

Aug. 25, 1953

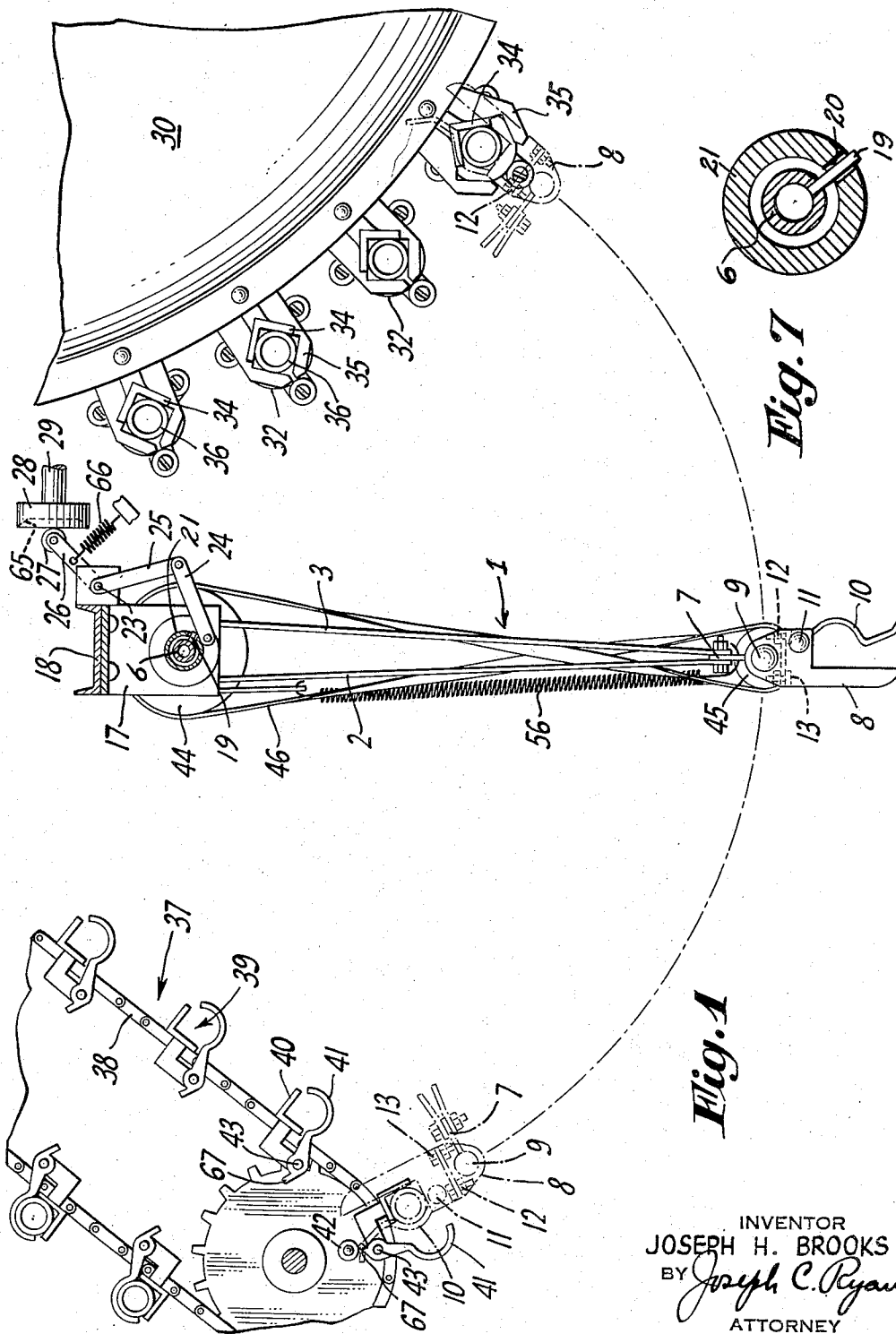
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2,649,975

LAMP TRANSFER APPARATUS

Filed Dec. 29, 1949

3 Sheets-Sheet 1



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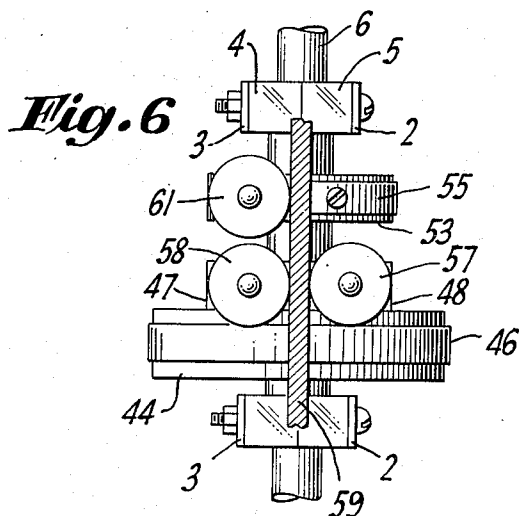
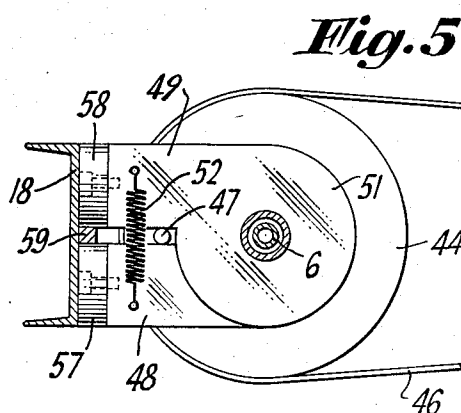
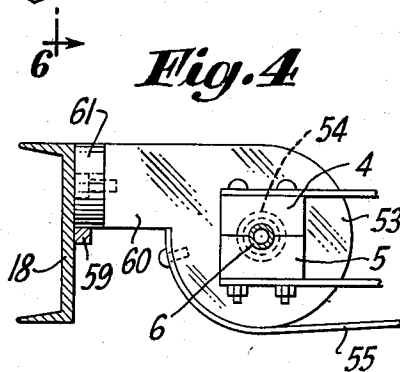
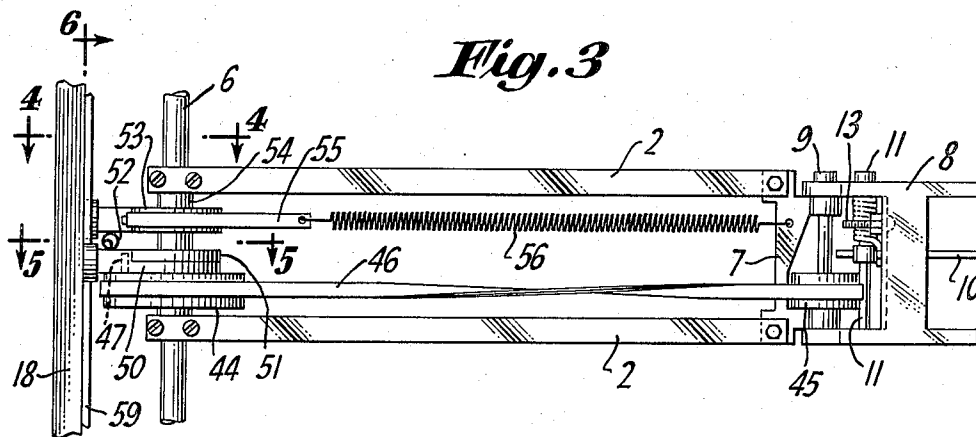
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UNITED STATES PATENT OFFICE

2,649,975

LAMP TRANSFER APPARATUS

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Application December 29, 1949, Serial No. 135,807

1 Claim. (Cl. 214—1)

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This invention relates to article transferring apparatus and more particularly to apparatus for transferring elongated tubular glass envelopes from one machine to another.

In the art of fluorescent lamp manufacturing, an elongated tubular glass envelope, open at both ends, is presented to a sealing machine where an electrode mount is sealed in each end thereof, thus providing a sealed envelope which constitutes the lamp. Upon the completion of this sealing operation, the lamp is removed from the sealing machine and transferred to another piece of lamp manufacturing equipment. Heretofore, this lamp transferring operation has been performed manually.

An object of this invention is to provide mechanical means for automatically unloading lamps from a lamp sealing machine.

Another object is to provide mechanical means for automatically transferring lamps from a lamp sealing machine to a conveyor which carries the lamps to the next lamp manufacturing operation.

A further object is to provide a mechanical arm with mechanical jaws for holding the lamps and effecting their transfer from the lamp sealing machine.

Another object is to provide means for rotating the lamp holding jaws about their own axis while the transfer arm on which they are mounted is rotating about the axis of the shaft on which it is mounted, to thereby insure proper orientation of the jaws with reference to the work heads at both the unloading and loading stations.

Further objects, advantages and features will be apparent from the following description, when read in conjunction with the accompanying drawings in which:

Figure 1 is a plan view, partly in section, taken along the line 1—1 of Figure 2, showing the lamp transfer arm assembly, a portion of the lamp sealing machine from which it removes the lamps, and the conveyor to which it transfers the lamps.

Figure 2 is an elevational view on a reduced scale of the apparatus of Figure 1, looking generally in the direction of the arrows 2—2 of Figure 1, but with the transfer arm in the pick-up position.

Figure 3 is an enlarged elevational view of the lamp transfer arm taken along line 3—3 of Figure 1.

Figure 4 is a detailed plan view, partly in section, taken along the line 4—4 of Figure 3, of a portion of the mechanism for preventing backlash of the lamp transfer arm.

Figure 5 is a detailed plan view, partly in sec-

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tion, taken along the line 5—5 of Figure 3, of another portion of the mechanism for preventing backlash of the lamp transfer arm.

Figure 6 is a detailed elevational view, partly in section, taken along the line 6—6 of Figure 3, of the mechanisms of Figures 4 and 5, showing their disposition relative to one another.

Figure 7 is an enlarged sectional detail of the lamp transfer arm oscillating means.

The apparatus of this invention comprises a lamp transfer arm, with a pair of lamp holding jaws mounted on the free end thereof. This arm is rotatably mounted on a shaft which, when actuated, moves the transfer arm in toward the lamp sealing machine until the transfer arm jaws engage and grip a lamp. The lamp is then moved upwardly a distance sufficient to clear it from the sealing machine mount support on which it was seated. The transfer arm is then moved outwardly to present the lamp to a conveyor. This conveyor has a plurality of heads with lamp gripping jaws thereon. When the transfer arm presents a lamp to a head of the conveyor the jaws of the head grip the lamp. The transfer arm is then moved away from the conveyor and back up to the lamp sealing machine to remove another lamp therefrom.

In Figures 1 and 3, a lamp transfer arm 1 comprises two pairs of arms 2 and 3, each of which is attached at one end thereof to split blocks 4 and 5 respectively on a cam shaft 6. The two pairs of arms 2 and 3 are connected to each other at the other end thereof by a plate 7. A lamp holding jaw 8 is fixedly mounted on a shaft 9 which is rotatably mounted in the plate 7. A spring-loaded lamp holding jaw 10 is fixedly mounted on a shaft 11 which is rotatably mounted in the shank of jaw 8. A pair of stops 12 and 13 are mounted on jaw 8.

In Figure 2, the lower portion of the cam shaft 6 extends into a cylinder 14 upstanding in a support 15. The end of the cam shaft 6 which is disposed within the cylinder 14 is provided with a piston 6a. The lower end of the cylinder 14 is connected through some suitable means not shown to a suitable shaft-actuating mechanism, such as a hydraulic drive for example, for developing reciprocation of the shaft 6. The upper portion of the cam shaft 6 extends through guide brackets 16 and 17 which are mounted on a standard 18. The upper portion of the cam shaft 6 has a cam follower 19 protruding from the face thereof into a slot 20 in a cylindrical cam 21 which is seated on bracket 16. The cylindrical cam 21 is provided with a collar 22. The collar

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22 is connected to one end of a shaft 23 through a link 24 and a lever 25. A lever 26, mounted on the other end of the shaft 23, has a cam follower 27 mounted on the free end thereof. This cam follower 27 rides on a cam 28 mounted on a drive shaft 29. The drive shaft 29 is connected to and synchronized with the main drive shaft of a lamp sealing machine 30, a fragmentary portion of which is shown in Figures 1 and 2.

Only such portions of the lamp sealing machine 30 as are necessary to illustrate the relationship between it and the apparatus of this invention are shown. The lamp sealing machine may be of the type shown in U. S. Patent 2,349,822, for example. In Figures 1 and 2, the lamp sealing machine 30 comprises a turntable 31 with a plurality of head 32 mounted about the periphery thereof. Each head 32 comprises a standard 33 on which a pair of guides 34 and jaws 35 are mounted for supporting and holding in position an elongated glass tube 36 as it is carried through a plurality of stations at which an electrode mount is sealed in the ends of the tube 36.

Only such portions of a conveyor 37 are shown as are necessary to completely illustrate the apparatus of this invention. In Figures 1 and 2, the conveyor 37, to which the lamp transfer arm 1 delivers lamps from the lamp sealing machine 30, is of the endless belt type. The belt 38 has a plurality of heads 39 mounted thereon. Each head 39 comprises an angle-iron standard 40, to which a lamp is delivered by the transfer arm 1, and a spring-loaded, normally closed finger 41 which holds the lamp in position on the conveyor 37. A roller 42 is disposed in the path through which the shank of the finger 41 of each head travels as it moves into the position at which it receives a lamp from the transfer arm 1. Engagement of the roller 42 by the shank of the finger 41 effects a pivotal movement of the finger about the shaft 43 on which it is mounted, thereby opening the finger for reception of a lamp therein.

It will be noted from an examination of Figure 1, in which the transfer arm 1 and its jaws 8 and 10 are shown in solid at an intermediate position in an operating stroke, and the jaws 8 and 10 are shown in phantom at the pick-up position at the lamp sealing machine and the delivery position at the conveyor, that not only must the transfer arm 1 be rotated about the axis of the cam shaft 6 on which it is mounted, but the jaws 8 and 10 must be further rotated in order to insure proper disposition of the jaws at the pick-up and delivery positions. This is accomplished by connecting a disc 44, rotatably mounted on the cam shaft 6, to a disc 45 fixedly mounted on jaw shaft 9, by means of a flexible metal crossed band 46. (Figures 1 and 3). A pin 47, upstanding on the top face of the disc 44, (Figures 3 and 5) is normally engaged by the adjacent sides of shanks 48 and 49 of discs 50 and 51 respectively. Both of these discs 50 and 51 are rotatably mounted on the cam shaft 6 and are connected to one another by a spring 52 (Figure 5).

Lost motion of the transfer arm 1 is taken up by a spring loaded collar 53 which is mounted on the cam shaft 6 through a sleeve 54. The collar 53 has a metal band 55 attached thereto and a spring 56 extends from the free end of this band 55 to the plate 7 of the transfer arm. Each of the shanks 48 and 49 of the discs 50 and 51 has a wheel 57 and 58 respectively mounted thereon and in engagement with a rail 59 on the standard 18. (Figures 3, 5 and 6.) The shank 60 of

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collar 53 has a wheel 61 mounted thereon and in engagement with the rail 59 (Figures 3, 4 and 6).

In the following description of the operation of the apparatus of this invention, the operating cycle of the lamp transfer arm 1 will be assumed to commence with the lamp transfer arm 1 at a point mid-way between the conveyor 37 and the lamp sealing machine 30 as illustrated in Figure 1.

In Figures 1 and 2, the cam shaft 6, driven by its actuating mechanism, moves upwardly, carrying with it the lamp transfer arm 1 which is mounted thereon. As the cam shaft 6 moves upwardly, rotation thereof in a counterclockwise direction is effected by the cam follower 19 thereon, riding in the slot 20 in the cylindrical cam 21, thus causing the lamp transfer arm 1 to move counterclockwise during its upward travel.

Since the jaws 8 and 10 of the transfer arm 1 must be disposed substantially perpendicular to the transfer arm, as shown in phantom in Figure 1, in order to effectively engage and grip the lamp 36 on the lamp sealing machine 30, a mechanism for accomplishing this has been provided. This mechanism comprises the discs 44 and 45 and the flexible metal crossed band 46 which connects these discs to one another (Figures 1 and 3). Since the transfer arm 1 is fixedly mounted on the cam shaft 6 and the disc 44 is rotatably mounted thereon, the counter-clockwise rotation of the transfer arm effects a displacement thereof with reference to the disc 44, the disc 44 being held stationary by the shanks 48 and 49 of the discs 50 and 51 which confine the pin 47 upstanding from the disc 44 (Figure 5). Since the disc 45 is fixedly mounted on the shaft 9, which is supported by the plate 7 of the transfer arm 1, the counter-clockwise rotation of the transfer arm also effects a displacement of disc 45 with reference to disc 44. Since the discs 44 and 45 are connected to one another by the flexible metal crossed band 46, and since the disc 45 is smaller in diameter than disc 44, displacement of disc 45 with reference to disc 44 causes the band 46 to move in a counter-clockwise direction and effect rotation of disc 45. Rotation of disc 45 effects rotation of shaft 9 on which it is fixedly mounted and jaw 8 which is also fixedly mounted on shaft 9. Since jaw 10 is mounted on jaw 8, jaw 10 moves therewith. Thus jaws 8 and 10 rotate in a counter-clockwise direction about the axis of the shaft 9 on which jaw 8 is mounted, as the transfer arm moves upwardly and in a counter-clockwise direction about the axis of cam shaft 6 on which it is mounted.

Since the degree of rotation of the jaws 8 and 10 about the axis of the shaft 9 is predetermined, viz., sufficient rotation to properly engage the lamp 36, a stop 12 is located on jaw 8 to arrest this rotational movement when the proper amount thereof has been effected. Engagement of the plate 7 of the transfer arm by the stop 12 on the jaw 8 occurs shortly before the jaws 8 and 10 engage the lamp 36. Although the rotational movement of the jaws 8 and 10 about the axis of the shaft 9 has been arrested, the transfer arm continues to rotate about the axis of the cam shaft 6. Since rotational movement of the disc 45 has been arrested, further counter-clockwise rotational movement of the band 46 effects counter-clockwise rotational movement of the disc 44 which is rotatably mounted on cam shaft 6. As the disc 44 rotates, the pin 47 upstanding thereon, (Figures 3 and 5) displaces the disc 50 in a counter-clockwise direction, thereby distending the spring 52.

As the jaws 8 and 10 move into engagement

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with the lamp 36, the spring-loaded, normally closed jaw 10 is forced open by engagement thereof with the lamp. At about the same time that the jaws 8 and 10 encircle and grip the lamp 36, the lamp holding jaws 35 (Figure 2) on the lamp sealing machine 30 release their grip thereon. The lamp is then moved upwardly a distance sufficient to effect clearance of the lamp sealing machine head.

As will be noted in Figure 2, the extreme upper end of the slot 20 in the cylindrical cam 21 is substantially vertical. Thus the final portion of the upward stroke of the cam shaft 6 is substantially vertical with no rotation. When the shaft 6 reaches the end of its upward stroke the lamp 36 has been gripped by the jaws 8 and 10 of the transfer arm 1 and moved upwardly a distance sufficient to clear the lamp sealing machine head. The lamp 36 is now ready to be moved outwardly, downwardly and in a clockwise direction by the transfer arm 1.

Outward movement of the lamp 36 to insure its freedom from possible engagement with any part of the lamp sealing machine before the downward and clockwise rotational movements are effected is accomplished by rotating the cylindrical cam 21 slightly in a clockwise direction. This is accomplished by the cam 28 on the shaft 29 (Figures 1 and 2). The cam 28 has a high side 62, a low side 63, and inclined surfaces 64 and 65 therebetween. As the cam 28 rotates with its shaft 29, the cam follower 27 on lever 26 is kept in positive engagement therewith by the spring 66. Rotation of the shaft 29 is synchronized with the stroke of cam shaft 6 on which the transfer arm 1 is mounted so that the cam follower 27 traverses the inclined surface 64 of the cam 28 when rotation of the cylindrical cam 21 in a clockwise direction is desired. The clockwise rotational movement of the cam follower 27 which is effected by its travel along the inclined surface 64 is transmitted into clockwise rotational movement of the cylindrical cam 21 through the lever 26, the shaft 23, the lever 25, the link 24 and the collar 22. Since the cam follower 19 on shaft 6 lies in the slot 20 in the cylindrical cam 21, the clockwise rotational movement of the cylindrical cam 21 effects clockwise rotational movement of the shaft 6 and the lamp transfer arm 1 which is mounted thereon. The lamp is now clear of the lamp sealing machine 30 and is ready for the downward and clockwise rotational movement which constitutes the delivery stroke. This stroke of the transfer arm 1 is effected by the downward movement of the cam shaft 6 and the rotation thereof which is effected by the cylindrical cam 21.

During the first portion of the clockwise rotation of the transfer arm 1, the disc 44 thereon, which has been displaced in a counter-clockwise direction during the corresponding last portion of counter-clockwise rotation of the transfer arm 1, is returned to the position thereof shown in Figure 5, due to the force exerted by the distended spring 52 through the shank 48 of disc 50 on the pin 47.

With the disc 44 now locked in a stationary position by the shanks 48 and 49 of discs 50 and 51 due to the confinement of the pin 47 therebetween, the next phase of the clockwise rotation of the transfer arm 1 effects a rotation of the jaws 8 and 10 on the axis of the shaft 9 about 180 degrees in order to properly orient the jaws for presentation of the lamp 36 held therein to a head of the conveyor 37, as shown in phantom in Figure 1. This rotation of the jaws 8 and 10

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on the axis of the shaft 9 about 180 degrees is accomplished during about 90 degrees of rotation of the transfer arm 1 about the axis of its shaft 6 because of the 2 to 1 ratio which exists between the diameters of discs 44 and 45. The actual clockwise rotation of the jaws 8 and 10 about the axis of shaft 9 is effected by the same mechanism which effected their counter-clockwise rotation described above. The displacement of the transfer arm 1 with reference to the disc 44 thereon causes the band 46 to rotate the disc 45 in a clockwise direction.

The stop 13 on jaw 8 (Figures 1 and 3) strikes the plate 7 of transfer arm 1 upon completion of the 180 degree rotation of the jaws, thereby arresting the rotation. With further rotation of the disc 45 thereby prevented, the clockwise movement of the band 46 effects clockwise rotation of the disc 44. As the disc 44 moves clockwise the upstanding pin 47 thereon displaces the disc 51 (Figures 3 and 5), thereby distending the spring 52. This rotation of the discs 44 and 51 on the shaft 6 occurs during the last few degrees of the clockwise rotational movement of the lamp transfer arm 1 as it approaches the conveyor 37 to which the lamp 36 is to be delivered.

The drive mechanism of the conveyor 37 is regulated so that a head 39 of the conveyor will be located at the lamp-receiving station thereon when the transfer arm 1 delivers a lamp thereto. As a head 39 moves into the lamp receiving station the shank 67 of the normally closed spring loaded finger 41 strikes the roller 42 and is opened thereby. The transfer arm 1 completes its delivery stroke by moving the lamp 36 into engagement with the angle-iron standard 40. With the lamp so disposed, the roller 42 is withdrawn from engagement with the shank 67 of the finger 41 by some suitable means (not shown), thereby permitting the spring-loaded finger 41 to snap closed about the lamp. The tension on the spring of jaw 10 of the transfer arm 1 is substantially less than the tension on the spring of finger 41 of the conveyor head 39 so that, as the cam shaft 6 on which the transfer arm 1 is mounted begins its return stroke, the jaw 10 will be forced open a distance sufficient to permit disengagement of the jaws 8 and 10 from the lamp 36.

Before the transfer arm 1 begins the upward rotational movement of its return stroke, it is displaced laterally a distance sufficient to effect clearance thereof from the conveyor 37 by the same mechanism employed to effect similar displacement to insure clearance of the lamp sealing machine at the start of the delivery stroke, viz., rotation of the cylindrical cam 21. Upon completion of the delivery stroke of the transfer arm 1, the cam 28 (Figures 1 and 2) has rotated to a point where the cam follower 27 has travelled completely across the low side 63 of the cam. Further rotation of the cam 28 causes the cam follower 27 to ride up the inclined surface 65. As the cam follower rides up this inclined surface, the lever 26 is displaced in a counter-clockwise direction. This counter-clockwise displacement of the lever 26 is transmitted through the shaft 23, the lever 25, the link 24 and the collar 22 to the cylindrical cam 21, thereby effecting counter-clockwise rotation thereof. Counter-clockwise rotation of the cylindrical cam 21 effects a similar rotation of the cam shaft 6 through the cam follower 19 thereon and the transfer arm 1 which is mounted on the shaft 6.

With the transfer arm 1 now clear of the conveyor 37, the upward rotational movement of the return stroke is effected. During the first por-

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tion of this movement, the disc 44 on the shaft 6, which had been displaced in a clockwise direction during the corresponding last portion of the delivery stroke of the transfer arm 1, is returned to the position thereof shown in Figure 5, due to the force exerted by the distended spring 52 through the shank 49 of disc 51 on the pin 47.

With the disc 44 now locked in a stationary position by the shanks 48 and 49 of discs 50 and 51 due to the confinement of the pin 47 therebetween, further rotation of the transfer arm 1 about the axis of the shaft 6 effects a displacement of disc 45 with reference to disc 44, and, through the band 46, effects rotation of the jaws 8 and 10 about the shaft 9 about 180 degrees as described in detail above. This completes the description of the operating cycle which commenced with the transfer arm 1 located in the position shown in Figure 1, as it moved toward the lamp sealing machine 30 to remove a lamp therefrom.

Thus the apparatus of this invention provides for the automatic mechanical transfer of lamps from a lamp sealing machine to another piece of equipment, such as the conveyor as shown and specifically described. The transfer is accomplished by a mechanical arm 1 to which concurrent rotary motion and motion in a vertical plane are imparted by the shaft 6 on which the arm 1 is mounted and the cylindrical cam 21 to which the shaft 6 is connected by the cam follower 19. A disc 44 rotatably mounted on the shaft 6 and a disc 45 fixedly mounted on the jaw shaft 9, in conjunction with the flexible crossed metal band 46 connected therebetween, constitute a means whereby the jaws 8 and 10 are rotated about the axis of the jaw shaft 9 during the major portion of the rotation of the transfer arm 1 about the axis of the shaft 6. At the beginning and at the end of each delivery and return stroke of the transfer arm 1, rotation of the jaws 8 and 10 is

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arrested by the stops 12 and 13 and the lost motion resulting therefrom is taken up by the disc 44 which is subsequently returned to its normal position by the discs 50 and 51, the shanks 48 and 49 of which are connected to each other by the spring 52.

What I claim is:

Apparatus for transferring an elongated tube from a pick-up to a delivery position, said apparatus comprising: a transfer arm; a shaft on which said transfer arm is fixedly mounted; a pair of tube-gripping jaws; a shaft rotatably mounted on said arm, one of said jaws being fixedly mounted thereon, and the other of said jaws being rotatably mounted on said first-mentioned jaw; means for rotating said first-mentioned shaft to effect oscillation of the transfer arm mounted thereon between the pick-up and delivery positions; means for rotating said tube-gripping jaws, about the axis of the shaft on which one of said jaws is fixedly mounted, during the major portion of the oscillation of said transfer arm; and means for arresting the rotation of the said fixedly mounted jaw at the beginning and the end of each oscillating stroke of said transfer arm.

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