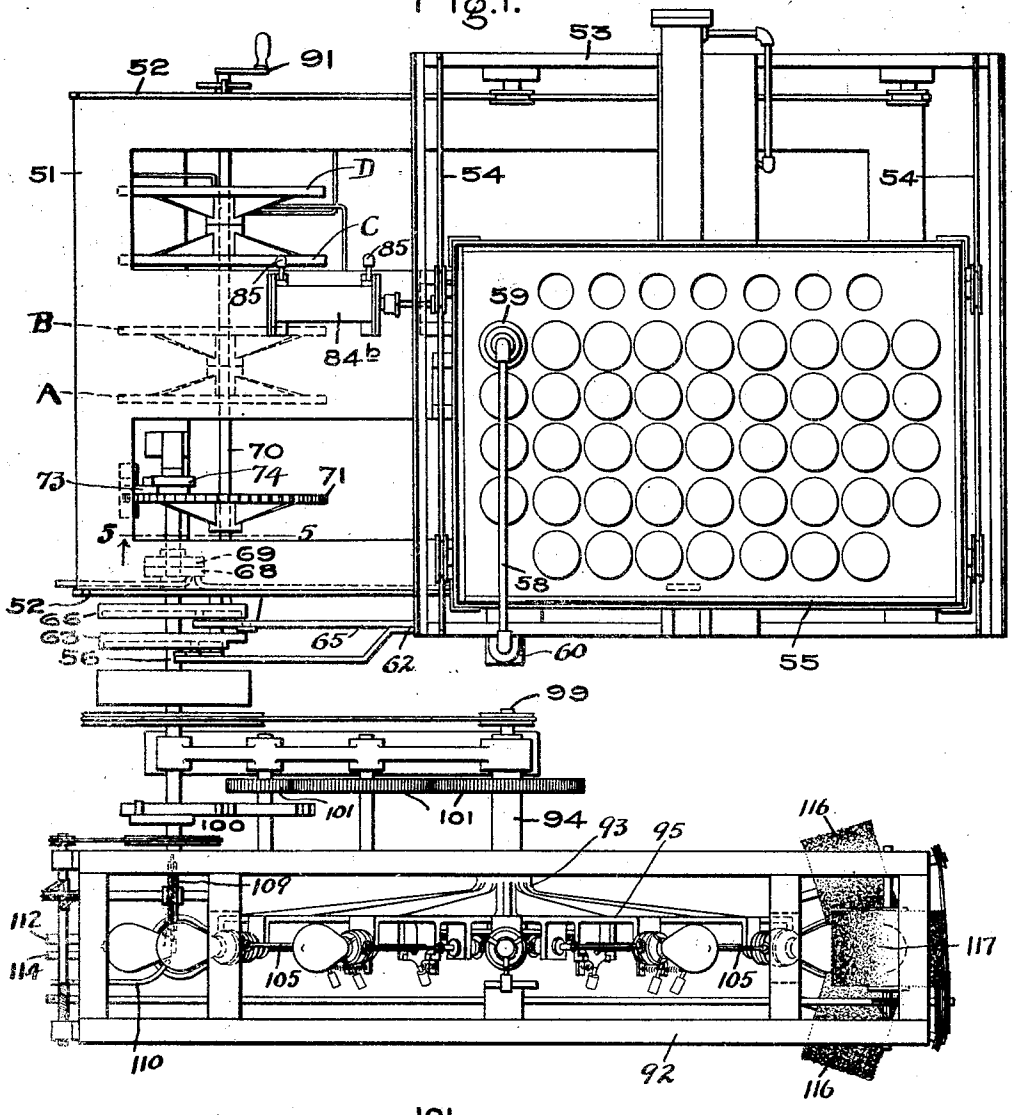


Fig. 15.

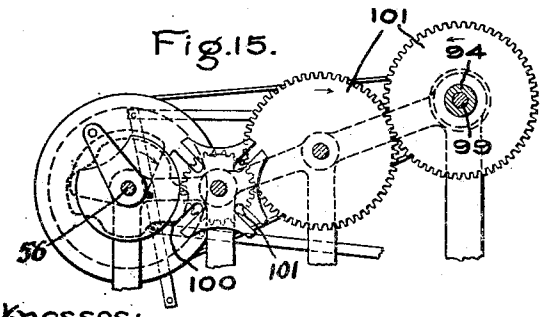


Fig. 8.

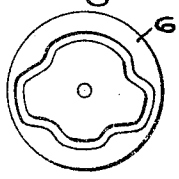
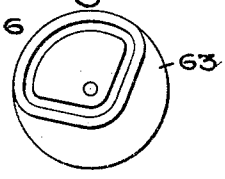


Fig. 9.



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5 SHEETS—SHEET 2.

Fig.13.

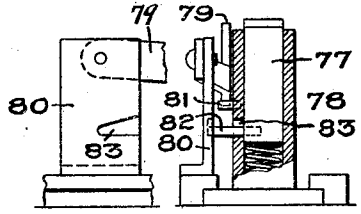


Fig.14.

Fig.2.

Fig.11.

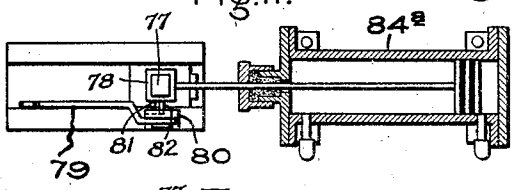


Fig.12.

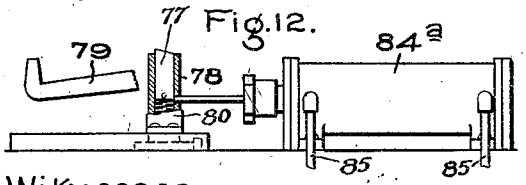
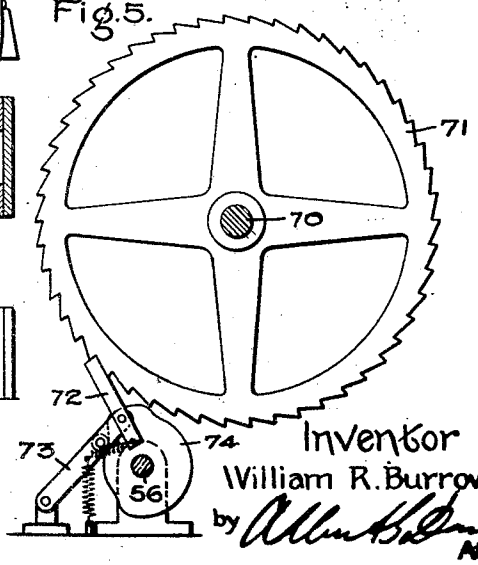


Fig.5.



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5 SHEETS—SHEET 3.

Fig.3.

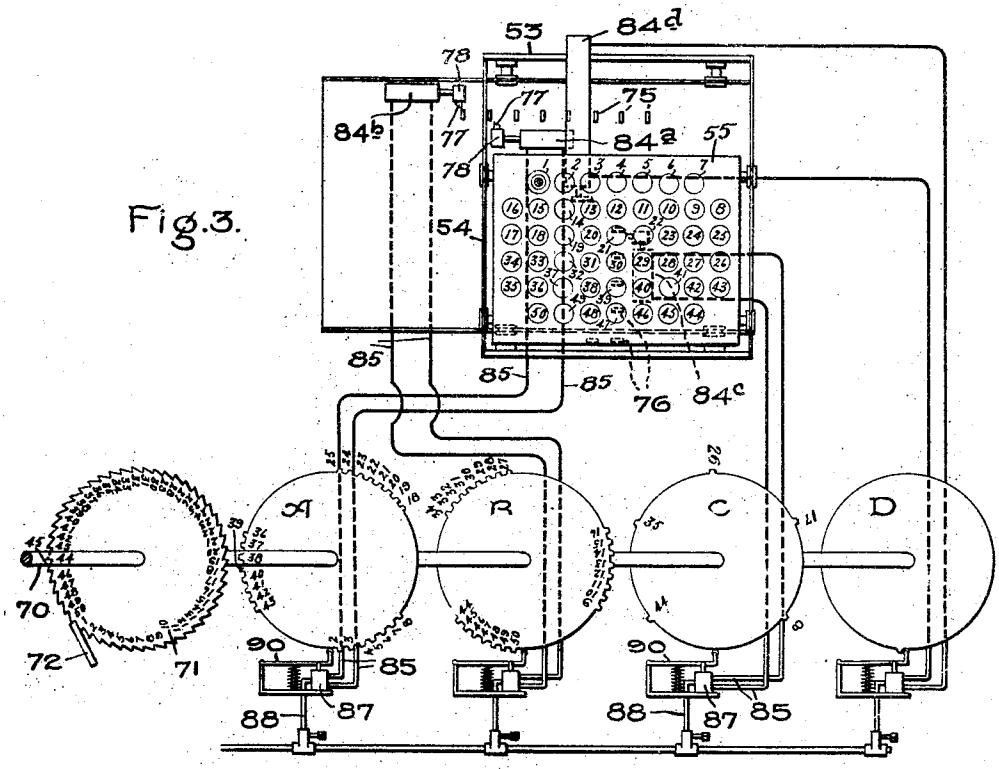


Fig.10.

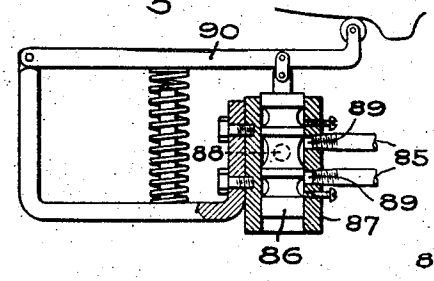


Fig.4.

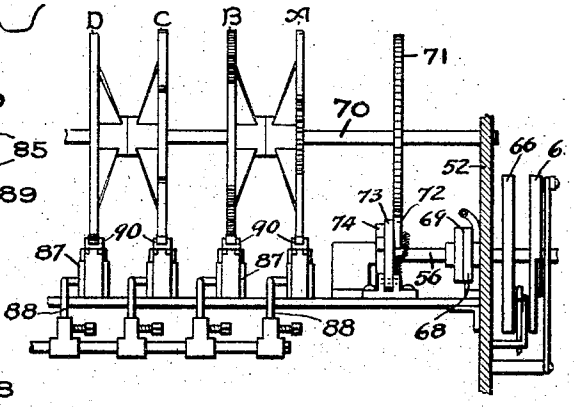


Fig.7.

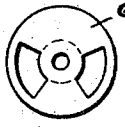
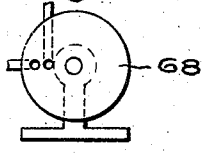


Fig.6.



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MACHINE FOR HANDLING INCANDESCENT LAMP BULBS.

APPLICATION FILED SEPT. 10, 1908.

1,045,943. Patented Dec. 3, 1912.

5 SHEETS—SHEET 4.

Fig. 16.

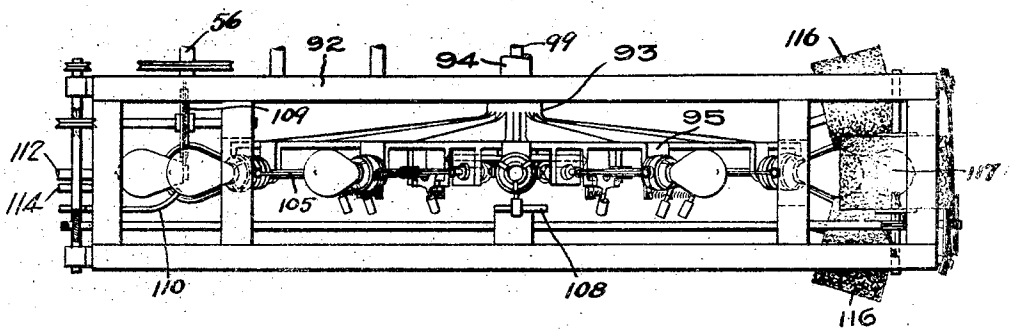
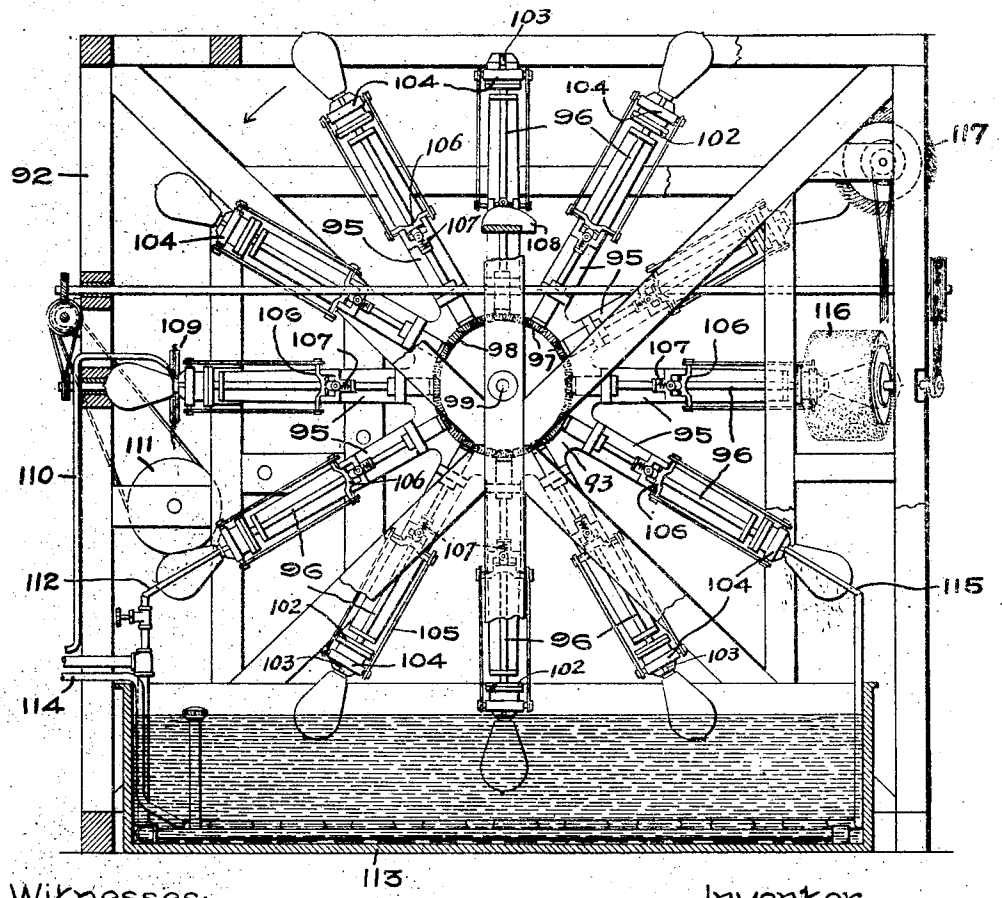


Fig. 17.



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APPLICATION FILED SEPT. 10, 1908.

1,045,943.

Patented Dec. 3, 1912.

6 SHEETS—SHEET 5.

Fig. 21.

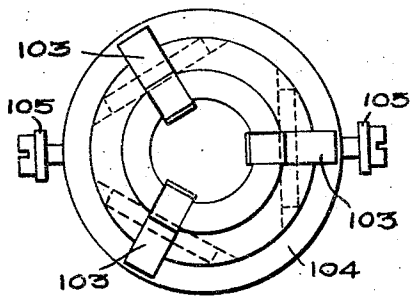
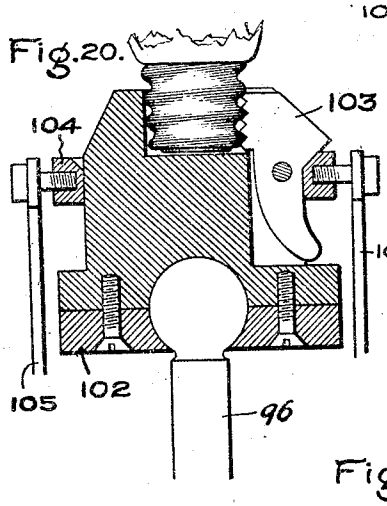


Fig. 20.



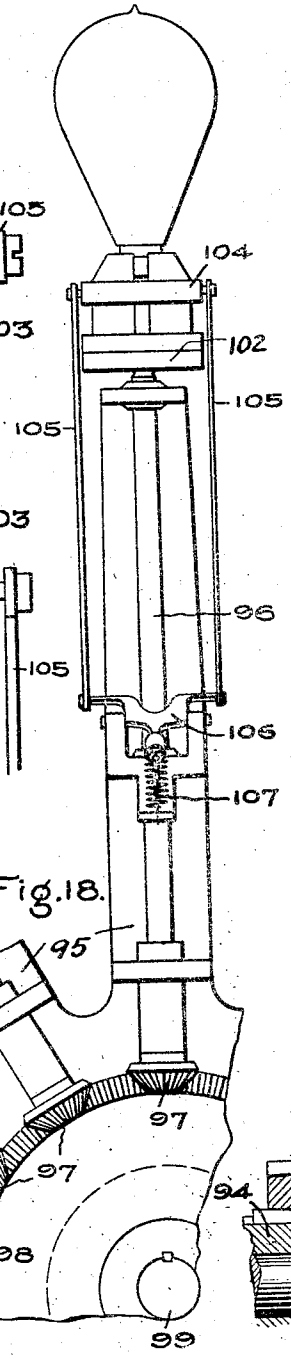
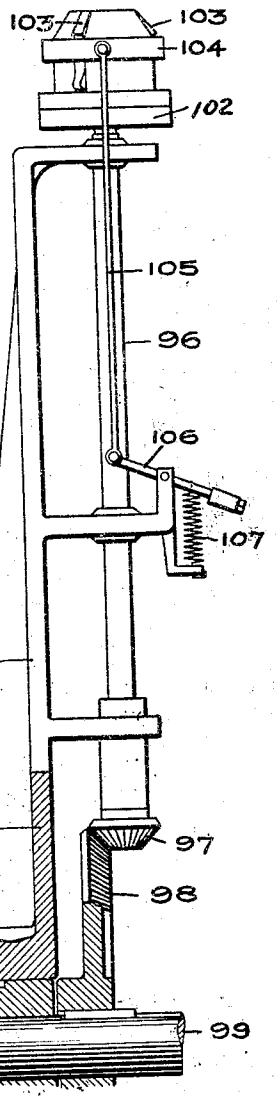


Fig. 18.

Fig. 19.



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William R. Burrows

by Albert G. Davis Atty.

UNITED STATES PATENT OFFICE.

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MACHINE FOR HANDLING INCANDESCENT-LAMP BULBS.

1,045,943. Specification of Letters Patent. Patented Dec. 3, 1912.

Application filed September 10, 1908. Serial No. 452,453.

To all whom it may concern:

Be it known that I, WILLIAM R. BURROWS, a citizen of the United States, residing at Newark, county of Essex, State of New Jersey, have invented certain new and useful Improvements in Machines for Handling Incandescent-Lamp Bulbs, of which the following is a specification.

My invention relates to machinery for handling glass articles, such as the bulbs of incandescent lamps and more particularly to machinery which will automatically take the bulbs from a tray or holder in a predetermined order, subject them to any desired treatment, such as washing, and replace the treated bulbs in the tray or holder.

The customary device for handling incandescent lamp bulbs during manufacture of the lamps and for storing the completed lamps is a rectangular tray or holder arranged to hold the bulbs in six parallel rows extending longitudinally of the tray, there being at each end of the tray a row of seven bulbs, and between the side rows four rows each containing nine bulbs. At various stages of the manufacture of the lamp the bulbs are subjected to treatment, such as the washing of the completed lamp, which requires the operator to take the bulbs from the tray and then replace them in the tray, an operation which requires considerable time and subjects the bulbs to the risk of breakage.

One object of my invention is to provide an automatic bulb-handling machine which will take the bulbs from the tray one after another in any desired order and place them where required, and which will, if desired, again pick up the bulbs and replace them in the tray; a further object being to provide a lamp-washing machine in which the soiled lamps are automatically taken from the tray in any desired order, placed in the washing machine and washed, and the clean lamps replaced in the tray without any attention on the part of the operator, who merely places the trays of soiled lamps in the machine and removes the trays of clean lamps after the machine has washed them and replaced them in the tray.

In carrying out my invention a movable bulb or tray holder holds the bulbs in definite relation to each other, preferably by holding the tray on which the lamps are disposed in parallel rows in such a manner that the tray moves with the tray holder. Some suitable form of transfer or gripping mechanism is mounted adjacent the movable holder and is arranged to pick up the bulbs from the holder and to place them where desired. In order to enable the transfer mechanism to pick up the bulbs in any desired order, the tray holder and the transfer or gripping mechanism is mounted adjacent the movable holder and is arranged to pick up the bulbs from the holder and to place them where desired. In order to enable the transfer mechanism to pick up the bulbs in any desired order, the tray holder and the transfer mechanism are movable relatively to each other and are interconnected in such a manner that after the transfer mechanism has been operated to pick up one bulb and to place it where desired, the relative movement of the holder and of the transfer mechanism brings another bulb within range of the transfer mechanism, which picks it up when the mechanism is again actuated. In the preferred construction, the tray holder is movably mounted and an actuating mechanism driven in definite relation to the transfer mechanism is arranged to shift the holder back and forth with relation to the transfer mechanism so as to bring the bulbs into operative relation to the transfer mechanism in any desired order. Since the trays are rectangular and have the bulbs arranged on them in parallel rows, the tray holder is preferably moved longitudinally of one row step by step to enable the transfer mechanism to pick up the bulbs in that row one after another, after which the holder is moved at right angles to the rows to bring the transfer mechanism into operative relation to the second row of bulbs, whereupon the holder is moved back along the second row of bulbs to enable the transfer mechanism to pick up the bulbs in the second row in succession. It is desirable but not necessary that the transfer mechanism begin at the same point on each tray, and, therefore, the actuating mechanism is arranged to automatically move the tray-holder back to a definite starting position after all the bulbs in the tray have been picked up by the transfer mechanism, whereby the bulbs in each tray placed in the machine will be picked up in the same order as those in the last tray.

My invention may be embodied in a ma-

chine for washing the bulbs of the finished lamps by mounting any suitable form of washing device adjacent the handling mechanism above described in such a position that the transfer mechanism takes a bulb from the tray and places it in the washing device. The preferred form of washing machine comprises a movable holder driven in definite relation to the transfer mechanism and tray-holder above described, and arranged to carry the soiled bulb through the various steps of the washing process. The soiled bulb is automatically placed in the movable holder by the transfer mechanism, which is arranged to interchange bulbs between the tray and the washing device, the soiled bulb from the tray being replaced by a clean bulb taken from the washing device by the transfer mechanism and placed on the tray. The movable holder of the washing device comprises some suitable clamp or gripping device which is automatically operated to receive the soiled bulb from the transfer mechanism, to hold the bulb firmly during the various operations to which the bulb is subjected, and finally to release the clean bulb as it is picked up by the transfer mechanism to be replaced in the tray.

My invention will be best understood in connection with the accompanying drawings which illustrate one of the various forms in which it may be embodied and in which—

Figure 1 is a plan view of a washing machine for lamp bulbs embodying my invention; Fig. 2 a side view in elevation of the transfer mechanism and the movable holder for carrying the tray of lamps; Fig. 3 a diagrammatic view showing the movable holder for the tray and the actuating mechanism for shifting the tray; Fig. 4 a view showing in elevation the cam shaft and the controlling valves for shifting the tray in the proper direction at the proper time; Fig. 5 a sectional view on the line 5—5 of Fig. 1 showing the pawl and ratchet mechanism for imparting an intermittent motion to the counter-shaft of the actuating mechanism for the tray holder; Fig. 6 a view of the valve seat and Fig. 7 a view of the coöperating valve which controls the bulb gripping device on the transfer mechanism; Figs. 8 and 9 plan views of the face cams which operate the transfer mechanism; Fig. 10 a view partly in section of a control valve forming a part of the actuating mechanism for the tray holder; Fig. 11 a plan view, with the cylinder in section, of a fluid pressure actuating device for moving the tray holder; Fig. 12 a side view in elevation of the mechanism shown in Fig. 11; Fig. 13 an enlarged side view of the ratchet mechanism forming part of the device shown in Fig. 11; Fig. 14 a view partly in section showing the movable member and spring-pressed pawl which forms part of the mechanism shown in Fig. 11; Fig. 15 a view in elevation showing the intermittent gearing for rotating the movable member of the washing device; Fig. 16 a top plan view of the washing device; Fig. 17 a side view of the washing device with the tank shown in section; Fig. 18 a plan view of a portion of the spider of the washing device, showing the bulb holder with a bulb in position; Fig. 19 a view at right angles to Fig. 18; Fig. 20 a sectional view of the clamping means for holding the bulb in the washing device; and Fig. 21 a plan view of the clamping device shown in Fig. 20.

In this specification reference numerals 1 to 50, inclusive, are used in pointing out the order in which the lamps are taken from the tray, hence the numerals referring to the structure of the machine begin with 51.

In the specific form of machine shown in the drawings the bulbs are automatically picked up from the tray, and after being washed are replaced in the tray by a bulb-handling device comprising a rectangular frame 51 having the upper surface provided with parallel guides or rails 52 on which a tray-shifting mechanism of any suitable kind travels. The form of mechanism shown in the drawings comprises a framework 53, which travels back and forth on the rails 52 on rollers or other suitable anti-friction devices. The framework 53 is provided with guides or rails 54 set at right angles to the guides on the frame 51, and a tray holder or frame 55 constructed to firmly hold a tray of lamp bulbs is mounted to travel back and forth on the guides 54 at right angles to the movement of the framework 53. The tray of lamps is set in the tray holder 55 with the rows of lamps parallel to the guides 52 and is moved both longitudinally and transversely of those rows by any suitable actuating mechanism driven from a driving shaft 56 journaled in the frame 51.

The lamps are automatically lifted from the tray in the tray holder and placed wherever required by any suitable form of transfer mechanism controlled by the driving shaft 56, so as to act in definite relation to the actuating mechanism for the tray holder. The transfer mechanism is preferably of the form shown in the drawings, in which the transfer mechanism is composed of a transfer member composed of a tube having a vertical portion 57 mounted beside the tray holder and a right angle bend in it. A horizontal portion 58, arranged to extend over the tray holder, is provided with any suitable bulb-gripping device, such as a vacuum cup 59, mounted on the end of the horizontal portion 58. The gripping device is actuated in any suitable way to grip and to release a bulb at certain times during the

movement of the transfer mechanism. Where the vacuum cup 59 is used as a gripping device it is connected through the transfer member to a vacuum pump and the connections are automatically controlled, so that when the cup is brought into engagement with the bulb the interior of the cup is connected to the vacuum pump and the suction is sufficiently great to enable the cup to lift the bulb out of the rack and to hold it as long as the vacuum is maintained. As best shown in Fig. 2, the vertical portion 57 of the transfer member is mounted on the frame 51 in guides 60, which permit the transfer member to rotate about the axes of the vertical portion 57 and also to slide longitudinally in the guides. The transfer member is rotated about its axis by means of a pinion 61 splined to the portion 57 of the transfer member and meshing with a rack 62, which is moved backward and forward by a face cam 63 mounted on the driving shaft 56, while it is raised and lowered by means of a collar 64 engaged by a fork on one end of a pivoted lever 65, which has at the other end a roller arranged to follow the groove in face cam 66, also mounted on the driving shaft 56. The gripping of the bulbs by the vacuum cup 59 when the cup has been lowered into engagement with the bulbs and the release of the bulbs after they have been moved to the desired point by the transfer mechanism is controlled from the driving shaft 56 by any suitable connections, preferably a flexible tube 67 connected to the transfer member and put in communication with a vacuum pump by a valve actuated by the driving shaft 56. The preferred form of control valve, as shown in the drawings, comprises a valve seat 68, shown in Fig. 6, which has two adjacent ports, one connected to the flexible tube 67 and the other to a vacuum pump, and a flat coöperating rotary valve 69, shown in Fig. 7, mounted on the driving shaft 56 and having bridging ports cut in it to connect the two ports in the stationary valve seat in certain positions of the valve. The cams 63 and 66 are so timed with relation to each other and to the valve 69 that when the transfer member is moved longitudinally of its axis of rotation to bring the vacuum cup 59 into engagement with a bulb in the tray on the tray holder the valve 69 connects the cup to the vacuum pump and maintains this connection while the cam 63 raises the transfer member, thereby lifting the bulb out of the tray and also while the cam 66 rotates the transfer member about its axis, thereby swinging the vacuum cup in a half circle and bringing the bulb to the place where it is to be deposited, whereupon the valve 69 closes the passage between the vacuum cup and the vacuum pump and causes the cup to release the bulb.

In order that the gripping device or vacuum cup of the transfer mechanism may pick the bulbs from the tray in a definite and predetermined order, there must be produced after each bulb is lifted from the tray a relative movement between the transfer mechanism and the tray holder of the proper direction and extent to bring the vacuum cup 59 into alinement with the next succeeding bulb which is to be picked up. In the machine illustrated the transfer mechanism does not change position on the frame, and the tray holder is moved by an actuating mechanism which moves the framework 53, and, therefore, the tray holder longitudinally of each row of bulbs in steps corresponding in length to the distance between adjacent bulbs, thereby bringing the bulbs in any one row within range of the transfer mechanism and in alinement with the vacuum cup 59 one after another, while after the bulbs in one row have been picked up the tray holder 55 is shifted transversely of the rows of bulbs a distance equal to the distance between adjacent rows, thereby bringing the end bulb of the adjacent row within range of the vacuum cup. Since the bulb tray is rectangular and the bulbs are arranged on it in parallel rows, all the bulbs can be brought within range of the vacuum cup by the movement of the tray in two directions at right angles to each other. Any suitable form of actuating mechanism for the tray holder may be used as long as it moves the tray in the proper manner and in the correct time relation to the transfer mechanism. The specific form of actuating mechanism shown in the drawing comprises shifting mechanism for moving the framework 53 longitudinally of the rows of lamps and traversing mechanism for moving the tray holder 55 transversely of said rows. The shifting and traversing mechanisms are timed by a control shaft 70, which determines the different movements of the tray holder, and is in turn actuated in definite relation to the transfer mechanism and to the driving shaft 56 by means of an intermittent gearing which imparts to the control shaft a step-by-step movement, the number of steps in the arrangement shown in the drawing corresponding to the number of bulbs in the tray. The preferred form of intermittent gearing for imparting the step-by-step movement to the control shaft, as shown in Fig. 5, comprises a fifty-tooth ratchet wheel 71 turned one tooth at a time at each revolution of the driving shaft 56 by means of a spring-pressed pawl 72 mounted on a swinging arm 73, which in turn is actuated by a cam 74 on the driving shaft 56.

The shifting mechanism for moving the framework 53 along the frame 51 and thereby shifting the tray longitudinally of the rows of lamps is controlled by shifting cams

A and B mounted on the control shaft 70, while the traversing mechanism for moving the tray holder 55 and the tray transversely of the rows of lamps is controlled by traversing cams C and D. As best shown in Fig. 3, each of the shifting cams A and B has three groups of projections on its periphery, and the mechanism is so arranged that each projection on either of the shifting cams will cause the shifting mechanism to move the framework 53 one step longitudinally of the rows of lamps. The traversing cam C has five projections, each of which causes the traversing mechanism to move the tray holder transversely of the rows of lamps in one direction by a series of steps, each of which is equal to the distance between adjacent rows, while the traversing cam D has a single projection which causes the traversing mechanism to move the tray holder in the other direction by one step equal to the distance between the two outer rows, thereby bringing the tray holder back to its initial position. In Fig. 3 all the projections on the shifting and the traversing cams are numbered from one to fifty, inclusive, and the lamps on the tray are correspondingly numbered to indicate that each projection causes the actuating mechanism to bring into alinement with the transfer mechanism the lamp which has the same number as the projection. In Fig. 3, the tray is shown in the starting position, and after lamp No. 1 is removed by the transfer mechanism, the projection 2 on the shifting cam A causes the shifting mechanism to move the framework 53 one step to the left thereby bringing lamp No. 2 within range of the transfer mechanism. This action is repeated as the control shaft 70 rotates thereby bringing the lamps Nos. 1 to 7 within range of the transfer mechanism in succession until the end of the first row is reached, at which time the projection 8 on shifting cam A causes a longitudinal movement of the framework 53 while at the same time projection 8 on traversing cam C causes the tray holder 53 to move one step transversely of the row of lamps, the net result of the two movements being to bring lamp No. 8 within range of the transfer mechanism. After the transfer mechanism has picked up lamp No. 8 the control shaft 70 causes the projection 9 on shifting cam B to actuate the shifting mechanism and thereby move the framework 53 one step to the right to bring lamp No. 9 within range of the transfer mechanism. When the end of the second row is reached and after lamp No. 16 has been picked up, the projection 17 on the traversing cam C causes the tray holder to be moved another step thereby bringing lamp No. 17 within range of the transfer mechanism. These operations are repeated in the proper sequence to enable the transfer mechanism to pick up the lamps in the order in which they are numbered, the framework 53 being moved step by step backward and forward along the guides 52, and the tray holder being moved step by step in one direction along the guides 54 until finally the lamp No. 50 is picked up by the transfer mechanism, whereupon the projection 1 on the traversing cam D causes the tray holder 55 to move back to its initial position bringing the lamp No. 1 within range of the transfer mechanism.

The step by step movement may be imparted to the framework 53 and to the tray holder 55 by any form of mechanism which will cause a movement of one step when actuated by one of its projections on either the shifting or the control cams. In the mechanism shown in the drawings for giving a step by step movement the framework 53 and the tray holder 55 are provided with a row of lugs or bars 75 and 76, the lugs 75 on the framework 53 being equal to the maximum number of lamps in a row on the tray and the distance between lugs being equal to the distance between the lamps in a row, while the number of lugs 76 on the tray holder 55 is equal to the number of rows of lamps on the tray, and the distance between the lugs is equal to the distance between adjacent rows or lamps. The lugs on the framework and on the tray holder are engaged one after another by any suitable mechanism which will move both the framework and the tray holder by steps equal to the distance between lugs. The mechanism shown in the drawings for coöperating with the lugs to produce a step by step movement comprises spring-pressed pawls 77 mounted on sliding members 78 which slide in guides in such a relation to the two series of lugs 75 and 76 that each spring-pressed pawl is normally in a position to catch behind a lug and thereby move either the framework or the tray holder. Each spring pressed pawl 77 is so shaped that it slides over the lugs without effect when moved in one direction and engages the lug when moved in the other direction. In order to prevent movement of the framework or the tray holder in the wrong direction, locking pawls 79 are pivotally mounted on standards adjacent each sliding member 78 and are arranged to engage with the lugs and thereby prevent movement of the framework or tray holder in the wrong direction. The locking pawl 79 normally tends to drop into inoperative position and is lifted into engagement with the lugs with which it coöperates by a pin 81 mounted on the sliding member 78 in a position to engage and lift the locking pawl 79 so that during the movement of the sliding member 78 in the wrong direction the locking pawl is in engagement with one of the lugs. Since both the framework 53

and the tray holder 55 are required to move backward and forward in opposite directions, two sliding members 78 with oppositely disposed spring-pressed pawls 77 are required for the framework and also for the tray holder, and in order to prevent one of the spring-pressed pawls from interfering with the operation of the other and locking the framework or tray holder immovable, each pawl 77 is provided with a locking pin 82 extending through the sliding member 78 to a point where the end of the locking pin is engaged by a retaining recess 83 cut in the side of the standard 80. The parts are so proportioned that as long as the sliding member 78 is drawn back to its extreme position as shown in Fig. 11, the locking pawl 79 is inoperative and the locking pin 82 is in the retaining recess 83, thereby holding the spring-pressed pawl 77 out of engagement with the lugs, although a slight movement of the sliding member away from its extreme position will carry the locking pin out of the retaining recess and permit the spring pressed pawl 77 to spring into engagement with one of the lugs.

Any suitable mechanism may be used to reciprocate the sliding members 78 at the proper time and in proper relation to each other, but in the preferred form of mechanism each sliding member is connected to the piston rod of a fluid pressure actuating device comprising a piston working in double-acting cylinders 84^a, 84^b, 84^c and 84^d with feed pipes 85 connected to each end of each cylinder to admit and exhaust fluid under pressure and thereby move the piston and sliding member 78 backward and forward. The feed pipes 85 of each cylinder are controlled by a suitable regulating device, such as the piston valve 86, which, as shown in Fig. 10 is mounted in a casing 87 provided with an inlet port 88 shown in dotted lines and with two outlet ports 89 between which are two ports for the feed pipes 85. The valve 86 is actuated from the cams on the control shaft 70 by means of a pivoted spring-pressed follower 90 having a roller on one end which is held against the cam by a spring. As is evident from Fig. 10, the grooves in the piston valve are so cut that when the valve is in the normal position, as shown in that figure, the upper feed pipe 85 is receiving from the inlet port 88 fluid under pressure which holds the sliding member in extreme position, while the lower feed pipe is connected to the lower outlet or exhaust port 89. These connections are reversed by a downward movement of the piston valve, which connects the lower feed pipe 85 to the inlet port 88 and permits the upper feed pipe 85 to discharge through the upper groove in the piston valve into the upper outlet or exhaust port 89. Each projection on the cams on the control shaft 70 causes a downward and upward movement of the piston valve 86 controlled by the cam, which results in a forward and backward movement of the piston in the cylinder corresponding to that valve and thereby causing one complete reciprocation of the sliding member 78 connected to that piston. As best shown in Fig. 3 the shifting mechanism for moving the framework 53 comprises two oppositely disposed cylinders 84^a and 84^b controlled respectively by the shifting cams A and B and operated alternately to move the framework 53 step by step, the cylinder 84^a moving the frame work to the left, and the cylinder 84^b moving the framework to the right. The traversing mechanism for moving the tray holder comprises a cylinder 84^c, which coöperates with the lugs 76 on the tray holder to move the tray holder step by step along the guides 54, each projection on the cam C causing the tray holder to move one step, and also a long cylinder 84^d, which has a stroke sufficient to move the tray holder from one outside row of lamps to the other and is controlled by the projection 1 of the traversing cam D to return the tray holder to its initial position by a single movement.

The various parts of the handling mechanism above described are so proportioned that when a tray of lamps is placed in the tray holder in the position shown in Fig. 3, the transfer mechanism is operated during one revolution of the driving shaft 56 to pick up lamp No. 1, move it to the desired position and there leave it, the control shaft 70 at the same time being rotated one step by the ratchet wheel 71 and the pawl 72.

After lamp No. 1 has been picked up and before the transfer mechanism returns to its initial position, the projection 2 on shifting cam A actuates the valve 86 governing cylinder 84^a, thereby moving the sliding member 78 corresponding to that cylinder, and causing the spring-pressed pawl 77 to engage one of the lugs 75 on the framework 53 and thereby move the framework 53 to the left a sufficient distance to bring lamp No. 2 within range of the transfer mechanism. The next revolution of the driving shaft 56 causes the transfer mechanism to pick up lamp No. 2 and the control shaft 70 to rotate one step, thereby bringing the projection 3 into position to operate the valve 86 and move the framework 53 another step. When the end of the first row is reached, projection 8 on shifting cam A again causes cylinder 84^a to move the framework while at the same time projection 8 of the traversing cam C causes cylinder 84^c to move the tray holder one step transversely of the rows of lamps, thereby bringing lamp No. 8 within range of the transfer mechanism. After lamp No. 8 is picked up, projection 9 on the shifting cam B causes the cylinder

84[b] to move the framework one step to the right to bring lamp No. 9 within range of the transfer mechanism. This movement continues and causes the lamps to be picked up in the sequence in which they are numbered in Fig. 3 until finally lamp No. 50 is reached, whereupon projection 1 on the traversing cam D causes the long stroke cylinder 84[d] to move the tray holder 55 back to its initial position in one movement, thereby again bringing the tray back to its initial position where lamp No. 1 is within range of the transfer mechanism.

The handling mechanism above described may be used to pick up lamps from a tray and to deliver them wherever desired since the movement of the transfer mechanism and the time of release of the lamp by the vacuum cup 59 may be controlled by varying the shape of the groove in the face cams 63 and 66 and the arrangement of the ports in the valve 69. The order in which the lamps are picked up from the tray may also be changed by varying the relative positions of the projections of the cams carried by the control shaft 70. It is also desirable that the machine may be set to begin work on any desired lamp or the tray may be shifted quickly to save time when the tray does not contain as many as fifty lamps. This result is easily accomplished by providing the control shaft with an adjusting handle 91, as shown in Fig. 1, by means of which the control shaft 70 may be turned by hand to any desired position independently of the driving shaft, on account of the pawl 72 and ratchet 71, and thereby the machine is caused to pick up any lamp desired.

While the handling mechanism may be used for various purposes it is shown in the drawings as a part of a washing machine for automatically washing the completed incandescent lamps in which the handling device automatically delivers the lamps to any suitable form of washing device. One form of washing device which is suitable for this purpose is shown in the drawings and comprises a frame 92 in which a spider 93 having a plurality of arms is rotatably mounted on a hollow shaft 94 as shown in Fig. 19. In the specific form of machine shown in the drawings, the spider is provided with twelve arms 95 radially disposed about a hub, and each carries, as shown in Figs. 18 and 19, a rotatable shaft 96, on the lower end of which is a beveled gear 97 in mesh with a beveled gear 98 mounted on the shaft 99 which extends through the hollow shaft 94 and is continually rotated at any desired speed by means of a pulley belted to the driving shaft 56. The spider 93 is intermittently rotated from the driving shaft 56 through an intermittent gear 100 connected to the hollow shaft 94 through spur gears 101. The spider has a step by step movement about its axis while the rotatable shafts 96 are continually rotating regardless of the position or movement of the spider.

The spider 93 carries the lamps through the various steps of the washing process by means of any suitable form of bulb holder mounted on the end of each arm of the spider in a position to receive a bulb which has been taken from the tray by the transfer mechanism. One desirable form of bulb holder or clamp comprises a clamping member 102 mounted on the end of the rotatable shaft 96 and provided with a plurality of clamping jaws 103 which are pivoted on the clamping member as shown in Fig. 20 and are moved into and out of clamping position by means of a control ring 104 which cooperates with inclined surfaces on the clamping jaws and is moved longitudinally of the rotatable shaft 96 by any suitable clamp controlling mechanism.

The bulb holder or clamp is automatically opened to receive a bulb, then grips the bulb, and after carrying the bulb through the washing process is automatically opened by any suitable automatic controlling mechanism to release the clean bulb. A simple and reliable device for controlling the clamp comprises rods 105 connected at one end to the controlling ring 104 and at the other end to a pivoted clamp actuator 106 mounted on each arm 95 of the spider and normally held by a spring 107 in a position to close the clamp so that the bulb is yieldingly held between the clamping jaws. The clamp actuator is provided with a roller on the end and is moved at the proper time by a stationary cam 108 which is placed, as shown in Fig. 17, in such a position that the holder which is within range of the transfer mechanism is held open while the transfer mechanism removes a clean bulb from it and places a soiled bulb in it. As the spider moves, the stationary cam releases the clamp actuator and the bulb, firmly gripped in the clamp continuously rotates and intermittently revolves about the shaft of the spider during the washing process.

The bulb in the holder may be washed by various mechanisms, one satisfactory form being that shown in the drawings in which the movement of the spider brings the bulb into operative relation to a burnishing wheel 109 which burnishes the base of the bulb. Any suitable fluid is delivered on the base of the bulb by a supply pipe 110, and the burnishing wheel is driven from the pulley 111 which in turn is continuously driven by suitable gearing from the driving shaft 56. The bulb is then carried into the next position where steam or hot water is thrown over the bulb from the steam pipe 112. The bulb is then carried into a tank 113 in which the water is maintained at the proper temperature by means of a steam pipe 114. After

passing through the tank, the bulb is rinsed by water delivered from a rinsing pipe 115 and is then carried to the drying rollers 116 which dry the sides of the bulb and also to a drying roller 117 which dries the tip of the bulb. As the thoroughly cleaned bulb returns to its initial position the clamp actuator engages the stationary cam, the clamp is released and the transfer mechanism removes the bulb from the bulb holder.

Since in washing lamps it is desirable to replace the clean lamps in the tray so they may be conveniently stored the mechanism is arranged to interchange lamps between the tray and the washing device. The cams and valve of the transfer mechanism are so set and proportioned that the transfer mechanism picks up a soiled bulb from the tray, swings into alinement with one of the bulb holders on the washing device and places the bulb in the holder. The spider is then rotated one step to bring a clean bulb on the next holder within range of the transfer mechanism, which thereupon picks up the clean bulb, swings back and places it in the tray in the place of the soiled bulb while the spider remains stationary. The tray is then moved one step, the transfer mechanism picks up the next soiled bulb, swings back and places the soiled bulb in the holder formerly occupied by the clean bulb. As a result of these operations the lamps are interchanged between the tray and the washing device, and after being washed are replaced in the tray. The operator need only place a tray of soiled lamps in the tray holder and remove the tray when it has been filled with clean lamps. If the operator neglects to remove the tray, the lamps are washed over and over again until the tray is either removed or the machine is stopped.

What I claim as new and desire to secure by Letters Patent of the United States, is,

1. In a machine for treating lamp bulbs, the combination with two carriers for bulbs, of a transfer member provided with gripping means, said member and said carriers being relatively movable to render said gripping means operative to pick up a bulb from either of said carriers and to deliver it to the other carrier, and common driving means for moving said carriers and said member relatively to one another and actuating said gripping means to cause said gripping means to pick up the bulbs first from one carrier and then from the other carrier.

2. In a machine for treating lamp bulbs, the combination with two movable holders for the bulbs, and driving means arranged to intermittently move said holders and to maintain them stationary in definite relation to each other, of a transfer mechanism for alternately picking up a bulb from one holder and placing it in the other when actuated, and means controlled by said driving means for actuating said transfer mechanism while said holders are stationary.

3. In a machine for treating lamp bulbs, the combination with two carriers for the bulbs, of a transfer mechanism comprising a gripping device mounted to pick up the bulb from either of said carriers and to deliver said bulb to the other carrier, driving means for moving said carriers and said transfer mechanism relatively to one another to cause said gripping device to automatically pick up from the first carrier and deliver to the second carrier a predetermined number of bulbs and then to automatically bring said gripping device into gripping relation to the bulbs in said second carrier to cause said mechanism to pick up from said second carrier and deliver to said first carrier a predetermined number of bulbs.

4. In a machine for treating lamp bulbs, the combination with two movable carriers for the bulbs and common driving means for moving said carriers in definite relation to each other, of a transfer arm mounted between said carriers to rotate and to slide along its axis of rotation, a bulb gripping device mounted on said arm to engage the bulbs in either of said carriers, means controlled by said driving means for rotating and sliding said arm to bring said gripping device first into gripping relation to the bulbs in one carrier and then into gripping relation to the bulbs in the other carrier, and means actuated by said driving means for causing said gripping device to first pick up the bulb from one carrier and deliver it to the other, and then pick up the bulb from said second carrier and deliver it to the first carrier.

5. In a machine for handling lamp bulbs, the combination with two movable carriers for the bulbs, of a transfer mechanism comprising a gripping device mounted to move into gripping relation to the bulbs in either carrier and means for moving said gripping device into gripping relation first to one carrier and then to the other to alternately transfer bulbs from the first carrier to the second and from the second carrier to the first, and a common driving means connected to said carriers and to said mechanism to maintain said carriers in definite relation to each other during movement of said mechanism and to shift said carriers alternately after each movement of said mechanism.

6. In a machine for handling lamp bulbs, the combination with two movable carriers for the bulbs, of a transfer mechanism comprising a gripping device movably mounted to pick up bulbs from either carrier and means for moving said device to pick up a bulb from one carrier and then from the other, of common driving means for said carriers and said mechanism connected to

actuate said mechanism to transfer a bulb from the first carrier to the second, then hold said mechanism inoperative and move said carriers relatively to each other, and then again actuate said mechanism to transfer a bulb from the second carrier to the first.

7. In a machine for washing lamp bulbs, the combination with two relatively movable holders for the bulbs, and driving means for moving said holders step by step in definite relation to each other, of a transfer mechanism constructed to pick up a bulb from the first holder and deliver it to the second and to pick up a bulb from the second holder and deliver it to the first, and connections between said transfer mechanism and said driving means for causing said mechanism to pick up a bulb from the first holder and transfer it to the second holder and then pick up a bulb from the second holder and transfer it to the first holder.

8. In a device for handling lamp bulbs, the combination with two movable bulb carriers, and driving means for alternately moving said carriers, of a transfer mechanism having a gripping device mounted to pick up a bulb from either of said carriers and deliver it to the other, and connections between said driving means and said mechanism for actuating said mechanism in response to movement of either of said carriers to cause said gripping device to pick up a bulb from the carrier which was moved and to deliver it to the other carrier which remained stationary.

9. In a machine for handling lamp bulbs, the combination with a holder arranged to hold the bulbs in parallel rows in predetermined order, of a transfer mechanism for handling bulbs brought within range of said mechanism, driving means for actuating said transfer mechanism, and actuating means controlled by said driving means to move said holder and said transfer mechanism relatively to each other to bring the bulbs within range of said mechanism in a predetermined order.

10. In a machine for handling lamp bulbs, the combination with a holder arranged to hold the bulbs in parallel rows in predetermined order, of a transfer mechanism for handling bulbs brought within range of said mechanism, driving means for actuating said transfer mechanism, actuating means controlled by said driving means to move said holder and said transfer mechanism relatively to each other to bring the bulbs within range of said mechanism in a predetermined order, and a manually-controlled device for controlling said actuating means independently of said driving means.

11. In a machine for handling lamp bulbs, the combination with a holder arranged to hold the bulbs in parallel rows in predetermined order, of a transfer mechanism for handling bulbs brought within range of said mechanism, driving means for actuating said transfer mechanism, and actuating means for said holder controlled by said driving means to move said holder in two directions at right angles to each other to bring the bulbs within range of said transfer mechanism in predetermined succession.

12. In a machine for handling lamp bulbs, the combination with a holder arranged to hold the bulbs in rows, of a transfer mechanism arranged to handle the bulbs brought within range of said mechanism, driving means for actuating said transfer mechanism, and actuating means controlled by said driving means to move said holder and said transfer mechanism relatively to each other to bring the bulbs in each row within range of said transfer mechanism in succession.

13. In a machine for treating lamp bulbs, the combination with a movable holder arranged to hold the bulbs in parallel rows, of a transfer mechanism arranged to remove a bulb from the holder when actuated, shifting means for moving said holder to bring said transfer mechanism into operative relation with bulbs in each row in succession, and traversing means for shifting said holder to bring said transfer mechanism into operative relation to the adjacent row of bulbs.

14. In a machine for handling lamp bulbs, the combination with a movable holder for holding the bulbs in parallel rows, of a transfer mechanism arranged to handle each bulb within the range of said mechanism, driving means for actuating said transfer mechanism, and actuating means for said holder comprising traversing means for moving said holder transversely to bring in succession rows of bulbs into alinement with said transfer mechanism, and shifting means arranged to intermittently move said holder longitudinally of each row in steps corresponding in number to the bulbs in said row to bring the bulbs within range of said transfer mechanism in succession.

15. In a machine for handling lamp bulbs, the combination with a movable holder arranged to hold the bulbs in parallel rows, of a transfer mechanism arranged to handle each bulb brought within range of said mechanism, driving means for actuating said transfer mechanism, and actuating means controlled by said driving means to shift said holder longitudinally of said rows in steps of requisite length and number to bring the bulbs within range of said transfer mechanism in succession and transversely of said rows equal to the distance between the rows whereby the bulbs in adjacent rows are handled in succession.

16. In a machine for handling lamp bulbs, the combination with a holder arranged to hold the bulbs in rows and mounted to move

both transversely and longitudinally of said rows, of traversing means for moving said holder transversely of said rows, shifting means for moving said holder longitudinally of said rows, and a controller arranged to operate said traversing means and said shifting means in definite relation to each other.

17. In a machine for handling lamp bulbs, the combination with a holder arranged to hold the bulbs in rows and mounted to move both transversely and longitudinally of said rows, of traversing means arranged to move said holder transversely of said rows in steps equal to the distance between said rows, shifting means arranged to move said holder longitudinally of said rows in steps corresponding with the distance between the bulbs in said rows, and a controller arranged to operate said traversing means to shift said holder one step and subsequently operate said shifting means to move said holder by steps corresponding in number to the number of articles in one of said rows.

18. In a machine for handling lamp bulbs, the combination with a holder arranged to hold the bulbs in rows and mounted to move both transversely and longitudinally of said rows, of traversing means for moving said holder transversely of said rows, shifting means for moving said holder longitudinally of said rows, and a controller arranged to operate said traversing means and shifting means to alternately move said holder the distance between rows and the length of one row.

19. In a machine for handling lamp bulbs, the combination with a holder arranged to hold the bulbs in rows and mounted to move both transversely and longitudinally of said rows, of two shifting devices arranged to move said holder step by step in opposite directions longitudinally of said rows, a traversing device for moving said holder transversely of said rows, a cam shaft provided with two shifting cams, each having groups of projections to control said shifting devices alternately, a traversing cam having a plurality of projections for controlling said traversing device, said cams being set to render each projection on said traversing cam operative in sequence to the alternate groups of projections on said two shifting cams, and means for intermittently driving said cam shaft by steps equal to the distance between the projections on said shifting cams.

20. In a machine for handling lamp bulbs, the combination with a holder mounted to move in two directions at right angles to each other, of traversing means actuated by fluid pressure for moving said holder in one direction, shifting means actuated by fluid pressure for moving said holder in the other direction, valves for controlling said traversing means and said shifting means, a cam shaft, and cams mounted on said shaft to actuate said valves in definite sequence.

21. In a machine for handling lamp bulbs, the combination with a holder arranged to hold a plurality of bulbs in a row, of a controller comprising a cam with a group of projections corresponding in number to the number of bulbs in a row, and shifting means actuated by each projection to move said holder longitudinally of the row of bulbs a distance equal to the distance between adjacent bulbs.

22. In a machine for treating lamp bulbs, the combination with a holder arranged to hold a number of bulbs in a row, of mechanism actuated by fluid pressure to move said holder longitudinally of the row of bulbs, a valve arranged to cause said mechanism to move said holder one step when said valve is actuated, and a cam having a plurality of projections each arranged to actuate said valve, said projections being equal in number to the number of bulbs in the row.

23. In a machine for treating lamp bulbs, the combination with a movable holder arranged to hold a number of bulbs in a row and having a row of lugs corresponding in number with the bulbs in a row, of actuating mechanism for imparting a step by step movement to said holder comprising a member slidably mounted to reciprocate relatively to said holder, a spring-pressed pawl mounted in said member to engage said lugs, and means for intermittently reciprocating said member, whereby said holder is moved longitudinally of the row of bulbs.

24. In a machine for treating lamp bulbs, the combination with a movable holder having a series of lugs thereon, of a reciprocating member mounted adjacent said holder, a spring-pressed pawl on said member to engage said lugs, a fluid pressure device for reciprocating said member, a valve for said device, and a control cam for said valve having a plurality of projections each arranged to actuate said valve to cause said member to reciprocate and move said holder the distance from one lug to the next.

In witness whereof, I have hereunto set my hand this eighth (8th) day of September, 1908.

WILLIAM R. BURROWS.

Witnesses:
CLARENCE T. VAN DEREN,
CHARLES R. COOK.