May 29, 1962 H. K. DICK ETAL 3,036,719

FILAMENT TRANSFER DEVICE

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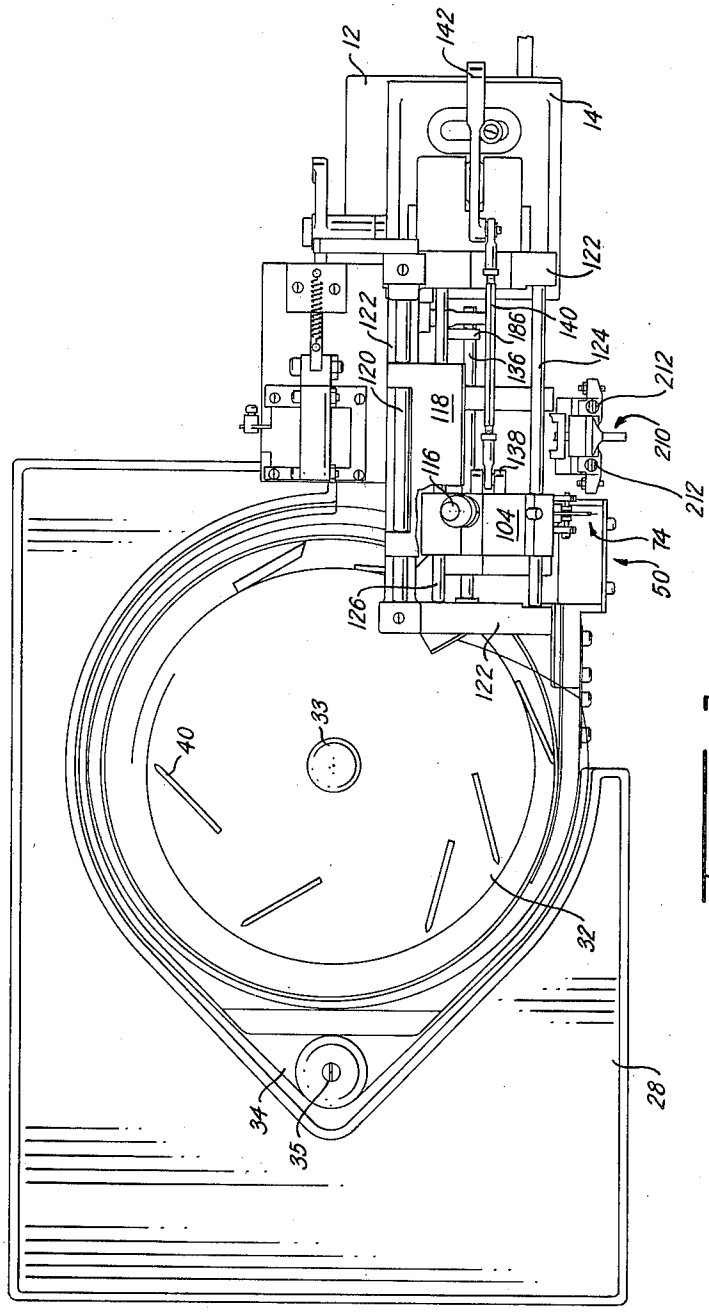


FIG. 1

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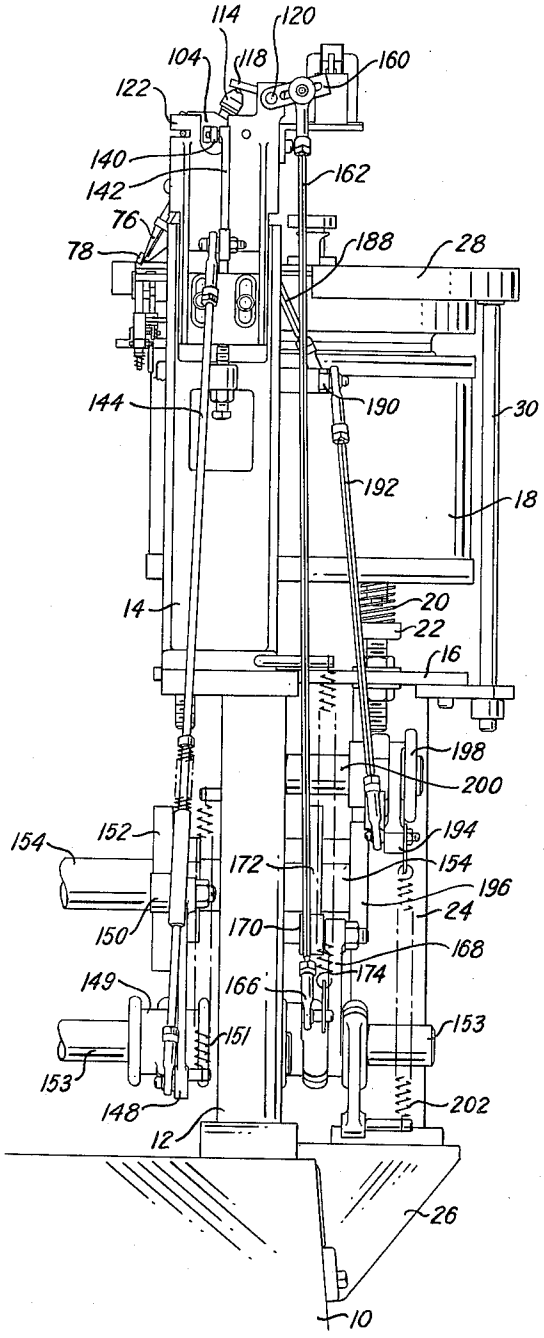


Fig. 2

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FILAMENT TRANSFER DEVICE

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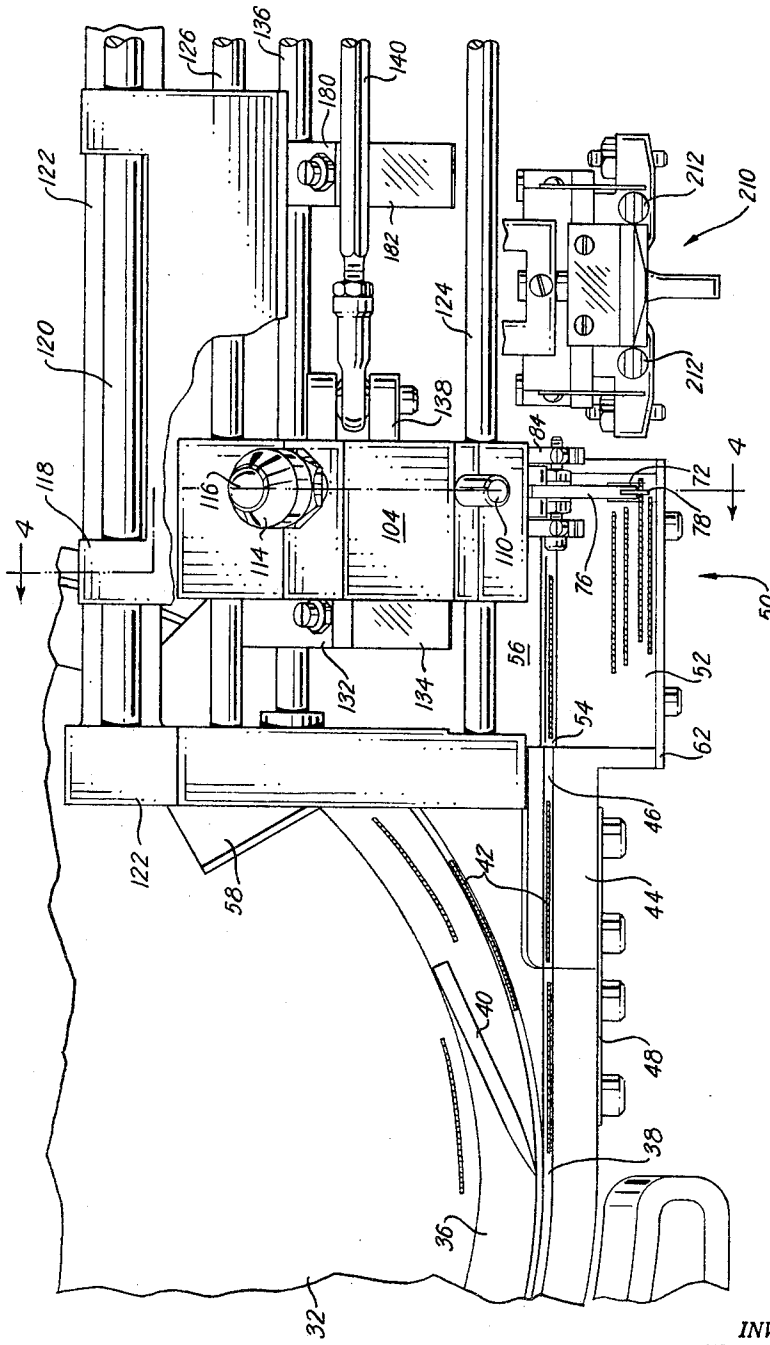


FIG 3

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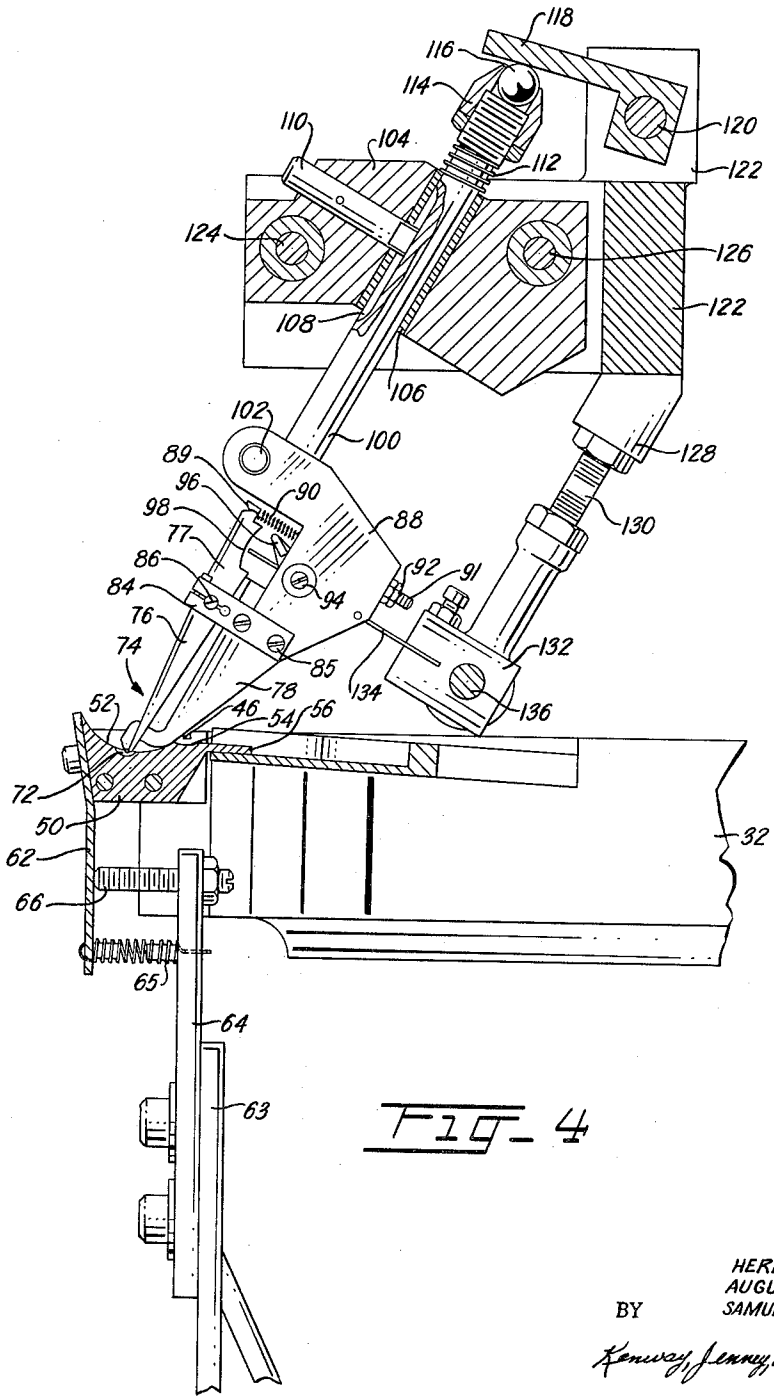


Fig. 4

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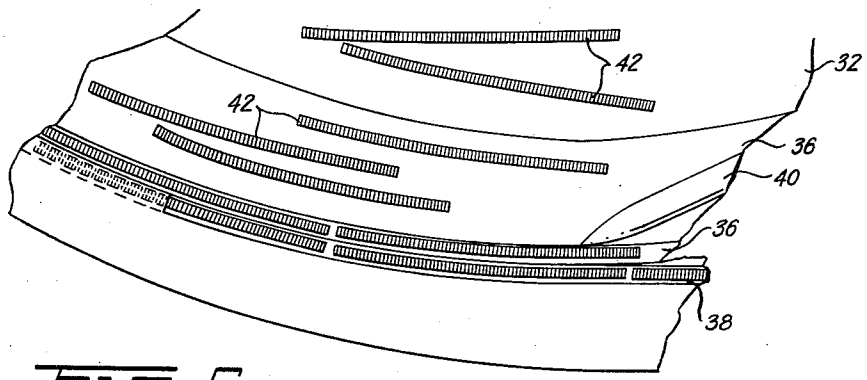


Fig. 6

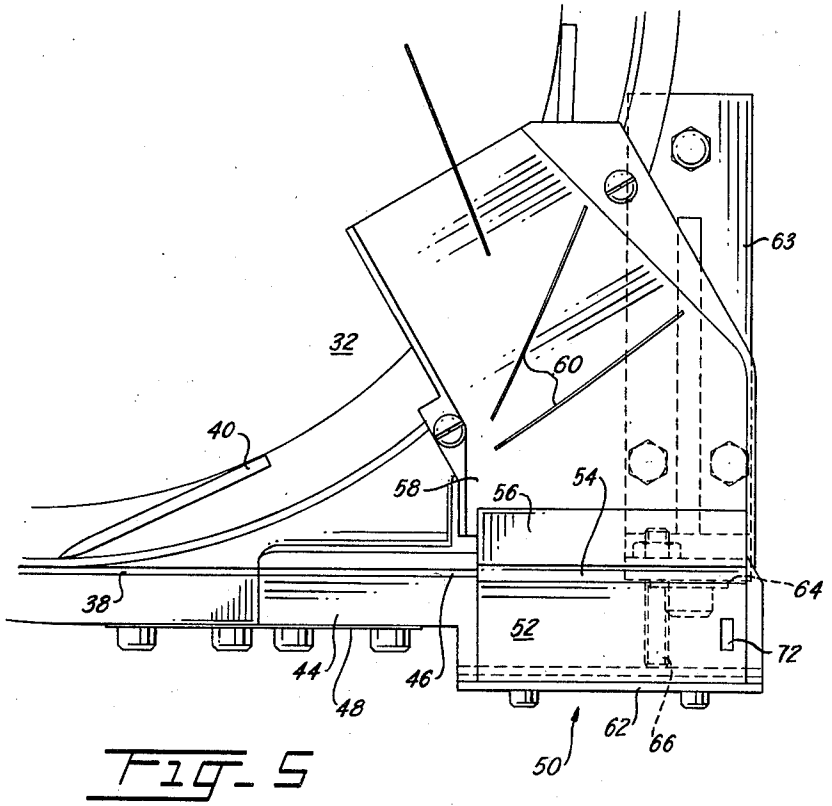


Fig. 5

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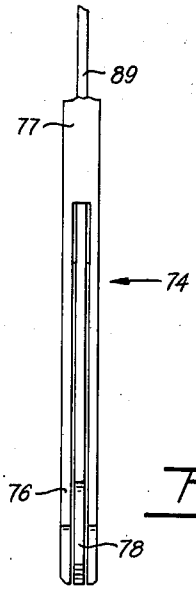


Fig. 8

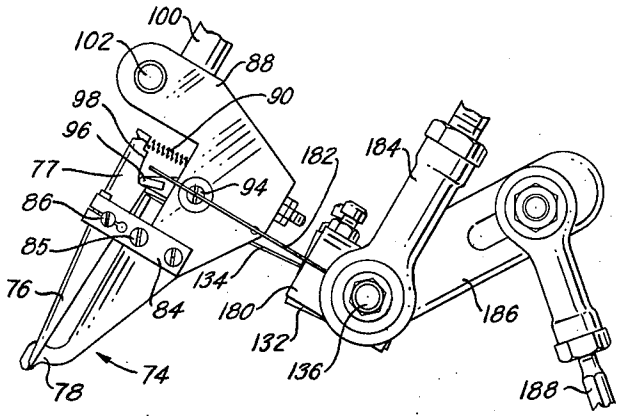


Fig. 7

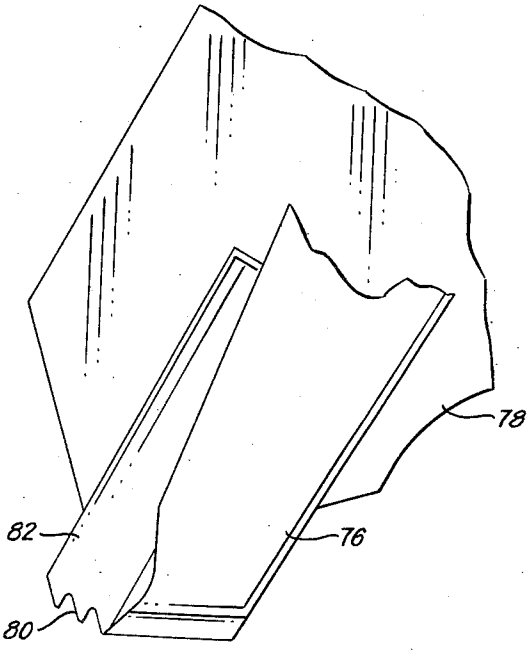


Fig. 9

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United States Patent Office 3,036,719 Patented May 29, 1962

3,036,719

FILAMENT TRANSFER DEVICE

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Filed Oct. 11, 1957, Ser. No. 689,521
3 Claims. (Cl. 214—1)

This invention relates to a device for successively transferring lamp filaments first from a random mass into a reservoir and thence into a receiver associated with a lamp stem assembling machine.

The problem of bringing lamp filaments into assembled position upon the lamp stem has long bothered the industry chiefly because of the fact that the filaments are very small and so flexible as to be limp. For example coil filaments having outside diameters ranging from .0035" to .050" and lengths in the order of 40 mm. to 50 mm. are commonly employed in commercial lamps. At first it was necessary that each filament be picked up with hand tweezers and manually assembled; the hand process is still in use to a limited extent but has been supplemented by machinery exemplified by the disclosure of Patent No. 2,597,354, H. B. Maloney, issued May 20, 1952, for example.

The present invention has for its principal object to improve the efficiency of filament transfer and feeding, with a view to increasing the speed of operation and decreasing the failures encountered in practice.

An important feature of the invention resides in the combination of a vibrating bowl feeder having its delivery end coupled to a spring mounted block containing a reservoir for filaments and means for automatically returning to the bowl filaments delivered in excessive quantities. In axial alignment with the reservoir is a receiver associated with the lamp stem assembly machine, and a carriage, mounted to slide parallel to the axes of the reservoir and receiver, is equipped with cam operated gripping fingers by means of which filaments are successively gripped and drawn into position on the receiver.

The spring mounting of the block is arranged to impart to the oncoming filaments motion primarily in axial translation, thus tending to preserve desired orientation of the filaments and avoiding the stoppages resulting from the tangling of misaligned filaments.

Moreover, the difficulties encountered in the past which stemmed from the limp and flexible character of the filaments are avoided in accordance with the present invention by virtue of the fact that each filament is gripped near its extremity and trailed axially from the reservoir to the receiver.

These and other objects and features of the invention will be more readily understood and appreciated from the following detailed description of a preferred embodiment selected for purposes of illustration and shown in the accompanying drawings in which:

FIG. 1 is a plan view of a filament feeding and transfer device constructed in accordance with the invention,

FIG. 2 is a side elevation of the device showing the cam controlled driving means,

FIG. 3 is a plan view on a larger scale of a portion of the device.

FIG. 4 is a view in cross section along the line 4—4 of FIG. 3,

FIG. 5 is a plan view of a spring mounted block containing the reservoir and the return chute, other portions of the device having been removed for purposes of illustration,

FIG. 6 is a plan view on an enlarged scale of the discharge end of the bowl feeder, showing also filaments at different levels in the bowl feeder,

FIG. 7 is a view in side elevation of the gripping fingers and the actuating mechanism therefor,

FIG. 8 is a view in end elevation of the gripping finger assembly, and

FIG. 9 is a view on a very much enlarged scale of the operative portions of the gripping fingers.

Before proceeding to a detailed description of the device illustrated in the drawings it is deemed appropriate first to describe in a general way the most important operating instrumentalities and their functions. In FIG. 1 there is shown a vibrating bowl feeder **32** of substantially conventional type, generally known in the trade as a "Syntron" feeder. The feeder **32** has a delivery channel **38** coupled through and intermediate L-shaped block **44** to a second block **50** best shown in FIGS. 4 and 5 and containing a concave elongated trough **52** into which filaments are successively introduced. As best shown in FIG. 1 there is a receiver **210** having filament receiving jaws in alignment with a long axis of the trough **52**. A gripping finger assembly **74** is mounted on a carriage **104** arranged to slide between the trough and the receiver **210**, the gripping fingers **74** being actuated first to pick up the extremity of a single filament in the trough and trail it into position on the jaws of the receiver **210**. While the carriage is bringing the gripping fingers back to seize another filament from the trough **52**, the receiver **210** carries the first filament into a lamp stem assembling machine (not shown). The receiver **210** may be of the type shown in the aforementioned patent to Maloney for example.

The structure by means of which the principal instrumentalities of the device are operated will now be described. As shown in FIG. 2 the machine includes a relatively massive base **10** upon which is mounted a post or pedestal **12** forming support for a main frame **14** upon which the elements of the device are assembled. A flat horizontal plate **16** disposed at the junction of the pedestal **12** and the frame **14** serves to support a vibratory feeder **18**, the latter being carried on the conventional spring mounting **20** supported by an adjustable post **22** threaded through the plate **16**. The plate **16** is further supported by means of a stout post **24** mounted on a bracket **26** effixed to the base **10**.

The construction of the vibrating bowl type feeder will not be described inasmuch as it is a standard piece of equipment readily obtainable on the market and not forming any part of the present invention. Surrounding the upper portion of the bowl **32** of the feeder **18** is a table **28** supported by a stanchion **30** bolted to the plate **16**. A transparent cover **34** is pivotally mounted at **35** upon the table **28** and is provided with a knob **33** by means of which it may be swung to and from the bowl **32**. Within the bowl **32** is the customary inclined spiral ramp **36** upon which the filaments are caused to travel as a result of the movement of the bowl. The ramp **36** terminates at the upper periphery of the bowl **32** in a delivery channel **38**.

It should be pointed out here that one of the difficulties encountered in the handling of lamp filaments is their tendency to agglomerate into tangled masses, a characteristic which has at times impeded the operation of the bowl feeder. It has been found that, in the case of relatively long filaments of very small diameter, improved results are secured if at the bottom of the bowl there are mounted a plurality of vertical baffles such as shown at **40** in FIGS. 1, 3 and 5. The filaments are shown at **42** in various positions within the bowl feeder. The precise action of the baffles **40** is not understood, and their exact locations cannot therefore be accurately prescribed. However, it appears that the baffles should be dispersed about the bot-

tom of the bowl in non-radial orientation, as best illustrated in FIG. 1.

Coming now to the portion of the machine in which the filaments are assembled in aligned relation for transfer to the receiver, there is provided an L-shaped block 44 secured to the bowl feeder by means of a leaf spring 48 bolted to the block 44 and to the feeder bowl 32. Cut into the block 44 is a thin channel 46 precisely aligned with the delivery channel 38. Bolted to the end of the L-shaped block 44 is a block 50, best shown in FIGS. 4 and 5. The block 50 is provided on its upper face with an elongated concave trough 52 long enough to accommodate a filament 42 and deep enough to contain several filaments. The concave trough 52 does not occupy the entire top of the block 50 but terminates at an intermediate point in a raised portion leading to a second and smaller concavity 54 in alignment with the end of the channel 46 in the block 44. Back of the concavity 54 is a rearwardly and downwardly inclined surface 56 leading to a chute 58 suspended over the bowl 32.

The purpose of the inclined surface 56 and the chute 58 is to provide a path for the return of excess filaments 60. They drop into the bowl 32 and in the course of time are again caused to travel up the ramp into the delivery channel 38. Bolted to the front face of the block 52 is a plate 62 which hangs below the block 50. A vertical plate 64 is bolted to a bracket 63 secured to the frame 14 (see FIGS. 4 and 5). The vertical plate 64 carries a stop bolt 66 which may be screwed in or out to bear upon the inner surface of the plate 62. A tension spring 65 connects plate 62 with plate 64 to hold the plate 62 firmly against the end of the bolt 66.

It will now be observed that the blocks 44 and 50 are securely bolted together and are mounted upon the bowl 32 by means of the leaf spring 48 in such fashion that the leaf spring, in combination with bolt 66 and spring 65, will substantially eliminate lateral vibration of the blocks 44 and 50. The bolt 66 provides a means for adjusting the location of trough 52 with reference to the gripping fingers 74. It has been found that the controlled vibration of the blocks, thus brought about, is effective to impart to the filaments, travelling through the channel 46 and onto the concave portion 54 of the block 50, a motion which is largely axial translation as the result of the vibratory movement of the bowl 32. The horizontal vibration of the block 50 is such that it is just sufficient to nudge filaments into the trough 52 until it is substantially filled. Thereafter the combination of the horizontal vibration of the block 50 and the contact upon filaments already in the trough 52 is effective to deflect excess filaments across inclined surface 56 and onto chute 58.

We now come to the structure employed to pick up filaments from the trough or reservoir 52. As will be seen in FIGS. 4 and 5, a slot 72 is milled in the interior surface of the trough 52 adjacent the end farthest away from the delivery channel 46. The slot accommodates an assembly of gripping fingers 74 best shown in FIGS. 7, 8 and 9 and including a pair of finger members 76 integral with a common shank portion 77 and accommodating between them a third finger 78 provided at its extremity with saw teeth 80 cut in the end of a strip 82 inset in the extreme end of the finger. Here it should be explained that the representation of the fingers in FIG. 9 is very greatly enlarged, as will be evident from the fact that the space between the teeth should be not more than 1½ times the diameter of the filament to be gripped; the machine has successfully been operated on filaments as small as .0035" in diameter.

The finger 78 is clamped between a pair of blocks 84 which are parts of an integral structure including a plate 88. The blocks 84 are provided with screws 85 which serve to clamp the finger 78 in place, as well as with a pivot 86 on which the fingers 76 are hung. The upper end of the shank 77 of the fingers 76 is provided with a hook 89 secured to one end of a spring 90 which passes through

a bore in the plate 88; the inner end of the spring 90 is secured to a threaded rod 91 carrying lock nuts 92 by means of which the tension on the spring 90 may be regulated. The plate 88 is also provided with an opening which receives a pivot pin 94 on which is mounted a T-shaped cam member 96 which engages at its center with a cam surface 98 cut into the rear portion of the shank 77 of the finger 76. As the cam 96 moves upwardly and away from the cam surface 98 the spring 90 moves the finger 76 to the left as shown in FIG. 9, toward closed position. The closing of the fingers takes place when the assembly 74 of the gripping fingers has been moved into the slot 72 at the end of the trough 52. If the end of a filament is trapped in the right hand tooth, the fingers 76 come to a stop, the spring 90 serving to exert gripping force of the fingers 76 against the filament trapped in the right hand tooth. If it happens that no filament is lodged in the right hand tooth, the fingers 76 will continue their travel across the teeth and grip a filament lodged in the second or left hand tooth, referring to FIG. 9. Although it would of course be possible to increase the number of teeth, it has been found that as a practical matter that two teeth are sufficient, since the gripping fingers always seem to find a filament lodged in one or the other of the teeth.

The upper end of the plate 88 is split and bored to receive the lower end of a rod 100 clamped in the split end of the plate 88 by means of a bolt 102. The rod 100 passes through a bushing 106 mounted in an inclined bore in a carriage 104. The rod 100 is provided with an elongated milled slot 108 into which projects a pin 110 carried mounted in a bore in the carriage 104 and passing through a corresponding hole in the bushing 106. The rod 100 projects entirely through the carriage 104 and carries a compression spring 112 interposed between the upper end of the bushing 106 and a cap member 114 mounted on the upper end of the rod 100 and serving to retain a steel ball 116 freely rotatable in the cap 114 and bearing against the lower surface of an L-shaped elongated plate 118. The plate 118 is mounted to rock upon a shaft 120 journalled at each end in a U-shaped frame member 122 secured to the main frame 14. The carriage 104 is slidably mounted on a pair of parallel rods 124 and 126 both of which are parallel to the long axis of the trough 52, for instance see FIG. 1.

Adjacent the left hand end of the frame 122 as viewed in FIG. 1 there is a socket 128 serving to receive the upper end of an inclined turnbuckle 130 in the lower end of which is mounted one end of a rock shaft 136 which carries a block 132 in which is clamped an elongated finger 134 disposed in position to encounter the cam 96 when the carriage and gripping fingers are moved to the extreme right opposite the slot 72 in the trough 52.

It will now be observed that when the carriage 104 has been moved to the position shown in FIG. 1 the plate 118 may be moved downwardly to move the gripping fingers 76 and 78 into the slot 72, the fingers then being opened as shown in FIG. 9. The shaft 136 may then be rocked to cause the finger 134 to encounter the cam 98 and flick it upwardly to the position shown in FIG. 4, at which time the fingers are closed to grip the end of a single filament lying in the trough 52. As will later be explained, the plate 118 is then lifted to permit the spring 112 to lift the gripping finger assembly 74 out of the trough 52. The mechanism for reciprocating the carriage 104 will now be described.

Secured to the carriage 104 is a yoke 138 carrying a pivot pin engaging one end of a pull rod 140 pivotally connected at its other end to a vertically disposed arm 142 of a bell crank lever pivotally mounted on the main frame 14 (see FIG. 2). The other arm of the bell crank lever 142 is substantially horizontally disposed and connected to the upper end of a vertically disposed rod 144 extending to the lower portion of the machine, just above the base 10, where it is in turn pivotally connected to one arm of a bell crank lever 148 having a journal 149

mounted on a shaft 153. The other arm of the bell crank lever 148 carries a roller cam follower 150 bearing on the surface of a cam 152 fixed to a shaft 154. A tension spring 151 is connected at one end to the bell crank lever 148 and its upper end to the pedestal 12, thus urging the cam follower into engagement with the cam 152. Through the linkages just described, rotation of the cam 152 is effective to reciprocate the carriage 104 at desired times and rates.

It will now be appropriate to describe the mechanism utilized for actuation of the plate 118. One end of the rock shaft 120 projects through the frame 122 and carries at its end a slotted plate 160 on which is pivotally mounted the upper end of a vertically disposed rod 162 pivotally connected at its lower end to one arm 166 of a bell crank lever also journalled on the shaft 153 and having another arm 168 terminating in a roller cam follower 170 bearing on the surface of the cam 172 also fixed on the shaft 154. A spring 174 is connected at its lower end to the extremity of the arm 166 of the bell crank lever and at its upper end to the base of the main frame 14. Through the linkages just described, the plate 118 is rocked to raise and lower the assembly of gripping fingers 74.

The device has now been described insofar as it relates to the feeding of the filaments into the trough and the removal of the filaments from the trough. It remains to describe the transfer of the filaments into the receiver of the lamp stem assembly machine. The receiver itself forms no part of the invention and is illustrated here diagrammatically at 210 in FIG. 1. For the details of the receiver we refer to the Maloney Patent No. 2,597,-354, partcularly FIG. 7 thereof. For our present purposes t is sufficient to say that the receiver includes a pair of posts 212 each of which is provided at its upper end with a groove dimensioned to accommodate a filament. The assembly upon which the posts 212 are mounted is operated in conjunction with a lamp stem-assembly machine as described in the Maloney patent, and it is the purpose of the present invention to provide a suitable device for depositing filaments into position upon the grooved upper ends of the posts 212.

It will be observed that the grooves in the posts 212 are in alignment and also in alignment with the long axis of the trough 52. There has been described the mechanism by means of which a filament may be picked from the trough 52 by the fingers 74. After the fingers 74 have been lifted and the carriage 104 reciprocated to the right as shown in FIG. 1, the fingers 74 reach a position opposite the right hand post 212. The plate 118 is thereupon actuated downwardly to lower the finger assembly toward the right hand post 212, and it is thereupon necessary that the fingers be opened to release the filament thus conveyed into position. To this end the rock shaft 136 is provided adjacent its right hand end with a block 180 (FIG. 7) carrying a finger 182 poised to intercept the T-shaped cam 96 and move it down against the cam surface 98 on the shank 77 and the fingers 76 and thereby open the fingers to the position shown in FIG. 9.

It will now be appropriate to describe the mechanism utilized to actuate the rock shaft 136 for operation of the cam 96. Fast upon the shaft 136 is a slotted lever 186 which is pivotally connected to a rod 188 connected at its lower end to one arm of a bell crank lever 190 pivotally mounted on a stub shaft secured to the frame 14. The other arm of the bell crank lever 190 is pivotally connected to a vertical rod 192 connected at its lower end to a bell crank lever 194 having a collar 198 journalled on a stub shaft 200 fixed to the pedestal 12. The lever 194 also carries a cam follower (not shown) bearing on a cam 196 also journalled on the shaft 154. The mechanism just described is effective to rock the shaft 136 at timed intervals to actuate the fingers 134 and 182 which operate to open and close the gripping fingers 76 and 78.

In the operation of the machine the vibratory bowl feeder discharges filaments 42 successively into the channel 46 of the block 44 and from there either into the trough 52 or into the return chute 58 depending upon the number of filaments momentarily stored in the trough or reservoir 52. The carriage 104 is brought to its left hand position by means of the rod 140, and the plate 118 is then rocked downwardly to advance the open gripping finger assembly 74 into the slot 72 whereupon a filament becomes lodged in one of the teeth 80. Then the shaft 136 is rocked to cause the finger 134 to flip the T-shaped cam 96 upwardly so that a spring 90 may move the fingers 76 across the teeth 80, thus trapping and gripping a filament in one or the other of the two teeth. Subsequently the plate 118 is rocked upwardly so that the spring 112 will retract the gripping finger assembly 74. Then the rod 140 pulls the carriage to the right, as viewed in FIG. 1. It will be remembered that the gripping fingers 74 have grasped the filament by its end; as the carriage moves, the filament trails behind the gripping fingers, no support being required. In the course of such movement the trailing portion of the filament first encounters the groove in the left hand post 212 on the receiver 210 and slides along in the groove until the carriage has moved the fingers to a position just to the right of the right hand post 212. After the carriage has stopped at its extreme right hand position, the plate 118 is then rocked downwardly so that the gripping fingers advance until their extremities are in proper alignment with the groove of the right hand post 212. When the fingers have stopped in that position, the shaft 136 is rocked downwardly to flip the cam 96 down and thereby open the fingers, thus depositing the filament in a position where it is supported in the grooves of the two posts 212. Subsequently the plate 118 is rocked upwardly to cause retraction of the gripping finger assembly 74; the carriage is pushed back to its left hand position whereupon the plate 118 again moves the gripping finger assembly down until it enters the slot 72 in the trough 52 to pick up another filament.

The advantages of the above described device will be readily apparent to those skilled in the art. In the first place it is totally unnecessary to manipulate the filaments by hand; even the loading of the trough or reservoir is automatic. It is unnecessary to provide means for supporting the entire body of the filament as it is moved from the trough to the receiver; the mode of operation involving gripping the filaments at one extremity and permitting the body of the filament to trail behind is made possible by the axial alignment of the trough and the receiver, thus permitting essentially straight line movement of the filaments in axial translation. All these and other advantages result in a great improvement in operating efficiency and economy as well as in increased speed of production.

Having now described and illustrated a preferred embodiment of our invention what we claim as new and desire to secure by Letters Patent of the United States is:

1. A filament transfer device comprising an elongated trough adapted to contain a limited quantity of limp filaments extending along a long axis of said trough, a receiver spaced from and in substantial alignment with said axis, said receiver having jaws extending transversely to said axis for receiving a filament therein, a carriage mounted to slide through a path parallel to the long axis of the trough and receiver, gripping fingers mounted for movement on said carriage from the path thereof toward and away from said trough and receiver, and cam-operated mechanism operating in timed relation first to slide the gripping fingers into the trough and therein gripping one end of a limp filament, then

retract the fingers, slide the carriage from the trough to the receiver, said filament being thereby dragged to the receiver and aligned with it, slide the fingers toward the receiver and then release the filament into said jaws.

2. A filament transfer device comprising an elongated trough adapted to receive a quantity of elongated filaments with the long axes thereof aligned with a long axis of said trough, a receiver spaced from and in substantial alignment with said long axis, said receiver having jaws extending transversely to said axis for receiving a filament therein, a carriage mounted to slide through a path parallel to the long axis of the trough and receiver, gripping fingers mounted for movement on said carriage from the path thereof toward and away from said trough and receiver, cam-operated mechanism operating in timed relation first to slide the gripping fingers into the trough, then retract the fingers, slide the carriage from the trough to the receiver, and then slide the fingers toward the receiver, and further cam-operated mechanism for closing said gripping fingers about one end of a filament after they enter the trough and for opening them after the fingers have been moved toward said receiver to deposit the filament in said jaws, said filament being thereby trailed in a self-aligning manner from said trough to said receiver.

3. A filament feeding machine comprising a trough for receiving a group of filaments, means for feeding filaments successively into said trough with the long axes thereof aligned with a long axis of said trough, a receiver spaced from said trough and in substantial alignment with the long axis thereof, said receiver having jaws extending transversely to said axis for receiving a filament therein, gripping fingers, a carriage mounted to slide parallel to said trough, means mounting said gripping fingers for reciprocation on said carriage, means for opening and closing said fingers, said fingers provided with means to select and grasp a single filament from a group of filaments, and drive mechanism operating in timed relation for reciprocating said gripping fingers into said trough, closing the said fingers, retracting said fingers, sliding the carriage, reciprocating said fingers toward the receiver and opening the fingers to deposit a filament in said jaws.

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