

Dec. 1, 1953 D. MULLAN ET AL 2,661,101
MACHINE FOR TURNING FLUORESCENT LAMPS AND
OTHER ELONGATED DEVICES END FOR END
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LAMP TURNING

Fig. 2.

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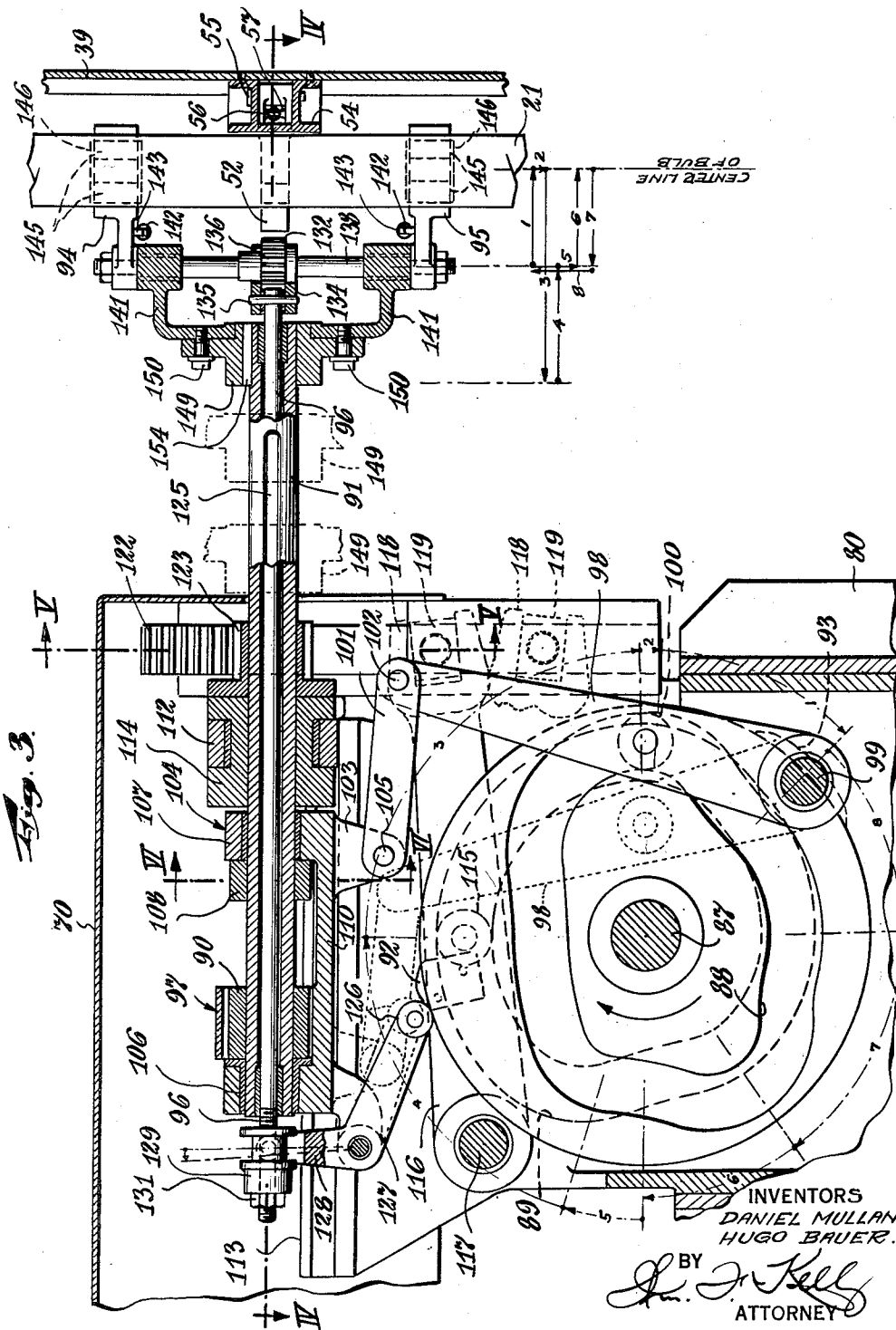
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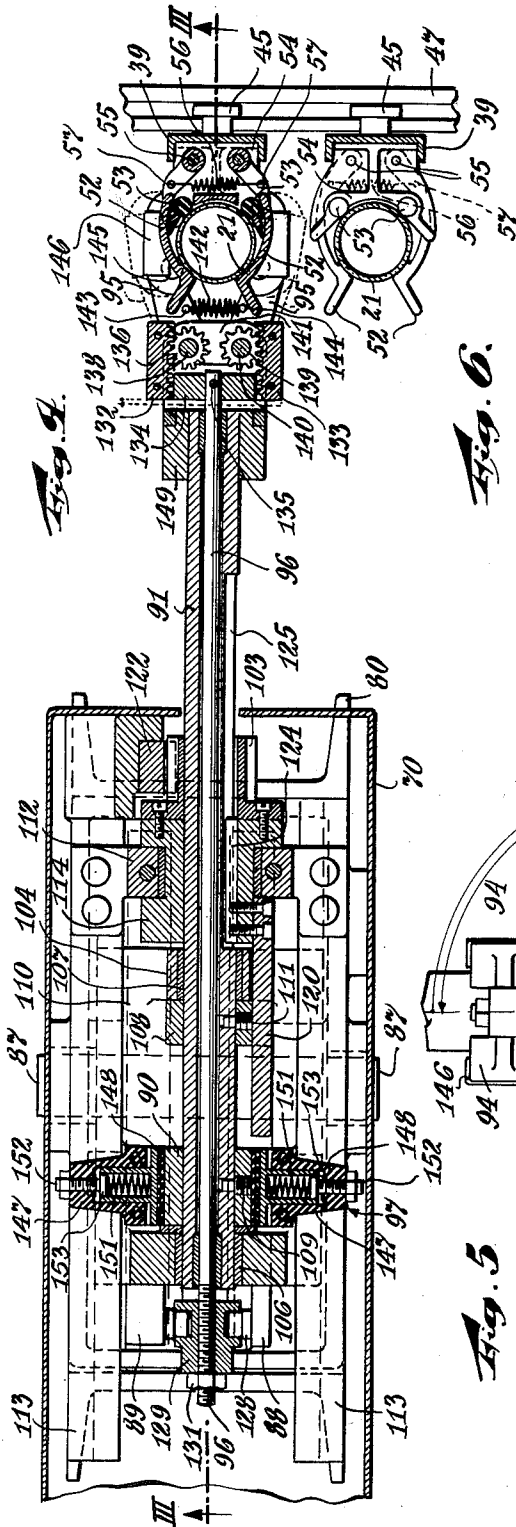


Fig. 4.

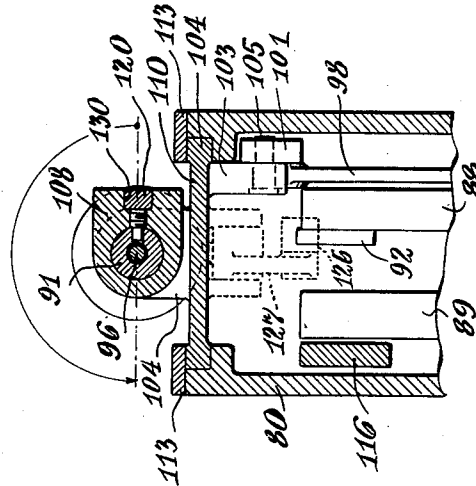


Fig. 5.

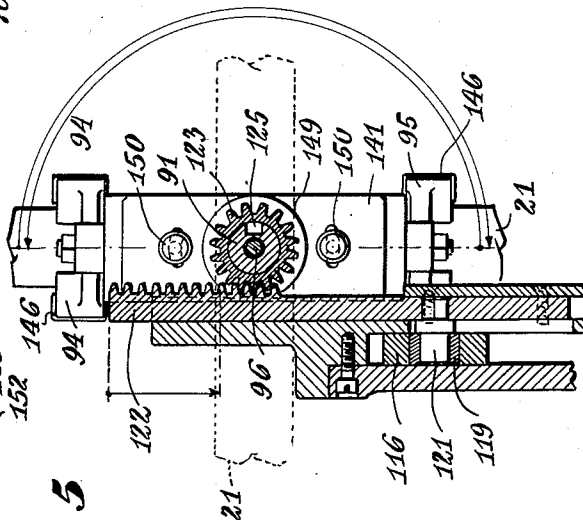


Fig. 6.

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UNITED STATES PATENT OFFICE

2,661,101

MACHINE FOR TURNING FLUORESCENT LAMPS AND OTHER ELONGATED DEVICES END FOR END

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Application March 14, 1951, Serial No. 215,603

14 Claims. (Cl. 214—1)

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This invention relates to the turning of fluorescent lamps, and other elongated electrical devices, end for end, as after one end has been processed.

The principal object of our invention, generally considered, is to provide a machine which takes a fluorescent lamp from a holder, reverses its position end for end, and returns it to said holder.

Another object of our invention is to provide a machine usable, for example, in connection with an automatic base threader to swing a fluorescent lamp bulb, while at an indexed position, around 180° and return it to the same bulb holder.

A further object of our invention is to provide a machine which, after the lower end of the envelope for a fluorescent lamp has been processed, grips said envelope, removes it from the processing machine, turns it 180° end for end, and replaces it on said machine for processing the other end of said envelope.

Other objects and advantages of the invention, relating to the particular arrangement and construction of the various parts, will become apparent as the description proceeds.

In the scale drawing:

Figure 1 is a plan view of apparatus embodying our invention.

Figure 2 is a side elevational view, with parts in section on the line II—II of Figure 1 in the direction of the arrows.

Figure 3 is a vertical longitudinal sectional view of the turning machine, on the line III—III of Figure 4, in the direction of the arrows.

Figure 4 is a horizontal sectional view on the line IV—IV of Figure 3, in the direction of the arrows.

Figure 5 is a fragmentary sectional view of the line V—V of Figure 3, in the direction of the arrows.

Figure 6 is a vertical sectional view on the line VI—VI of Figure 3 in the direction of the arrows.

There is a machine, covered by the Mullan et al. application, Ser. No. 219,606, filed April 6, 1951, containing a reference to the present case, and which threads bases automatically on first one end and then the other of fluorescent lamp envelopes. In order that said machine shall be fully automatic, we have provided a machine embodying the present invention for reversing the positions of such envelopes by turning them end for end after a base has been threaded on one end, so that one may be similarly threaded on the other end.

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After such envelopes have had their bases applied or threaded thereon, but before said bases are cemented in place, the lead wire portions which project through and beyond the hollow contact pins are bent over the ends of said pins to prevent the bases from slipping off the respective ends of the lamps. These lamps are then processed to cement the bases in place thereon. After this has been done, they are transferred, one by one, to a machine embodying the invention described and claimed in the Mullan application, Serial No. 215,602, filed simultaneously herewith. As the lamps are transferred to the machine, the operator pulls down on the leads extending beyond the contact pins of each lower base, and fits each lamp into holders on the machine. The machine indexes said lamps from station to station, trimming off the top or bottom lead wires flush with the ends of the contact pins, and then trimming off the remaining bottom or top lead wires also flush with the ends of said contact pins.

Each lamp then passes to a position station "7" where the ends of the lower contact pins are coated with flux. Each lamp then passes to a position station "9" where the leads in the lower ends of said lower pins are soldered to the pin ends. The machine of the present invention then, at station "13," for example, automatically reverses each lamp one by one, that is, turns it end for end, and at the fluxing station "17" and soldering station "19" operations are repeated at the then lower ends of the lamps. The lamps are, after any desired processing, removed one by one in finished condition.

General apparatus

Referring to the drawings in detail, like parts being designated by like reference characters, the apparatus of our invention, including the machine for trimming, fluxing and soldering the lead wires of fluorescent lamps, as an example of one machine with which our turning machine may be employed, comprises a conveyor for supporting and transporting a series of electrical devices, such as fluorescent lamps 21. These lamps have had bases 22 and 23 cemented thereto, from the contact pins 24 of which project leads not yet connected thereto.

A frame 25 is used for supporting said conveyor with said lamps, together with drive means 26, described in detail in the Mullan application previously referred to, for causing movement of said conveyor to index said lamps one by one from station to station. Mechanism 27 is used

for trimming the lead wire portions which project beyond the ends of the contact pins of said lamps while held upright, or with their axes vertical, as they are positioned on said machine. There is used mechanism 28 for fluxing the ends of the contact pins at the bottoms of said lamps, mechanism 29 for then soldering the lower ends of said fluxed pins, and automatic lamp-turning mechanism 31, here specifically described and claimed, for effecting a reversal of the position of each lamp. There is used mechanism 32 for fluxing the then lower end of each lamp, and mechanism 33 for soldering the then lower end of each lamp.

The conveyor 34 has been described in detail in the Mullan application, previously referred to, so it is only necessary to say that it comprises a table 35 which may be in the form of a channel member with the web at the top and flanges projecting downwardly, said table desirably being supported from a base 36. Upstanding from the table are pedestals 37, all being united to an upper channel member 38.

The lamps are held by means of a series of normally vertical channel members 39, each carrying at its lower end a base holder or socket member 41. The latter is provided with an upstanding flange 42 secured to the lower end of its channel member 39, by means such as set screws 43. The outer part of the normally horizontal portion is downwardly offset, as indicated at 44, to provide a conforming seat for the lower base 22 of the supported lamp. The offset portion 44 is also slotted, transversely of the machine, as disclosed in detail in the Mullan application referred to, so that the contact pins on the base are received therein and it is insured that the supported lamp is, oriented about its vertical axis in a position where its contact pins lie in planes perpendicular to the direction of the lamp movement, so that they are properly positioned for the desired processing operations.

Each channel member 39 carries rollers 45 and 46 pivoted thereto, the former of which travels in a pedestal-carried track member 47, and the latter of which rides in a corresponding lower groove in a similar pedestal-carried track member 48. This means that each channel member is supported for travel on an upper track member 47 and prevented from getting out of an upper groove thereof by a lower roller riding in a lower groove of a lower track member 48. These track members extend along the front and back of the machine. At both ends, the channel members 39 and their carried lamps are supported by chains 49 and 51. The lamps may travel from one end to the other along the front and to the back of the machine, the lamps being loaded, say at Station "2" and unloaded after desired processing.

Each channel member 39 is also provided with a pair of spring-actuated gripping hooks or lamp holder arms 52, shown most clearly in Figures 3 and 4, and so shaped that a lamp may be pushed therebetween into engagement with shock absorbing bumpers 53, inset into the lamp holder body 54. The bumpers may be formed of "Transite" or other suitable material having some resilience to prevent breakage of the lamp when inserted into place. The arms 52 are pivoted to the body member 54, as indicated at 55, and urged into engagement with one another by a spring 56 extending between pin portions 57 thereof. The body 54 of each holder is secured to the respective channel 39 in any desired manner, as

by means of bolts (not shown). Movement of the arms 52 toward one another to an undesired extent is prevented by engagement thereof with portions of the lamp holder body 54. The lower ends of the lamps rest in the socket members 41 which also serve as height locators.

The conveyor 34 and lamp turning machine 31 are both driven from a single source of power, such as an electric motor (not shown), as through reduction gearing as by means of a chain passing over sprocket wheel 58 on drive shaft 59. The drive shaft carries at one end a cam 61 in which rides a roller 62 on a lever 63, pivoted at 64 to the frame of the machine. The free end of the lever 63 is connected to link 65 by pin 66, the other end of the link being connected to a crank 67 by pin 68. The crank 67 is mounted on a vertical shaft 69 carrying sprocket wheels over which the chains 49 and 51 pass. The series of channel members 39 are connected to the chains 49 and 51 as by means of angular clips 71 and 72. All of this construction is more fully described in said Mullan application, previously referred to.

The shaft 69 also carries a ratchet 73 engaged by a pawl 74 connected to the crank 67 by pin 75, whereby reciprocation of the link 65, at each revolution of the shaft 59, turns the shaft 69 sufficiently to move, through the chain of mechanism more fully described in the application previously referred to, each lamp-supporting channel from one station to the next. A pawl 76, pivoted to the table and spring biased toward the ratchet 73, is provided to hold said ratchet in a station position while the crank 67 is being returned preparatory to making the next indexing movement.

The shaft 59 may also carry a sprocket wheel 77 over which a chain 78 passes to a corresponding sprocket wheel 79 on shaft 81. The shaft 81 may likewise carry a sprocket wheel over which a chain 82 passes to drive sprocket wheel 83 on shaft 84 of the lamp-turning machine 31. The shaft 84 may also carry a sprocket wheel over which a chain 85 passes to a sprocket wheel 86 on cam shaft 87 of said turning machine. Other suitable positive drive means for the lamp-turning machine may be substituted.

Details of lamp-turning machine

All of the operations of the lamp turning part 31 of the whole machine are controlled in synchronism with the operation of the conveyor part 34 of the whole machine by means of a slide-operating cam 88 and a lamp-turning cam 89, both cams being secured to the shaft 87, pivotally mounted in the frame 80 of the machine. The slide-operating cam 88 effects the reciprocation of the lamp turning shaft 91, while the lamp-turning cam 89 effects the rotation of said shaft. Protuberances 92 and 93 on the periphery of one cam, such as that designated 88, effect opening of the lamp holder jaws 94 and 95 through reciprocation of the rod 96. A cover 70 is desirably provided for the machine.

Generally speaking, there are three movements which have to be provided for to accomplish the lamp turning operation. These movements are:

(1) The horizontal reciprocation of the lamp-turning shaft 91.

(2) The rotation or turning of said shaft 91 about its axis, and

(3) The horizontal reciprocation of the jaw-opening rod 96. In order to prevent overrunning

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of the rotation operation, there is also provided a brake device 97 which introduces a desired amount of friction into the mechanism.

The reciprocation of the lamp-turning shaft

During operation of the machine, turning of the cam 88, which receives roller 100 of the slide actuating cam lever 98, thereby effects oscillation thereof. Said lever is connected to the frame by pin 99, with its free end acting on connecting rod 101 by means of pin 102. The other end of the connecting rod 101 is linked to a depending portion 103 of a carriage 104 by means of pin 105. This carriage 104 whose base 110 is mounted to slide between the frame 80 and slide ways 113, mounts the back portion of the shaft 91. It also serves to reciprocate said shaft by including between bearing portions 106 and 107 thereof, the breaking device 97 and a turning collar 108. The braking device collar or brake drum 90 is prevented from movement on the shaft 91 by means of set screw 109, while the turning collar is prevented from such movement by means of set screw 111. The shaft 91 passes through a longitudinally stationary bearing 114 rotatable in split bushing secured to a pillow block 112 on the frame 80 of the machine, and is aligned in its sliding and turning in said bearing by the carriage 104. This means that turning of the cam 88 effects reciprocation of the shaft 91 through bearing 114 held by pillow block 112, while the actuating carriage 104 is guided on the frame by slide ways 113.

The rotation of the lamp-turning shaft

While the shaft 91 is being reciprocated, as previously described, it is also turned by the cam 89 acting on roller 115 carried by lever 116 connected to the frame 80 by pivot pin 117. The lever 116 is bifurcated at its end, as indicated at 118, to receive swivel block 119. The latter receives pin 121 extending from lamp-turning rack 122. This rack engages pinion 123 secured to bearing 114 and not only transmitting turning motion to shaft 91 by means of key 124 secured to said bearing and received in elongated keyway 125 in said shaft, but also through extension turn key 120. The latter is secured to and extends longitudinally from bearing 114. The key 120 slides in a receiving notch 130 in the turning collar 108 while the key 124 slides in the way 125. This means that as the lever 116 oscillates up and down, the shaft 91 and its connected lamp-holding jaws are correspondingly turned through a double keyed connection.

The reciprocation of the jaw-opening rod

The jaw-opening rod 96 is reciprocated to open the lamp holding jaws 94 and 95 during the inward movement thereof to take a lamp from the lamp holder arms 52, draw it outwardly therefrom, turn it end for end, and again after replacing said lamp in said holder arms. The first movement is effected by the protuberance 92, and the second by the protuberance 93, both desirably disposed on the periphery of cam 88, engaging roller 126 on bell crank lever 127. As it is desired to open the jaws 94 and 95 only when at or near the positions shown in full lines in Figure 3, rearward movement of the carriage 104, to which the bell crank lever is pivoted, does not affect the desired operation. The upper arm 128 of said lever is bifurcated to straddle rod 96 and a rod shifter collar 129, acting between receiving

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flanges thereof. The collar 129 is adjustably secured to said rod by nut 131.

The other end of the rod 96 carries racks 132 and 133, extending from the jaw-opening rack holder 134, connected to said rod by means of pin 135. These racks respectively engage pinions 136 and 139. Pinion 136 is fixed on shaft 138 carrying the left hand jaws 94 and 95 as viewed in Figure 1, while the pinion 139 is fixed on shaft 140 carrying the right hand jaws 94 and 96 as viewed in said figure. The shafts 138 and 140 are pivoted in turning head 141 desirably secured in properly aligned position to hub 149 by set screws 150. The hub 149 is connected to shaft 91, as by means of key 154.

The respective jaws are urged to lamp-gripping engagement by means of springs 142, the ends of which respectively engage upstanding projections 143 and 144 on said jaws, so that the normal position of the jaws is closed. They are only opened when moved to grab a lamp from holder arms 52 on the conveyor 34 or to return said lamp to said arms. In order to minimize shock to such a lamp during the taking and replacing thereof, as well as prevent longitudinal slipping of said lamp in said jaws, each jaw desirably has a pair of plugs 145 of rubber, or other suitable shock-absorbing material, set thereinto and held in place by means of plug holders 146.

The brake for the lamp turning shaft

The carriage 104 of the machine has secured thereto a pair of brackets 147, each of which receives a turning brake shoe 148 pressed against the collar 90 held by the screw 109 by means of a spring 151. The compression of each spring is adjusted by a set screw 152 acting on a spring engaging block 153. This means that at all times during turning of the shaft 91, movement is opposed by frictional action of the brake shoes, obviating undesired overrunning.

Operation

There are eight phases in the operation of the lamp turning mechanism, represented by the correspondingly-numbered arrows of Figure 3. The first phase may be considered as when the lamp holder jaws 94 and 95 are moved forward to grip a lamp. This is accomplished by the cams turning through the arc designated 1 in Figure 3, moving the jaws inwardly toward the lamp a distance indicated by the arrow 1. As this is accomplished, the jaws are opened and closed about a lamp 21 by the peripheral cam portion 82 at the top of the slide-opening cam 88. At this time there is no motion imparted by the lamp-turning cam 89 to its lever 116. The position of the parts at the end of phase 1 is shown in full lines in Figures 3 and 4.

Phase 2, as the cams turn through the arc designated 2 involves no other motion. Phase 3, when the cams are turned through an arc designated 3, means a withdrawal of the lamp to extreme outer position through the distance designated by the arrow 3. At the same time the lamp-turning cam 89 pulls down on its lever 116 and twirls the lamp holding jaws 94 and 95, starting to reverse the position of the lamp end for end.

Phase 4 is where the lamp moving jaws 94 and 95 are moved forward toward the holder on the machine, at the same time completing the reversal of the lamp end for end. Phase 5 involves a pause or hesitation in the operations, while during phase 6 the lamp is moved back to the position illustrated in full lines, forcing the jaws

or arms 52 on the machine open, to replace the lamp 21 in reverse position. At the end of said phase, the jaws 94 and 95 are released. In phase 7 the slide-opening cam 88 causes a return of said jaws, as indicated by the arrow 7. Said jaws 94 and 95 are closed during said return movement, as well as reversed to initial position. Phase 8 is a dwell period like phases 2 and 5.

From the foregoing, it will be seen that we have devised a machine which automatically removes a fluorescent lamp or other elongated object from another machine or part of the whole machine in which it is being processed, reverses it end for end, and restores it to said processing machine or part in which initially held. Although a preferred embodiment of our invention has been disclosed, it will be understood that the turning machine 31 may be used in other applications where an elongated or double-ended device is to be moved from a processing machine, turned end for end, and restored to said machine. Also other modifications may be made within the spirit and scope of the appended claims.

We claim:

1. In a machine for processing fluorescent lamps, a conveyor indexing from station to station, means on said conveyor for holding, while performing operations on the lower end portion of, a series of said lamps with their axes vertical and subject to forcible removal, and means at one of said stations for automatically removing each lamp from its holding means, reversing it in position and returning it to said holding means for the performance of similar operations on the other end portions, said means comprising auxiliary apparatus driven in synchronism with said machine and including a frame, a carriage slidable on said frame, means for effecting desired sliding of said carriage, a shaft mounted to turn in, and carrying means to prevent relative longitudinal movement with respect to, said carriage, a pillow block mounted on said frame, a bearing carrying said shaft and turning in said block, a pinion secured to said bearing, means also secured to said bearing for turning said shaft with said pinion while allowing independent reciprocation, gripping means carried by said shaft, and means for operating said gripping means to approach a lamp, grasp and withdraw it from its holding means, twirl it about a horizontal axis to reverse position, and return it to its holding means.

2. In a machine for cooperating with another machine processing fluorescent lamps, in which other machine said lamps are arranged in a series and resiliently held subject to forcible removal, with their axes vertical and indexed from station to station, two pairs of jaws spring-biased to closed position, each jaw being mounted on the end of a shaft, a pinion on each shaft, a hollow lamp-turning shaft on which said jaw shafts are mounted and extend transverse thereto, a jaw-opening rod reciprocable in said lamp-turning shaft, racks engaging said pinions and operable by said rod to open said jaws, a cam shaft, a pair of cams mounted on said shaft, means for turning said cam shaft in synchronism with the operation of said processing machine, a carriage in which said lamp-turning shaft is rotatable, collar means on said shaft to cause it to reciprocate with said carriage, one of said cams operating a lever link-connected to said carriage, causing the latter and said shaft to reciprocate a movable rack, a bearing through which said lamp-turning shaft passes, a pinion

secured to said bearing, a key on said bearing and movable in an elongated key-way in said shaft, a lever operable by said other cam to cause turning of said pinion and shaft at desired positions, one of said cams having protuberances, a bell crank lever connected to said jaw-opening rod so as to open said jaws to receive a lamp at a desired time and again open said jaws to release such a lamp at a desired time, the cams being so shaped and protuberances so related that the lamp-turning shaft moves in as a lamp is indexed at a station, its jaws open and close about said lamp, said lamp-turning shaft then retracts drawing said lamp out of its holding means where indexed, turning it end for end, moving it back to the same holding means, whereupon said jaws are again released and the shaft again retracts, during which last motion the jaws are reversed in position ready for the next operation.

3. In a machine for processing fluorescent lamps, a conveyor indexing from station to station, means on said conveyor for resiliently holding a series of said lamps with their axes vertical and subject to forcible removal, and means at a reversing station for automatically removing each lamp from its holding means, reversing it in position and returning it to said holding means, said means comprising a frame, a shaft mounted in said frame, a pair of cams mounted on said shaft, means for driving said cam shaft in synchronism with said conveyor, a carriage slidable on said frame and disposed above said cams, a hollow shaft turnable in said carriage but not slidable relative thereto, a lamp-turning head mounted on the end of said hollow shaft, a pair of shafts extending parallel to one another and transverse to said hollow shaft, a jaw mounted on each end of each shaft, and co-operating with the jaw at the corresponding end of the other shaft, spring means urging the jaws of each pair toward one another, a pinion on the intermediate portion of each of said jaw shafts, a jaw-opening rod reciprocable in said hollow shaft, a pair of racks secured to an end of said jaw-opening rod and meshing with said pinions, so that as said rod is reciprocated said jaws are opened against the force of their springs, a collar secured to the other end of said rod, a bell-crank lever, means pivoting said bell-crank lever on said carriage, a collar on said rod engaged by one arm of said bell-crank lever, one of said cams having protuberances engaging the other arm of said bell-crank lever for reciprocating the rod in said shaft at times when it is desired to open said jaws, a pillow block mounted on said frame, a bearing rotatable therein and through which said hollow shaft passes, a pinion secured to an end of said bearing, a rack meshing with said pinion, a lever pivoted on said frame and operated by one of same cams to reciprocate said rack and thereby oscillate said pinion, a key on said bearing engaging an elongated keyway in said hollow shaft for transmitting rotary motion from said pinion to said shaft, and means transmitting longitudinal motion to said carriage and hollow shaft comprising a lever mounted on said frame, a roller thereon engaged by said other cam, and a connecting rod between the free end of said lever and said carriage, the cams being shaped and the protuberances positioned so that as a lamp is indexed at the reversing station the hollow shaft reciprocates toward it, the jaws carried thereby are opened and closed about said lamp, the hollow shaft is retracted pulling said lamp from its

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resilient holding means, turning it end for end, and replacing it in said holding means.

4. In a machine for processing one by one each of elongated objects, a conveyor for resiliently holding such objects in a series and subject to forcible removal, and means for turning them end for end, and replacing them in reversed position on said conveyor comprising a frame, a shaft mounted in said frame, a cam mounted on said shaft, means for driving said cam shaft in synchronism with movement of said conveyor, a carriage slidable on said frame and disposed above said cam, a hollow shaft carrying means for holding one of said objects, turnable in said carriage but not slidable relative thereto, a lever mounted on said frame, a roller thereon engaged by said cam, a connecting rod between the free end of said lever and said carriage, said cam being shaped so that it reciprocates said hollow shaft toward and away from said conveyor as desired for effecting the purpose, turning mechanism for said hollow shaft, and another cam also mounted on said cam shaft, operably connected to said turning mechanism, and shaped so that it turns said hollow shaft as desired for the purpose.

5. In a machine for taking one by one each of vertically-positioned elongated objects resiliently held in a series on a conveyor and subject to forcible removal, turning them end for end, and replacing them in reversed position on said conveyor, a frame, a shaft mounted in said frame, a cam mounted on said shaft, means for driving said cam shaft in synchronism with movement of said conveyor, a carriage slidable on said frame toward and away from said conveyor and disposed above said cam, a hollow shaft carrying means for holding one of said objects, said hollow shaft being turnable in said carriage but not slidable relative thereto, a pillow block mounted on said frame, a bearing rotatable therein and through which said hollow shaft passes, a pinion secured to an end of said bearing, a rack meshing with said pinion, a lever pivoted on said frame and operated by said cam to reciprocate said rack and thereby oscillate said pinion, a key on said bearing engaging an elongated keyway in said shaft, a collar on said shaft formed with an outwardly opening notch, and an extension turn key on said bearing slidable in said notch, and together with said key serving for transmitting rotary motion from said pinion to said shaft, the cam being shaped so that as an object is indexed at a predetermined station, after being removed from said resilient holding means, it is reversed end for end before being returned thereto.

6. In a machine for taking one by one each of vertically-positioned elongated objects resiliently held in a series on a conveyor and subject to forcible removal, turning them end for end and replacing them on said conveyor, a frame, a shaft mounted in said frame, a cam mounted on said shaft, means for driving said machine and conveyor in synchronism, a hollow shaft slidable and turnable with respect to said frame, a lamp-turning head mounted on the end of said shaft, a pair of shafts mounted in said head, extending parallel to one another and transverse to said hollow shaft, a jaw mounted on each end of each shaft of said pair and co-operating with the jaw at the corresponding end of the other shaft, spring means urging the jaws of each pair toward one another, a pinion on an intermediate portion on each of said jaw

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shafts, a jaw-opening rod reciprocable in said hollow shaft, a pair of racks secured to an end of said jaw-opening rod and meshing with said pinions, so that as said rod is reciprocated said jaws are opened against the force of their springs, a bell crank lever pivoted to means moving longitudinally with said hollow shaft, a collar on said rod engaged by one arm of said bell crank lever, and protuberances on said cam engaging at desired times the other arm of said bell crank lever for reciprocating said rod and opening said jaws against the force of their springs, so that one of said elongated objects may be gripped in said jaws and released therefrom at desired times.

7. In a machine for taking one by one each of vertically-positioned elongated objects resiliently held in a series on a conveyor and subject to forcible removal, turning them end for end and replacing them in said holding means, a frame, a shaft mounted on said frame, a carriage slidable on said frame, abutment portions on said carriage, means for effecting desired sliding of said carriage, a hollow shaft turnable in said carriage but not slidable relative thereto, object-gripping elements carried by said hollow shaft, means for turning said hollow shaft, said hollow shaft carrying a collar in engagement with one abutment portion and a brake-drum collar in engagement with another abutment portion of said carriage, and means to prevent overrunning of turning movement of said hollow shaft, comprising a pair of brackets mounted on said carriage, a brake shoe in each bracket, a spring urging each brake shoe from said bracket toward the brake-drum collar, and means for adjusting the compression of said springs.

8. In a machine for processing fluorescent lamps, a conveyor indexing from station to station, and means at one of said stations for automatically removing each lamp from its holding means, reversing it in position and returning it to said holding means, said means comprising a frame, a shaft mounted on said frame, a cam mounted on said shaft, means for driving said cam shaft in synchronism with said processing machine, a carriage slidable on said frame and disposed above said cam, a hollow shaft carrying means for holding one of said lamps, turnable in said carriage but not slidable relative thereto, a lever mounted on said frame, a roller thereon engaged by said cam, and connecting rod between the free end of said lever and said carriage, said cam being shaped so that it reciprocates said hollow shaft toward and away from said conveyor as desired for correspondingly moving said lamps, and means for effecting desired turning of said hollow shaft.

9. In a machine for processing fluorescent lamps, a conveyor indexing from station to station, means on said conveyor for resiliently holding a series of said lamps with their axes vertical and subject to forcible removal, and means at a reversing station for automatically removing each lamp from its holding means, reversing it in position and returning it to said holding means, said means comprising a frame, a shaft mounted in said frame, a cam mounted on said shaft, means for driving said cam shaft in synchronism with operation of said processing machine, a carriage slidable on said frame toward and away from said conveyor and disposed above said cam, means for effecting desired sliding of said carriage, a hollow shaft carrying means for holding one of said lamps, said hollow shaft being turna-

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ble in said carriage but not slidable relative thereto, a pillow block mounted on said frame, a bearing rotatable therein and through which said hollow shaft passes, a pinion secured to an end of said frame and operated by said cam to reciprocate said rack and thereby oscillate said pinion, a key and an extension turn key on said bearing respectively engaging an elongated keyway in said shaft and a notch in the collar on said shaft, for transmitting rotary motion from said pinion to said shaft, the cam being shaped so that as a lamp is indexed at said reversing station, it is after removal from said conveyor reversed end for end before being returned thereto.

10. In a machine for processing fluorescent lamps, a conveyor indexing from station to station, means on said conveyor for resiliently holding a series of said lamps with their axes vertical and subject to forcible removal, means at one of said stations for automatically removing each lamp from its holding means, said means comprising a frame, a shaft mounted in said frame, a cam mounted on said shaft, means for driving said cam shaft and conveyor in synchronism, a hollow shaft slidable and turnable with respect to said frame, means for effecting desired sliding and turning movements of said hollow shaft, a lamp turning head mounted on the end of said shaft, a pair of shafts mounted in said head, extending parallel to one another and transverse to said hollow shaft, a jaw mounted on each end of each shaft of said pair and cooperating with the jaw at the corresponding end of the other shaft, spring means urging the jaws of each pair toward one another, a pinion on an intermediate portion of each of said jaw shafts, a jaw-opening rod reciprocable in said hollow shaft, a pair of racks secured to an end of said jaw-opening rod and meshing with said pinions, so that as said rod is reciprocated said jaws are opened against the force of their springs, a bell crank lever pivoted to means moving longitudinally with said hollow shaft, a collar on said rod provided with flanges between which one arm of said bell crank lever extends, protuberances on said cam engaging at desired times the other arm of said bell crank lever for reciprocating said rod and opening said jaws against the force of their springs, so that one of said lamps may be gripped in said jaws and released therefrom at desired times.

11. In a machine for processing fluorescent lamps, a conveyor indexing from station to station, means on said conveyor for resiliently holding a series of said lamps with their axes vertical and subject to forcible removal, means at one of said stations for automatically removing each lamp from its holding means, reversing it in position and returning it to said holding means, said means comprising a frame, a shaft mounted on said frame, a carriage slidable in said frame, means for effecting desired sliding of said carriage, a hollow shaft turnable in said carriage but not slidable relative thereto, said shaft for that purpose carrying a collar in engagement with one abutment portion and a brake-drum collar in engagement with another abutment portion of said carriage, and means to prevent overrunning of turning movement of said hollow shaft, comprising a pair of brackets mounted on

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said carriage, a brake shoe in each bracket, a spring urging each brake shoe from said bracket toward the brake-drum collar, means for adjusting the force exerted by said springs, and lamp-gripping elements carried by, and means for effecting desired turning of, said hollow shaft.

12. Mechanism for reciprocating a hollow shaft, rotating it, and operating gripping means at one end thereof, comprising a frame, a carriage slidable on said frame, said shaft being mounted to turn in said carriage and carrying collar means engaging bearing portions of said carriage to prevent relative longitudinal movement between carriage and shaft, a pillow block mounted on said frame, a bearing carrying said shaft and turning in said block, a key and a pinion secured to said bearing, said key engaging an elongated keyway in said shaft, and means for operating said gripping means comprising a rod slidable in said shaft, a cam shaft, means for effecting desired sliding of said carriage, comprising a cam on said shaft, a lever operated thereby, a link connecting said lever to said carriage, a rack engaging said pinion, another cam on said cam shaft for reciprocating said rack, and protuberances on one of said cams for reciprocating said rod with respect to said hollow shaft.

13. Mechanism for reciprocating a hollow shaft and operating gripping means at one end thereof, comprising a frame, a carriage slidable on said frame, said shaft carrying collar means engaging bearing portions of said carriage to prevent relative longitudinal movement between carriage and shaft, a bearing on said frame carrying said shaft, and means for operating said gripping means comprising a rod slidable in said shaft, a cam shaft, a cam on said shaft, a lever operated thereby, a link connecting said lever to said carriage, and protuberances on said cam for reciprocating said rod with respect to said hollow shaft.

14. Mechanism for reciprocating a shaft and simultaneously rotating it, comprising a frame, a carriage slidable on said frame, said shaft being mounted to turn in said carriage and carrying collar means engaging bearing portions of said carriage to prevent relative longitudinal movement between said carriage and shaft, a pillow block mounted on said frame, a bearing carrying said shaft and turning in said block, a key and a pinion secured to said bearing, said key engaging an elongated keyway in said shaft, a rack engaging said pinion, a cam shaft, cams on said shaft for respectively reciprocating said carriage and rack lever operated by said carriage cam, and a link connecting said lever and carriage.

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