Nov. 22, 1932. C. A. MATSON 1,888,429

LACE TIPPING MACHINE

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Fig. 1.

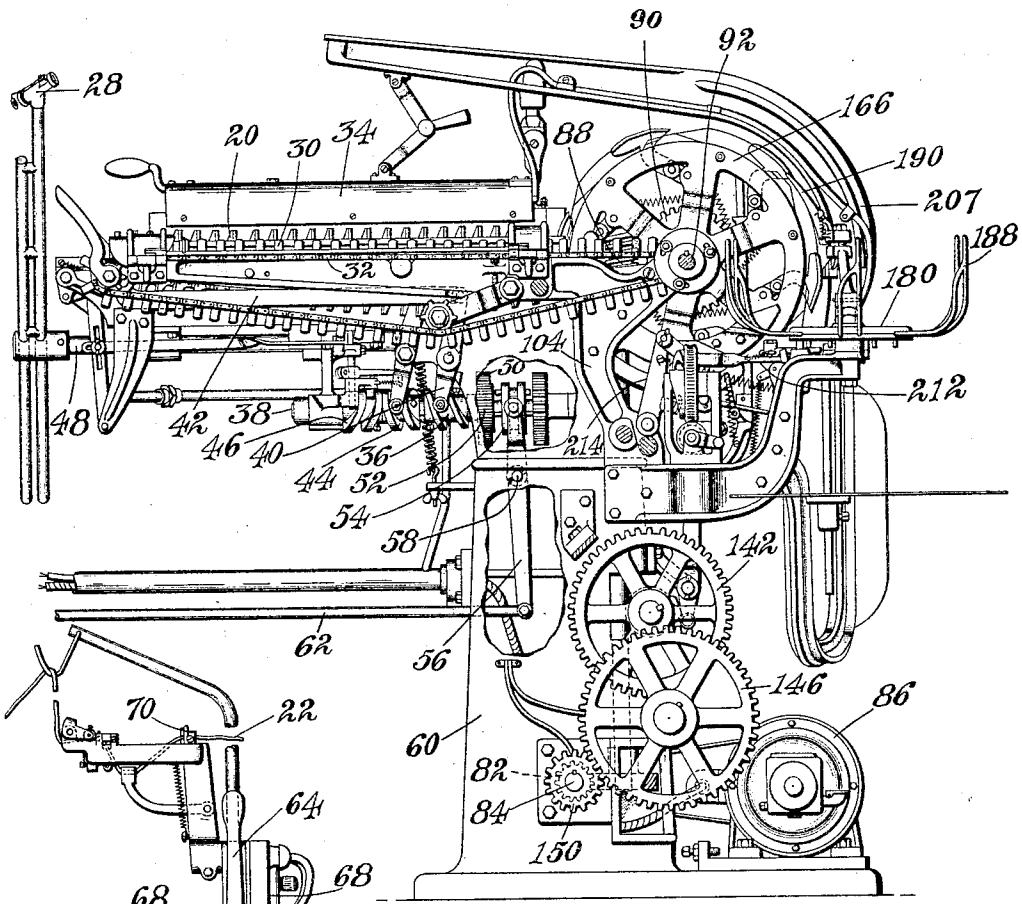



Fig. 2.

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LACE TIPPING MACHINE

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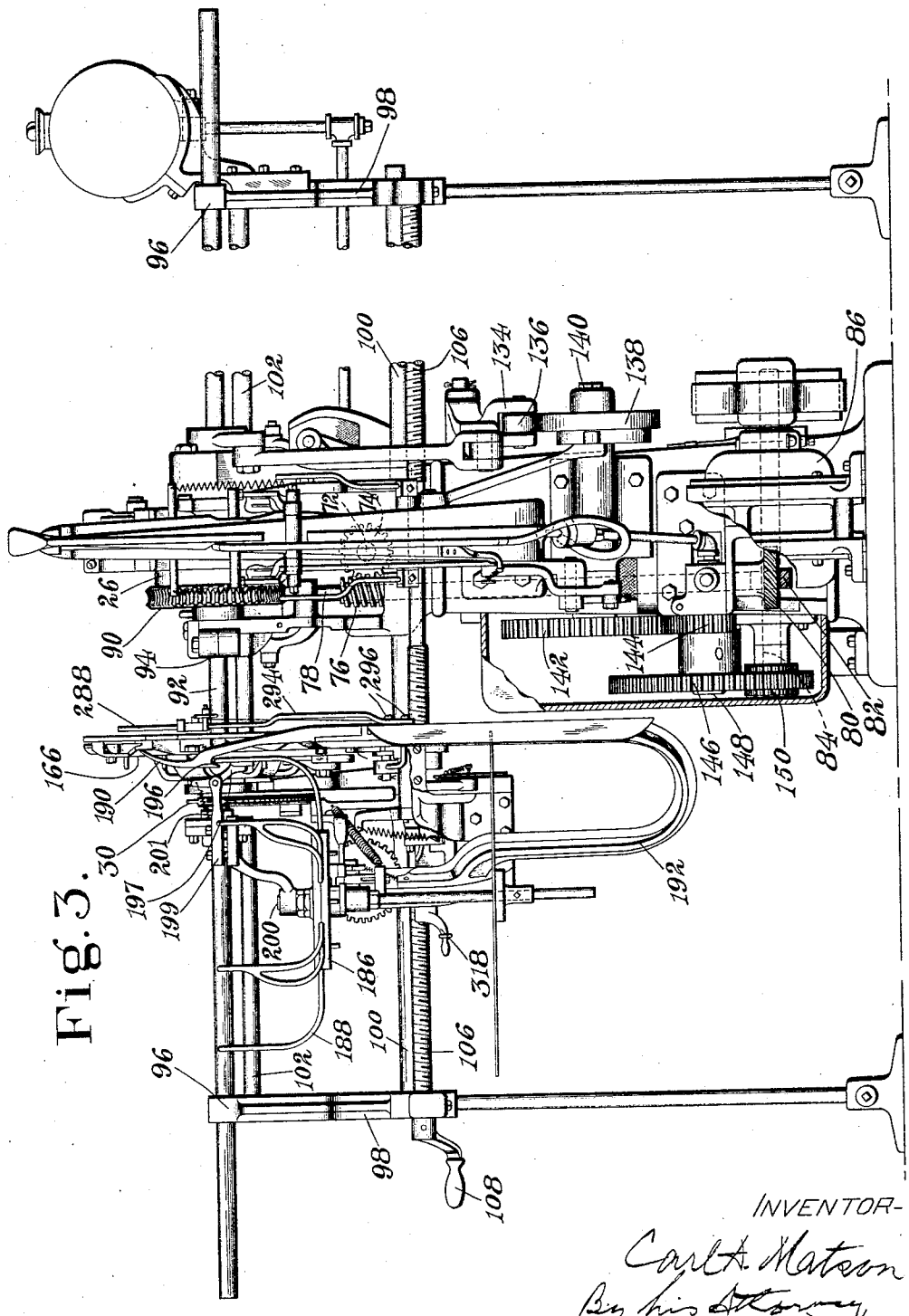



Fig. 3.

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LACE TIPPING MACHINE

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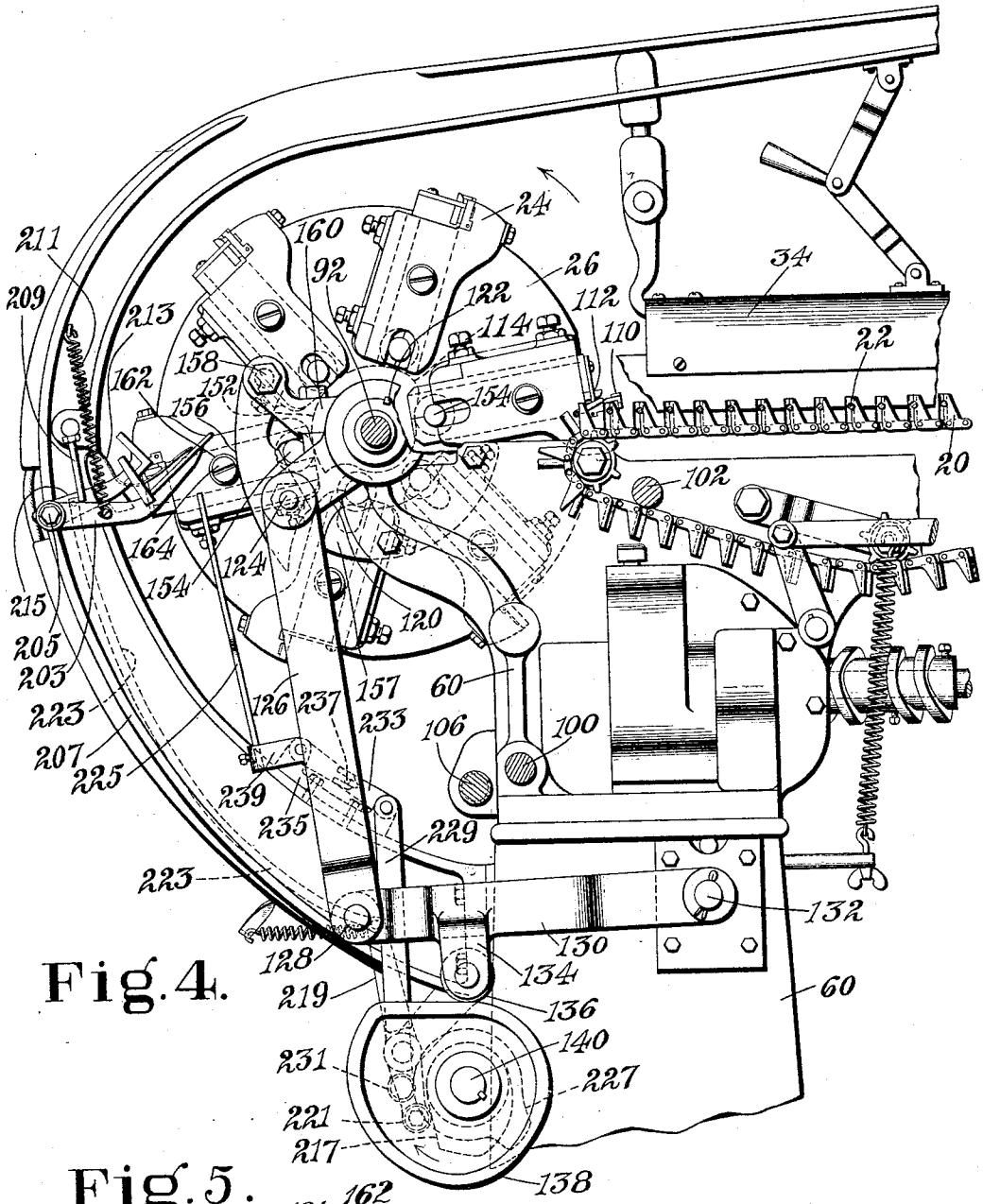



Fig. 4.

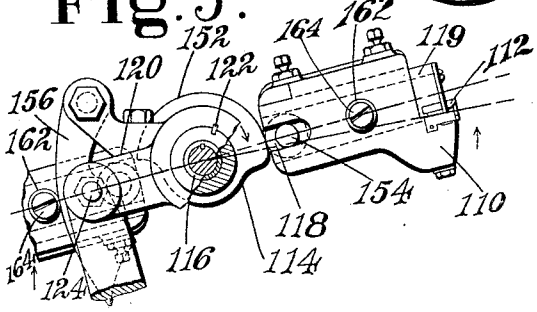



Fig. 5.

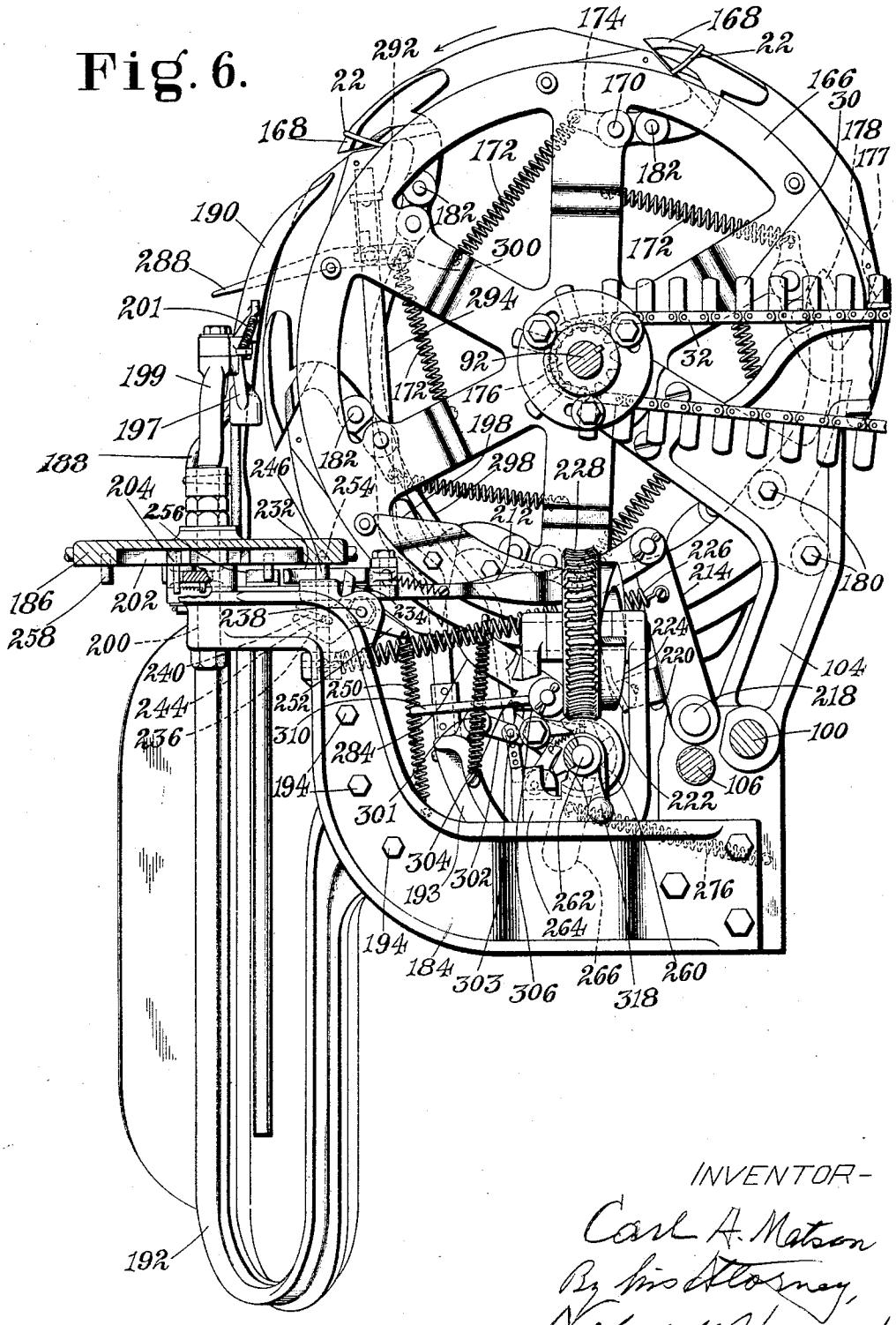
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LACE TIPPING MACHINE

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Fig. 6.




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LACE TIPPING MACHINE

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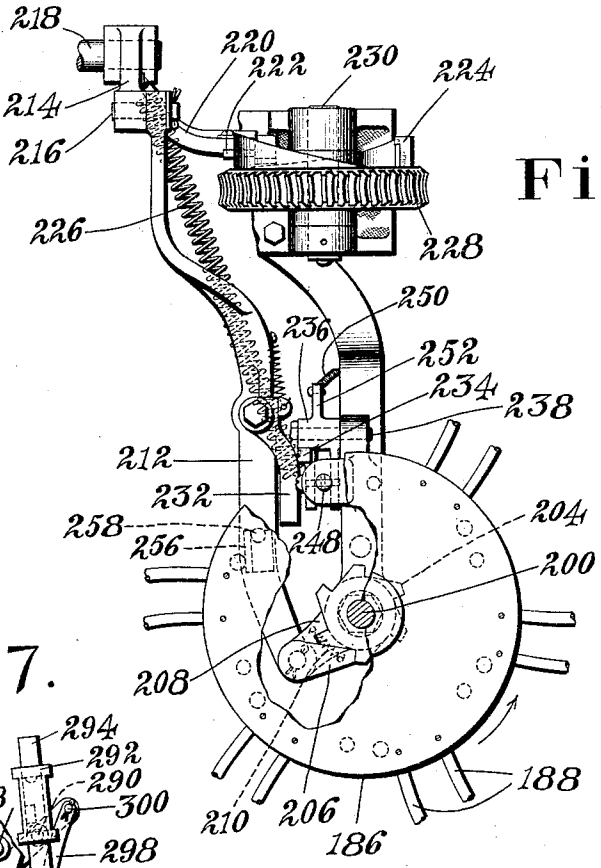
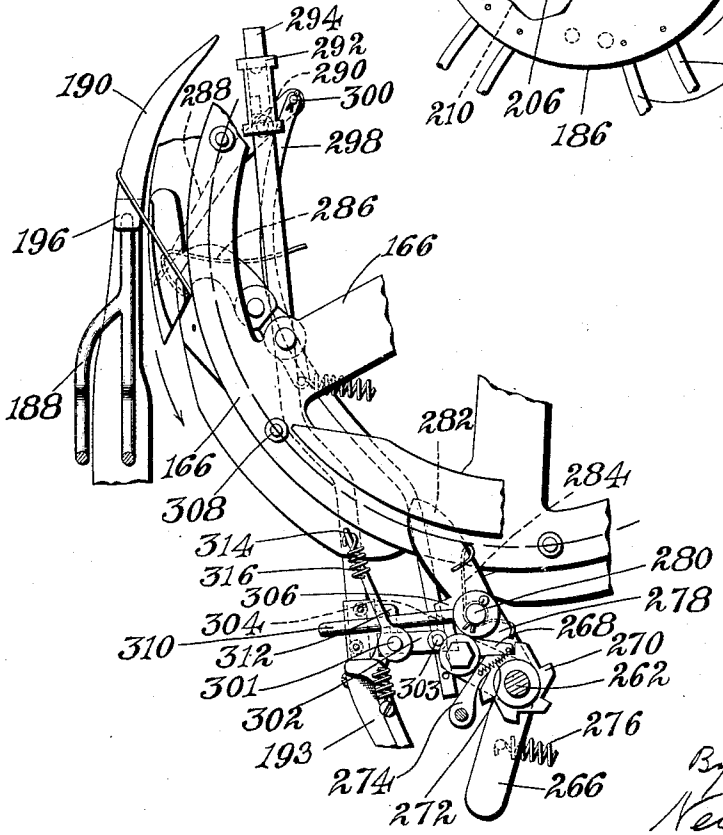



Fig. 8.

Fig. 7.




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LACE TIPPING MACHINE

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Fig. 9.

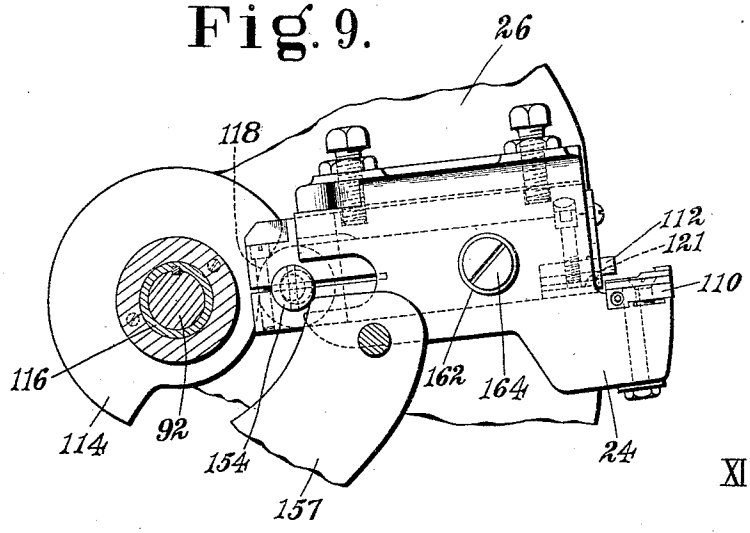



Fig. 10.

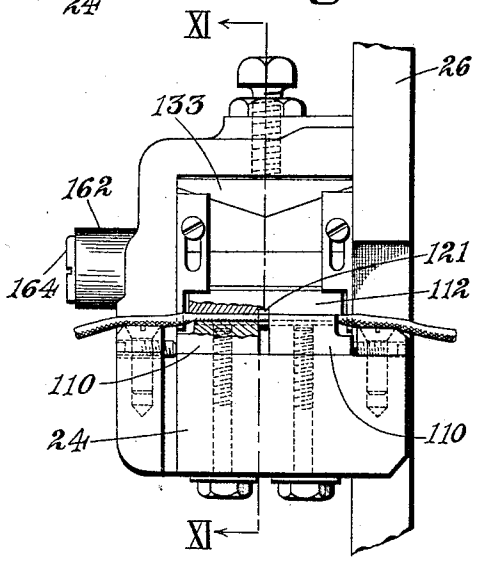



Fig. 12.

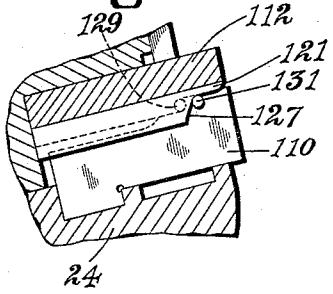
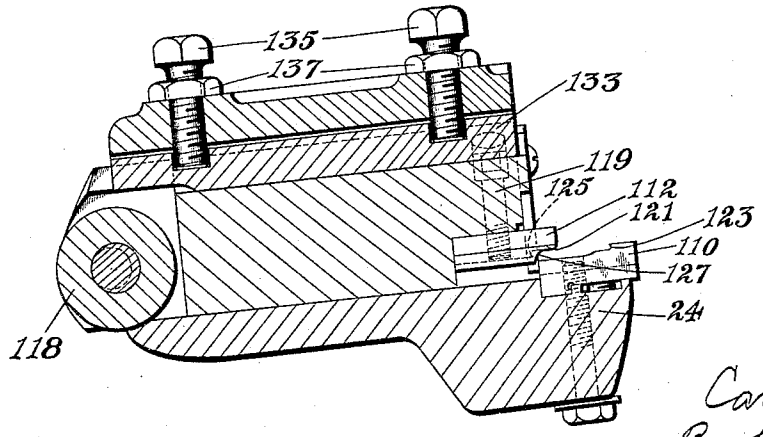



Fig. 11.




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# UNITED STATES PATENT OFFICE

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## LACE TIPPING MACHINE

Application filed March 15, 1929. Serial No. 347,424.

This invention relates to lace tipping machines and is illustrated as embodied in a machine of the type disclosed in United States Letters Patent No. 1,594,971 and No. 1,605,965, granted on August 3, 1926, and November 9, 1926, respectively, on my applications.

In the machines disclosed in the above-mentioned patents, a continuous length of lacing is formed into a series of loops which are intermittently and successively moved on a conveyor into a position herein termed a "receiving" position in which a portion of the lacing having previously been treated intermediate between the vertices of the loops with a moldable material is presented to a mechanism for molding the treated portion and for severing it at its mid point to cut a finished lace from the continuous length of lacing. The molding mechanism comprises a plurality of dies which are mounted on a rotating carrier and which are carried successively into engagement with and closed about successive strands of lacing to effect the formation of tips thereon by a relatively fixed cam about which the die mechanism rotates. The dies are held closed throughout a part of a revolution and are then opened to release the lace tips and to permit the discharge of the laces at what is termed herein their "discharge" position.

On account of the relatively large amount of pressure required to mold the lace tips, the operating parts of the dies must have great strength. Therefore, as illustrated in the above-mentioned patents, the movable elements of the dies including their roll followers which engage with a cam for closing the dies as they rotate about the cam are relatively large. Moreover, for the sake of smoothness in the operation of the machine, that portion of the cam surface which causes the dies to be closed should have a larger radius of curvature than that of the roll followers. The minimum angle through which the dies may move with respect to the cam in order that they shall be completely closed is therefore determined to a large extent by the diameter of the roll followers, and it is apparent that the greater the diameter of the rolls, the greater will be the angle through which the dies pass while closing, and the shorter the period during which the dies can be held closed to mold a lace tip.

If, in order to provide a rapid closing of the dies, the operating face of the cam is relatively steep, there results considerable side pressure in the guideways for the movable elements of the dies causing excessive friction and wear and hence the likelihood of misalinement of the elements of the dies. On the other hand, if the face of the cam which is operated to close the dies has a relatively slight inclination to obviate the above difficulties, the angle through which the dies must rotate in order to be completely closed would be so great as to reduce the molding period to such an extent that it would be necessary to run the machine at an uneconomically low speed in order to provide an adequate molding period.

In view of the above prerequisites of construction and in order to provide a high-speed machine in which lace tips of superior quality may be molded, an object of the invention is to provide an improved lace tipping machine so organized that the tip-molding period extends through a much greater part of the cycle of operation of the die mechanism than it has heretofore. In accordance with this object, an important feature of the invention is constituted by the combination with a tip molding die mounted for movement between lace receiving and discharge positions, and die operating means for closing and opening said die to effect the molding of a lace tip therein, of means for moving the die operating means in a direction opposite to that of the movement of the die to close it, the last-mentioned means also being constructed and arranged to return the die operating means to its original position. To insure against the die being opened as the die operating means is returned to its original position, the die operating means as embodied in the machine illustrated herein is returned to its original position at a speed slower than that of the die. Preferably, and as shown herein, the die operating means comprises a cam which is moved quickly as

soon as the lace to be molded has been fed to the die in order further to insure a relatively rapid closing of the die. This movement is derived from connections with a driving cam which is operatively connected with the means for driving the lace conveying means. The driving cam is also of such shape that the operating cam is retracted gradually to its initial position by the time that the lace-tip molding die will have again reached the lace receiving position.

As laces are finished by the machine in which the invention is illustrated as embodied, they are deposited on a collecting means comprising a plurality of lace holders, a predetermined number of laces being collected on each holder. A further and important object of the invention is to provide improved mechanism for causing the collecting means to be operated after a predetermined number of laces has been transferred to one of the holders in order to bring an empty holder into a position in which it may receive laces as their tips are removed from the tipping device. To this end, the illustrated machine, which comprises a tipping device, a lace collecting means, means for operating said collecting means, and means for transferring laces from the tipping device to the collecting means, is provided also with means controlled by the laces for causing the transferring means to actuate the above-mentioned operating means. As a result of the use of such a construction a very light pressure of a lace against one element of the mechanism will cause a positive driving connection to be established between the means which transfers laces to the holders on the collecting means and the means for rotating the holders after the desired predetermined number of laces has been received on one of them, thereby insuring an accurate count of the collected laces.

In the drawings,

Fig. 1 is a side elevation of a machine in which the invention is embodied;

Fig. 2 is a side elevation of a control apparatus for the machine shown in Fig. 1;

Fig. 3 is a rear elevation with parts removed;

Fig. 4 is a sectional side elevation of the tip molding die mechanism;

Fig. 5 is an elevation with parts in section illustrating the means for closing and opening the tip molding dies;

Fig. 6 is a side elevation of the mechanism for collecting the counting finished laces;

Fig. 7 is a side elevation of a portion of the mechanism illustrated in Fig. 6 showing a lace being transferred to the collecting means;

Fig. 8 is a plan view with parts broken away of a part of the mechanism shown in Fig. 6 for operating the collecting means;

Fig. 9 is a side elevation showing a die and a part of its operating means;

Fig. 10 is an end elevation of the die shown in Fig. 9;

Fig. 11 is a sectional elevation taken along the line XI—XI of Fig. 10; and

Fig. 12 is an enlarged section of the molding elements of the die in closed position taken along the line XI—XI of Fig. 10.

The machine herein illustrated comprises a pair of spaced feed chains 20 (Figs. 1 and 4) which are intermittently moved to bring loops of lacing material 22 previously supplied thereto into position to be received by tip-molding dies 24 (Fig. 4) which are mounted on a continuously rotating carrier 26, one feed chain 20 being at each side of the carrier 26. The lacing 22 is supplied to the feed chains by means of an oscillating arm 28 which leads it over lugs 30 on a pair of loop forming chains 32 at opposite sides of the machine. The lugs on the loop forming chains 32 form the vertices of the loops of lacing the central portions of which are grasped at either side of their center and outside of the dies by the feed chains 20. The loop forming chains 32 are driven at a constant rate through connections with the mechanism for driving the die carrier 26.

For a detailed description of the manner in which a continuous length of lacing is fed to the illustrated machine in loops, reference may be had to the above Letters Patent No. 1,594,971 disclosing a machine which, in the above respect, operates similarly to that in which the present invention is embodied.

Mechanism is provided at the location where the lacing is supplied to the feed chains 20 for applying a molding compound to a portion of each loop of lacing intermediate between the feed chains 32, and between this location and that in which the dies operate to form lace tips is a pre-treating zone created by a heating unit 34 which partially sets the molding composition on the laces, thereby facilitating the molding operation. The feed chains 32 are intermittently driven by a ratchet mechanism, operated by a cam 36 (Fig. 1) fixed to a rotatable shaft 38, by means of connections comprising a lever 40 associated with the cam and a link 42 connecting the lever with the ratchet mechanism. Cams 44 and 46 operate means for supplying molding material at the mid portion of the loops of lacing, as more fully shown and described in the above-mentioned Letters Patent. The arm 28 is adjustably fixed on the end of a shaft 48 which is constructed and arranged to be oscillated by connections (not shown) comprising a gear 50 which meshes with a gear 52 loose upon the shaft 38. A clutch 54 is splined to the shaft 38 and may be moved into or out of engagement with the gear 52 to connect the apparatus for oscillating the arm 28 with or disconnect it from

the feed chain driving mechanism. The clutch is operated by means of a lever 56 the upper forked end of which engages a peripheral groove in the clutch. The lever 56 is fulcrumed on a pin 58 in a frame 60 and is connected at its lower end by a link 62 to a control lever 64 (Fig. 2) by means of which the clutch may be operated with ease by the operator of the machine. The control lever 64 is pivotally mounted on a stand 66 which supports the electrical starting and cut-out equipment 68 as well as a mechanism 70 for severing the lacing in case imperfections in the form of knots or enlarged portions occur in the lace. The severing mechanism operates to sever the lacing and simultaneously to shut off the power, as fully described in the above-mentioned Letters Patent No. 1,605,965, before a knotted or otherwise imperfect portion of the lace reaches the arm 28.

The shaft 38 is driven at a relatively slow speed by a reduction gearing (not shown) operated from a shaft 72 (Fig. 3) to one end of which is attached a worm wheel 74 which meshes with a worm 76 on an upright driving shaft 78 journaled in the frame 60. At its lower end the drive shaft 78 is provided with a skew gear 80 meshing with a similar gear 82 on a shaft 84 horizontally journaled in the frame and which may be connected in any suitable manner to a source of power such as a motor 86.

Continuous rotation is imparted to the die carrier 26 by means of a worm 88 (Fig. 1) integral with the upper end of the drive shaft 78. A worm gear 90 meshing with the worm 88 is fixed to one side of the carrier and is also keyed to a shaft 92 (Fig. 3) rotatably supported in bearings 94 at either side of the carrier and also in the outer bearings 96 in the standards 98 one of which is at each side of the machine. The standards 98 are alined and fixed with respect to the frame 60 by means of rods 100 and 102. The rods 100 and 102 also provide guides for supports 104 (Fig. 6) one at each side of the machine on each of which is mounted means for removing finished laces from the loop forming and feed chains and means for collecting and counting the finished laces. Since the distance between the loop forming chains determines the length of lacing being made in the machine, it is necessary that means be provided for conveniently adjusting laterally the position of the loop forming chains. To this end, the supports 104, the position of which determines the lateral position of the loop forming chains, may be moved longitudinally along the guide rods 100 and 102 and the shaft 92 by means of a screw 106 which extends from one standard 98 to the other and which has a left-hand thread on one side of the machine and a right-hand thread on the other, so that the supports 104 at either side of the machine are moved an equal amount but in opposite directions whenever the screw 106 is turned. To facilitate the operation of the screw 106 a hand crank 108 is fixed to one end thereof.

The above features of construction have been completely described in the above-mentioned Letters Patent and reference may be had thereto for a more detailed description of those parts of the present machine.

In the illustrated machine the rotation of the dies and the intermittent motion of the feed chains are so correlated that successive dies operate on successive strands of lacing held by the feed chains as the dies reach the receiving position, which is that occupied by that die in Fig. 4 shown as about to remove a lacing from the feed chains. Each die comprises a molding element 110 (Fig. 11) fixed relatively to the carrier 26, and a relatively movable molding element 112, which elements are held in closed position, or that position in which the molding elements are operatively associated to form a lace tip on the lacing material held therebetween, while the dies rotate from their receiving position to their discharge position or that occupied by the die, as herein shown, diametrically opposite to the die at the lace receiving position. At the discharge position the molding elements of the dies are separated to release the lace upon which a tip has been molded.

In order to close the dies, they are rotated about a cam 114 (Figs. 5 and 9) which is rotatably mounted on a bushing 116 keyed to the shaft 92. Roll followers 118 engage the operating face of the cam and are mounted on the inner ends of the supports 119 for the movable elements 112 of the dies. When a die is in receiving position the cam 114 and the follower are in the position shown in Figs. 4 and 9 and it is apparent that, on account of the counterclockwise direction of rotation of the carrier, the die which is in receiving position will be closed as its follower passes the eccentric portion of the cam face. In order to accelerate the closing of the dies, the cam 114 which is rotatably mounted on the shaft 92, is rotated quickly through a relatively small angle in a direction opposite to that of the rotation of the carrier by mechanism which will next be described.

Each of the illustrated relatively fixed molding elements 110 is composed of two parts separated sufficiently to allow a knife 121 to slide therebetween. The knife is fixed in a recess in the relatively movable element of the die 112. The rounded form of the completed lace tips is imparted thereto by cooperating curved faces 123 and 125 on the relatively fixed and movable die elements respectively. When the dies are closed the space included between the cooperating curved walls 123 and 125 of the die is sub-

stantially cylindrical, which shape is therefore imparted to the molded tip which occupies that space. As illustrated in Figs. 11 and 12, the shearing portion 127 of the knife 121 is disposed slightly in advance of the curved face 125 of the relatively movable die member which supports the knife. As shown in Fig. 12, the shearing edge 127 of the knife is sufficiently advanced with respect to the molding face of the movable die element 112 that when the dies have been closed the shearing edge 127 of the knife will have passed the curved molding face 123 of the relatively fixed element 110, thereby shearing a small portion of the lace, equal in length to the width of the knife, from the center of the molded portion of the lace, thereby forming two completed tips therefrom. In Fig. 12, 129 indicates the position of the molded lace tips in the dies when closed, and 131 indicates the position of the severed portion of the lace. A running fit between the support 119 and the die 24 is insured by the proper adjustment of a gib 133 by means of set screws 135 which may be locked to the die 24 in adjusted position by nuts 137.

An arm 120 (Fig. 4) is fixed by means of a key 122 to the hub of the cam 114 and is pivotally connected by means of a bolt 124 to a link 126 which is also pivoted by means of a pin 128 to the outer end of a lever 130 fulcrumed to the frame 60 on a stub shaft 132. Between the ends of the lever 130 is a pair of depending arms 134 between which is mounted a roll cam follower 136 which engages the face of a cam 138 keyed to a shaft 140 rotatably mounted in the frame 60. In order that the cam 114 shall be operated in synchronism with the movement of the feed chains the shaft 140 is positively connected to the drive shaft 78 which also operates mechanism for driving the feed chains, as above described. This connection comprises a gear 142 (Fig. 3) fixed to the end of the shaft 140 remote from the cam 138 and arranged to mesh with a pinion 144 which is integral with the hub of a gear 146 rotatably mounted on a stub shaft 148 fixed in the frame. The gear 146 meshes with a pinion 150 keyed to the shaft 84 which also provides power for the drive shaft 78 through the skew gears 80 and 82 as above described.

It may be noted that upon further operation of the machine from that position in which the parts are shown in Fig. 4, the cam 114 will be rotated in a clockwise direction by the mechanism above described, thereby tending to close the dies at the receiving point irrespective of the movement of the dies about the shaft 92, and that bodily movement of the dies about the shaft 92, and hence about the driving cam 114, will also tend to close the dies irrespective of the movement of the cam. Since the rotation of the cam and that of the carrier for the dies are simultaneous and in opposite directions, each movement augmenting the effect of the other to close the dies, the angle through which the carrier must rotate before the dies are permitted to close is appreciable reduced. Thus a relatively long molding period is insured since the dies are closed with great rapidity as soon as a lace has been fed thereto. In order that the dies shall be held closed between their receiving and discharging positions, the operating cam 114 is provided with a face 152 which is concentric with the shaft 92 about which the cam 114 and the die carrier 26 rotate.

In order to separate the dies at the discharging position, each movable element thereof is provided with a pin 154 which engages the inner edge of a wedge 156 pivotally mounted on a bolt 158 fixed in an extension of a cap 160 for one of the bearings 94. As the die carrier brings a die to the discharging position, a roll 162 mounted on a screw 164 carried by the relatively fixed part of the die engages the outer face of the wedge 156, providing a temporary abutment therefor. As the die rotates past the wedge, the latter's inner face engages the pin 154 which is moved inwardly, carrying with it the movable element of the die to an extent determined by the proportions of the wedge. Just before the wedge 156 operates to separate the elements of the die which is in discharging position, the operating cam 114 has been moved to close the die which is in receiving position. This movement carries the concentric portion of the cam 114, which holds closed the dies that are between receiving and discharging position, past the follower 18 of the die which is in discharging position so that it is free to be moved inwardly by the wedge 156 as above described, thereby releasing the tips on one end of each of two laces. Shortly after the pin 154 passes off the wedge 156 it engages with a cam plate 157 fixed to the frame, which cam plate retracts the movable die element to its extreme inner position, that position in which it is illustrated in Fig. 9, and holds it there until the die leaves the lace receiving position.

It may be noted that the driving cam 138 is so proportioned as to rotate the operating cam 114 to close the dies quickly. In other words, the cam 138, as illustrated, need be rotated substantially only one eighth of a revolution in order to operate the cam 114 to close the dies, while it must be rotated substantially one half a revolution in the same direction before the operating cam 114 shall have been retracted to the position in which it is shown in relation to the die in feeding position (Fig. 4). The retractive movement of the illustrated cam 114 is necessarily in the same direction as the rotation of the carrier but is at a slower rate in order that the

die last closed shall remain closed until it reaches its discharging position.

As also illustrated in the above-mentioned Letters Patent No. 1,594,971, a pair of wheels 166 fast upon the shaft 92 are associated with the supports 104 (one of these wheels being shown in Fig. 6), and are constructed and arranged to grasp the lace at the inner side of the loop forming chains 32 near the vertices of the loops in order to support the laces in conjunction with the dies as the laces are removed from the loop forming and feed chains. A series of clamps, one for each die, are pivotally mounted on each of the wheels 166 on pins 170 and are resiliently held normally to clamp a lace against the wheel 166 by means of springs 172 attached to extensions 174 of the clamps 168. The wheels 166 are splined to the shaft 92 and hence must rotate at the same speed as the carrier 26, and the lugs 30 on the loop forming chains 32 are so spaced in relation to the peripheral velocity of a sprocket 176, which is fixed to the wheel 166 and which drives the loop forming chains 32, that successive clamps 168 grasp and receive successive loops of lacing from the loop forming chains 32. To facilitate this operation the clamps 168 while at their lacing receiving position are held retracted, as indicated at 177 in Fig. 6, by means of a cam 178 which is fixed to the support 104 by screws 180 and which engages a pin 182 extending laterally from each clamp 168. Before the wheel 166 has rotated sufficiently so that a clamp has removed a loop of lacing from the loop forming chain 32, the pin 182 will have passed off the end of the cam 178, thereby allowing the spring 172 resiliently to urge the clamp 168 toward the wheel 166 holding the lacing just removed from the chain 32 against the wheel 166.

A bracket 184 is fixed to the lower end of each support 104 and carries at its upper end a reel 186 having a plurality of lace receiving holders 188, means to be described later is constructed and arranged to move the reel so as to bring the holders successively into a position at which the laces having completely molded tips are transferred thereto and the movements of the reel occur as soon as a predetermined quantity of laces have been deposited upon a holder. To assist in the transfer of the laces to the lace holders, a horn 190 is attached to the upper extremity of a U-shaped extension 192 one of which is fastened to each bracket 184 by means of bolts 194. As shown in Figs. 3 and 6, the tip of each horn 190 is in juxtaposition to a wheel 166 and is so placed with respect thereto that loops of lacing held by the clamps 168 are guided over the horn in passing by it. The transfer of the laces from the horn to a holder of a reel is further facilitated by an extension 196 of the horn 190 (Figs. 3 and 7), which extension overhangs the upper extremity of that lace holder which is in position to receive laces. As the lace passes off the horn 190 it is drawn between the holder 188 and a catch 197 (Fig. 3) pivoted on a support 199 secured to the upper extremity of a shaft 200 which carries the reel 186. A spring 201 normally urges the lower end of the catch 197 against that holder of the reel which is adjacent to the horn 190, thereby preventing a large collection of laces on the holder 188 from creeping upwardly on the holder and interfering with the rotation of the reel. When the wheel 166 has been rotated so far that the pin 182 on a clamp 168 engages a face 198 on the cam 178, that clamp 168 is retracted, thereby freeing the lace previously clamped to the wheel 166.

As the vertex of a looped lacing is thus being transferred from the wheel 166 to a holder 188 of the reel 186 at either side of the machine, the completed lace tip is being removed from the die at its discharge position. The means for removing the tipped extremity of the lacing from the molding dies is constructed in duplicate, each of which comprises a finger 203 (Fig. 4) which is pivoted on a stub shaft 205 supported in an arcuate extension 207 of the frame of the machine. The finger 203 is urged toward its uppermost position, determined by a stop 209, by a helical spring 211. As a die rotates to its discharge position, a part of the lace about to be removed from the die is brought into engagement with a light spring 213 the function of which will be described later and which is fixed to the finger 203. Upon further rotation of the dies a finger 215 which is pivoted on the shaft 205 is rotated, by means which will presently be described, in a clockwise direction as viewed in Fig. 4 to clamp a lace against the finger 203, clockwise rotation of which is resisted by the spring 211. The rotation of the fingers 203 and 215, when a lace is clamped therebetween, is at a greater rate than the rotation of the dies in which the lace to be removed has been tipped and hence causes the removal of the lace tips from the dies. This movement is derived from a cam 217 fixed to the shaft 140 which is connected to the finger 205 by means of a lever 219 having on one end a roll follower 221 which engages the cam 217 and having pivoted to its other end one end of a curved link 223 the other end of which is pivoted to the finger 215. At the time that the fingers 203 and 215 are operated, the part of the lace which they grip is held relatively taut between the wheel 166 and the die, being in engagement with the spring 213 under the extremity of the finger 215 before the latter is moved. When the finger 215 is lowered, however, thereby forcing the lace against the finger 203, tension is immediately imparted to the lace by the spring 213 over which the lace has been stretched. It may

thus be seen that the lace is tensioned to some extent even before the finger 203 has been rotated, and that the tension will pull, or tend to pull, the tipped end of the lace out of the die as soon as the molding elements thereof have been separated. To insure the removal of the laces from the fingers 203 and 215 as well as from the dies, additional means is provided comprising an auxiliary finger 225 which is constructed and arranged to be oscillated suddenly in a counterclockwise direction from its position illustrated in Fig. 4 as soon as the fingers 203 and 215 begin their upward movement after having pulled a lace tip from the dies which molded it. This movement is provided by a cam 227 mounted on the shaft 140 and connected to the finger 225 by means of a bell crank one arm 229 of which carries a roll follower 231 which engages the cam 227. The other arm 233 of the bell crank, which is pivoted in one extremity of a bracket 235 fixed to the extension 207, is bifurcated to receive a pin 237 fixed in one extremity of a lever 239 also pivoted on the bracket 235 and which lever at the other end supports the finger 225. When the lace, having been placed over the horn 190 and later the holder 188, is struck by the finger 225, it falls away from the wheel 166 and is held entirely by the holder 188 upon which it has been deposited. After a predetermined number of laces have thus been transferred from the wheel 166 to a holder 188, the reel 186 is rotated to bring an empty holder into position to receive laces, which is that occupied by the holder illustrated in Figs. 6 and 7.

The mechanism for thus turning the reel 186 comprises means for intermittently rotating the reel through an angle equal to that separating the lace holders. This means is power operated but is controlled by the laces transferred from the wheel 166 to an arm 188, it being understood that the lace being thus transferred acts to trip the mechanism for operating the reel 186 and hence is not affected in any cycle of operation of the machine in which a lace is not transferred to the reel 186. The mechanism for bringing an empty holder into lace receiving position remains inactive in the event of the absence of a lace at any clamp 168. The control of the reel turning mechanism by the laces themselves is, of course, effective to insure an accurate count of the laces.

The reel 186 is rotatably mounted on the shaft 200 (Fig. 6) fixed in the upper extremity of the bracket 184 and carries in a recessed portion 202 a ratchet wheel 204 (Figs. 6 and 8). A pawl 206 is pivoted to one extremity of a rock arm 208 also rotatably mounted on the shaft 200. A helical spring 210 connects the pawl and the rock arm resiliently to hold the pawl in engagement with the ratchet 204. The pawl and ratchet mechanism is operated intermittently to rotate the reel (for example, after one hundred and forty-four laces have been deposited on one of the arms 188) by means of a link 212 pivoted to the rock arm 208 at one end and at its other end to a lever 214 by means of a pin 216. The lever 214 is fulcrumed on the support 104 on a stub shaft 218 (Fig. 6) which is fixed to the support. Between the ends of the lever 214 is an extension 220 carrying at its outer end a cam follower 222 (Figs. 6 and 8) which is held in engagement with the face of a cam 224 by a helical spring 226 connecting the lever 214 with the bracket 184. The cam 224 is integral with a worm wheel 228 rotatably mounted on a shaft 230, the driving mechanism for which will presently be described. It is now apparent that upon rotation of the illustrated cam 224 the lever 214, as shown in Fig. 6, will be rotated in a clockwise direction until the follower 222 passes the highest point on the cam. At that instant the lever 214 is free to be rotated in a counterclockwise direction by the action of the spring 226, thereby moving the link 212 to the right which, through the pawl and ratchet mechanism above described, rotates the reel 186 through that part of a revolution corresponding to the angle separating successive lace holders 188. While the predetermined quantity of laces are being transferred to the reel 186, the cam 224 is being rotated through the angle separating successive highest points, which cam through the connections above described, moves the link 212 to its extreme right-hand position as seen in Fig. 6. When the parts are in this position a catch 232 is in juxtaposition to an upstanding lug 234 integral with a lever 236 pivoted on a bolt 238 in the upper portion of the bracket 184. The lever 236 is provided with an arm slotted as at 240 to receive a pin 244 transversely fixed in a rod 246 which is slidably engaged in a bearing 248 integral with the bracket 184. A spring 250 connecting the bracket 184 to an arm 252 on the lever 236 normally urges the lever in a clockwise direction thereby tending to lift the rod 246 upwardly to engage within sockets 254 so placed in the reel 186 that it is locked, when one of its arms is adjacent to the horn 190, by the reception of the rod 246 therein. When the cam 224 releases the lever 214 to rotate the reel 186, the catch 232, which, at the beginning of its movement, is behind the lug 234 on the lever 236, engages the lug, thereby rotating the lever 236 in a counterclockwise direction as viewed in Fig. 6, lowering the rod 246 and thereby unlocking the reel 186. Upon further movement of the link 212 the catch 232 will be carried past that point at which the lever 236 is released, caused by the lug 234 slipping off the upper side of the catch to the position shown in Fig. 6. Thus the rod 246 is resiliently urged up-

wardly against the reel 186 by the spring 250 and engages within the succeeding sockets 254 as the reel rotates to bring them into a position of alinement with the rod. If, for any reason, this locking apparatus should fail to operate, the reel is prevented from rotating past the desired point by a bracket 256 fixed to the link 212 which is engaged by pins 258 depending from the reel 186 and so placed that the reel will be stopped by the bracket 256 when a holder is adjacent to the horn 190.

In the illustrated machine the cam 224 comprises a face so proportioned that, upon one complete revolution, the reel is operated twice; therefore the worm wheel 228 should be rotated a half revolution while the number of laces desired to be deposited upon any one arm 188 are being transferred thereto. The mechanism for operating the worm wheel and cam in this manner comprises a worm 260 (Fig. 6) fixed to a shaft 262 (Figs. 6 and 7) supported by a yoke 264 which also supports the shaft 230 and which is fixed to the bracket 184. The worm 260 is intermittently operated by a ratchet mechanism comprising a bell-crank lever 266 pivotally mounted on the shaft 262 and to which is pivotally connected at one end a pawl 268 adapted to engage a ratchet wheel 270 fixed to the shaft 262. A spring 272 is connected with an extremity of the pawl 268 and likewise to the end of a pawl 274 which is supported by the yoke 264 in order to prevent a counterclockwise rotation of the worm 260. It is apparent that the spring 272 will hold both pawls 268 and 274 in operative relation with the ratchet wheel 270. The bell-crank lever 266 is normally urged in a counterclockwise direction by a spring 276 which connects the arm 266 with the support 104. The bell-crank lever 266 is oscillated intermittently whenever a lace is transferred to the reel to turn the worm through that part of a revolution corresponding to the number of teeth on the ratchet wheel 270. For this purpose the bell crank 266 also comprises an arm 278 to the upper end of which is pivoted on a pin 280 a finger 282 the movement of which on the pin 280 is limited. A spring 284 normally urges the finger 282 in a counterclockwise direction to its extreme left-hand position, as illustrated in Fig. 6. In order that the finger shall be brought into position to be acted upon to operate the reel operating mechanism above described, the lace 286 which is held taut between the clamp 168 and the corresponding die engages a lever 288 pivoted on a pin 290 fixed in a sleeve 292 which is adjustably clamped to a rod 294 which is secured to one extremity of an extension 193 of the bracket 184 by screws 296. When the lever 288 is thus rotated, as illustrated in Fig. 7, a link 298 pivoted to the lever 288 by means of a pin 300 is lifted, thereby rotating in a counterclockwise direction a lever 302 fulcrumed at 301 to the extension 193 and pivoted at 303 to the link 298. The right-hand end of the lever 302 is provided with a face 304 adapted for engagement with the lower surface of a lug 306 on the finger 282, rotating it in a clockwise direction against the tension of the spring 284 when the lever 288 is depressed. Thus, the upper extremity of the finger 282 is moved within the path of movement of a series of pins 308 on the wheel 166, one for each of the clamps 168. Upon further rotation of the wheel 166 the pin 308 corresponding to that clamp 168 holding the lace which has lifted the finger 282 into operative position, as just described, engages the finger 282 and rotates it in a clockwise direction, as viewed in Figs. 6 and 7, thereby operating the pawl and ratchet mechanism 268, 270 which operates the means for bringing an empty arm of the reel 186 into lace receiving position. As the finger 282 approaches the extremity of its clockwise rotation, a hook 310 connected to the pin 280 engages a hook 312 fixed to the lever 302, thereby rocking the lever 302 in a clockwise direction and lowering the link 298 and rotating the lever 288 to the position in which it is shown in Fig. 6. To the end of an upwardly extending arm 314 of the lever 302 is secured a helical spring 316 so arranged that it is substantially in alinement with the arm 314 when the lever 302 is in the extreme position of its clockwise rotation. It will now be apparent that, upon a slight movement of the lever 302 in a counterclockwise direction caused by the lace 286 engaging the lever 288, the lever 302 will be rotated by the spring 316, thereby lifting the finger 282 into a position in which it may be engaged by the approaching pin 308. As a pin 308 passes off the end of the finger 282, the lever 288 is set in its position shown in Fig. 6 as described; and the finger 282 is returned to its position, as shown in Fig. 6, by the spring 276.

In order that an empty holder 188 of the reel 186 may be brought adjacent to the horn 190 at any period of the machine's operation, a hand crank 318 is fixed to the shaft 262 and by operation of the crank, the cam 224 may be rotated manually to actuate the mechanism for rotating the reel.

In the operation of the machine, let it be assumed that a continuous length of lacing is being fed in loops to the loop forming and feed chains, as described above and as more fully explained in the above-mentioned patents, it being understood that, in the illustrated machine, the feed chains 20 are intermittently moved and that the loop forming chains 32 are continuously moved, being driven by the same means which drives the die carrier 26. As a loop of lacing held by the feed chains 20 approaches that position

it occupies when it is gripped by the die 24, one of the dies in the carrier 26 will have been rotated to a position such as that of the die in Fig. 4 which is about to operate on a lace. As soon as the die has thus come in contact with a lace on the feed chains, it is closed by means of the cam 114 about which the carrier rotates, the cam itself being rotatable in a direction opposite to the rotation of the carrier quickly to close the die. As soon as the die 24 thus operated by the cam 114 has been closed, the cam is rotated in the opposite direction until it is again in the position in which it is shown in Fig. 4. This retraction of the cam occurs at a slower rate than that of the rotation of the carrier 26 in order not to release the die last operated upon, but soon enough to be in position to close the succeeding die as soon as it leaves the lace receiving position. When the dies reach the discharge position, which is substantially that which the most nearly horizontal die (at the left-hand side of the carrier) occupies (Fig. 4), the wedge 156 operates to open the dies upon further rotation of the carrier, thereby releasing the lacing. At this point the cam 217 operates the finger 215 to clamp the lace about to be delivered from the dies against the cooperating finger 203 to which the lace has been brought by the rotation of the carrier. The cam is so shaped that the fingers firmly gripping the lace travel at the point where the lace is grasped at a greater rate than that of a corresponding point on the die. The fingers 203 and 215 therefore operate to pull the tip of the lace out of the die. As soon as the lace is freed from the die, the auxiliary finger 225 is rapidly oscillated past the fingers 203 and 215, thereby freeing the lace tips from these fingers and allowing the laces to fall outwardly and to become entirely supported by the holder 188. The above operation of the fingers occurs during a relatively short interval of time and all of the movements of the fingers are abrupt and rapid in order effectively to free the tipped end of the lacing.

The lace being transferred from the reel to an arm 188, in passing over the horn 190, contacts at its taut side with the lever 288 and in lowering it throws the upstanding arm 314 of the lever 302 far enough off center so that the spring 316 may quickly operate the lever 302 to hold the finger 282 in the position in which it is illustrated in Fig. 7. Upon further rotation of the wheel 166 the pin designated 308 will engage the upper end of the finger 282 and carry the finger with it in a clockwise direction, thereby rotating the ratchet wheel 270 a corresponding amount in the same direction. When the finger 282 reaches the latter portion of its travel the hook 310 engages the hook 312 to reset the lever 302 in its original position, thereby holding the lever 288 in the position in which it is shown in Fig. 6 until another lace is transferred to the holder. The rotation of the ratchet wheel 270 causes the cam 224 to be rotated an amount depending upon the number of teeth in the worm gear 228. It will now be apparent that for each cycle of the cam 224 there should be as many teeth on the worm wheel 228 as the number of teeth in the ratchet wheel 270 may be divided into the number of laces desired to be counted and collected upon any arm 188, assuming that the worm wheel has only one thread. The above operation occurs as the finished laces are delivered one by one to the reel and once for each lace so transferred. While the predetermined number of laces desired to be counted are thus collected on a holder 188, the cam 224 is being rotated about its support 230 to retract the lever 214 to its extreme position in a clockwise direction. As soon as the predetermined number of laces to be counted have been transferred to the reel the cam 224 will have been rotated to allow the follower 222 to pass over a high point thereon and the spring 226 then operates the lever 214 in a counterclockwise direction, moving the link 212 and hence the pawl and ratchet 206 and 204 to bring an empty holder of the reel adjacent to the horn 190. Thus, in the illustrated machine, the operative may allow several of the arms to collect and accurately count a predetermined number of laces before the reel need be unloaded.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a lace tipping machine, in combination, a tip molding die mounted for movement between a lace receiving and a lace discharge position, die operating means for closing and opening said die to effect the molding of a lace tip therein, and means for moving said die operating means in a direction opposite to that of the movement of the die to close the latter, said means being constructed and arranged to return the die operating means to its original position.

2. In a lace tipping machine, in combination, a tip molding die mounted for movement between a lace receiving and a lace discharge position, die operating means for closing and opening said die to effect the molding of a lace tip therein, and means for moving said die operating means in a direction opposite to that of the movement of the die to close the latter and subsequently in the opposite direction to its original position at a slower speed than that of the movement of the die.

3. In a lace tipping machine, a rotatable die for molding a lace tip therein between a lace receiving position and a discharge position, means for operating said die, and means for rotating said die operating means in a direction opposite to that of the rotation of

the die to mold a lace tip therein constructed and arranged to return the die operating means to its original position.

4. In a lace tipping machine, a tip molding die continuously rotating between a lace receiving position and a discharge position, rotatably mounted means for closing said die operable in a direction opposite to that of the rotation of said die to close the die, and means for operating said die closing means to close the die constructed and arranged subsequently to retract said die closing means to its initial position without releasing said die as it passes between the lace receiving and discharge positions.

5. In a lace tipping machine, a molding die, means for continuously moving said die between a lace receiving position and a discharge position, a conveyor for bringing lacing in loops into engagement with a molding face of said die, means for closing said die about the lacing fed thereto, and means for operating said die closing means in a direction opposite to that of the die to close the die, and subsequently return said die closing means to its initial position to open the die as it approaches a succeeding loop of lacing on said conveyor.

6. In a lace tipping machine, a continuously rotatable carrier supporting a plurality of dies, an intermittently operated conveyor for feeding lacing in loops successively to successive dies, a rotatable cam for closing said dies about the lacing fed thereto in lace receiving position and for holding those dies closed which are between the receiving and discharge positions, and means for rotating said cam in a direction opposite to that of the rotation of the dies to close them, said means being constructed and arranged to retract said cam in the opposite direction at a slower rate than that of the movement of the dies.

7. In a lace tipping machine, a plurality of dies mounted on a continuously rotatable carrier, rotatable means for closing said dies in succession upon reaching that position in which they receive laces, and mechanism for rotating said means in a direction opposite to that of the rotation of the carrier to close the dies, constructed and arranged to return the said means to its original position whereby the die is opened.

8. In a lace tipping machine, a plurality of dies radially mounted on a continuously rotatable carrier, and an oscillating cam for closing said dies successively as they leave that position in which they receive laces constructed and arranged to be rotated in a direction opposite to that of the carrier to close the dies and subsequently to be rotated in the opposite direction but at a slower rate than that of the rotation of the carrier.

9. In a lace tipping machine, a plurality of dies mounted on a continuously rotatable carrier, means for holding said dies closed during substantially one half of a revolution of the carrier, and means for rotating said last mentioned means in a direction opposite to that of the rotation of the carrier to close the dies upon leaving that position in which they receive laces and subsequently rotating it in the opposite direction to its initial position before succeeding dies are brought to the lace receiving position.

10. In a lace tipping machine wherein a die is continuously rotated between a receiving position and a discharge position, means for holding said die closed between its receiving and discharge positions, and means for rotating said first-mentioned means in a direction opposite to that of the die to close the die whereby a molding period of maximum length is insured and gradually retracted in the opposite direction to its initial position.

11. In a lace tipping machine, a tip-forming die, means for continuously rotating said die between a lace receiving position and a discharge position, oscillating means for holding said die closed between its lace receiving and discharge positions, and means for operating said oscillating means quickly in a direction opposite to that of the rotation of the die to close the die whereby a molding period of maximum length is insured and gradually in the opposite direction without releasing said die.

12. In a lace tipping machine, a die mounted for continuous rotation, means for closing said die, and means for operating said closing means in a direction opposite to that of the direction of movement of the die to cause the die to mold a lace tip therein said operating means being constructed and arranged gradually to retract said closing means to its initial position while said closing means holds the die in closed position.

13. In a lace tipping machine, means for forming a series of loops of lacing from a continuous length thereof, a die for molding tips on said lacing, means for moving said die between a lace receiving position and a discharge position, means for operating said die and said loop forming means in synchronism whereby the loops of lacing are successively brought into the lace receiving position, means for holding said die closed between the lace receiving and discharge positions, and means for operating said closing means in a direction opposite to that of the movement of the die to mold a lace tip therein constructed and arranged to return said operating means to its initial position.

14. In a lace tipping machine, means for forming a series of loops of lacing from a continuous length thereof, a die for molding tips on said lacing, means for moving said die between a lace receiving position and a discharge position, means for operating said die and said loop forming means in synchro-

nism whereby the loops of lacing are successively brought into the lace receiving position, means for holding said die closed between the lace receiving and discharge positions, and means for moving said last-mentioned means quickly in a direction opposite to that of the movement of the die to close the die and for gradually retracting it in the opposite direction to its initial position to release the tipped lace.

15. In a lace tipping machine, means for forming a series of loops of lacing from a continuous length thereof, a die for molding tips on said lacing constructed and arranged to be moved between a lace receiving position and a discharge position, means for moving said die and said loop forming means in synchronism whereby the loops of lacing are successively brought into receiving position, means for closing and opening said die, and means for moving said die opening and closing means oppositely to the direction of movement of the die to close it and subsequently to retract said die opening and closing means at a slower rate than that of the movement of the die whereby the die is held closed until it reaches the lace discharge position.

16. In a lace tipping machine, means for forming a series of loops of lacing from a continuous length thereof, a die for molding tips on said lacing, means for moving said die between a lace receiving position and a discharge position in synchronism with said loop forming means whereby the loops of lacing are successively brought into the receiving position, means for closing said die about the lacing fed thereto comprising a cam, and means for rotating said cam alternately oppositely to and in the direction of movement of the die to cause said die to be closed substantially at the lace receiving position and opened at the lace discharge position.

17. In a lace tipping machine, means for forming a series of loops of lacing from a continuous length thereof, a plurality of dies constructed and arranged to form tips on said lacing, means for moving said dies continuously between a lace receiving position and a discharge position, means for bringing the lacing loops successively into the receiving position operated synchronously with the dies, a rotating cam for closing said dies about the lacing fed thereto, and means for operating said cam in a direction opposite to that of the movement of the dies to close said dies in succession as they pass from the lace receiving position, and in the opposite direction to release the dies in succession as they arrive at the discharge position.

18. In a lace tipping machine, means for forming a series of loops of lacing from a continuous length thereof, a plurality of tip forming dies, mechanism for moving said dies successively between a lace receiving position and a discharge position, means for bringing the lacing loops successively into the receiving position operated synchronously with the dies, die operating means for closing said dies in succession upon reaching their receiving position and for releasing them in succession as they arrive at the discharge position, and means for causing said die operating means alternately to be moved in a direction opposite to that of the motion of the dies and then retracted while successive dies pass the lace receiving position.

19. In a lace tipping machine, means for forming a series of loops of lacing from a continuous length thereof, a plurality of tip-forming dies, mechanism for moving said dies successively between a lace receiving position and a discharge position, means for bringing the lacing loops successively into the receiving position operated synchronously with the dies, die operating means for holding said dies closed during a part of their movement, and means for moving said die operating means in a direction opposite to that of the movement of the dies to close the dies quickly upon leaving their lace receiving position and subsequently in the opposite direction to its initial position before a succeeding die is moved to the lace receiving position.

20. In a lace tipping machine, means for forming a series of loops of lacing from a continuous length thereof, a plurality of dies for forming tips intermediate between the ends of the loops, means for carrying said dies between a lace receiving position and a discharge position, means for bringing the lacing loops successively into the receiving position operated synchronously with the dies, means for holding said dies closed while passing between receiving and discharge positions, means for driving said last-mentioned means quickly in a direction opposite to that of the movement of the dies to close the dies whereby a molding period of maximum length is insured and gradually to retract it in the opposite direction to its initial position without releasing said dies, and means for operating said driving means at a constant speed in timed relation with the movement of said dies.

21. In a lace tipping machine, a molding die comprising relatively fixed and movable tip forming elements, a carrier for supporting said die which may be rotated to move the die between a lace receiving position and a discharge position, a rotatable cam concentric with said carrier for operating said movable tip forming element of the die to mold a lace tip therein, a cam for driving said die operating cam and connections therebetween, said driving cam being of such proportions that the die operating cam is rotated quickly to close the die upon leaving its receiving

position thereby to insure a relatively long molding period.

22. In a lace tipping machine, a molding die comprising relatively fixed and movable tip forming elements, a carrier for supporting said die which may be rotated to move the die between a lace receiving position and a discharge position, a rotatable cam concentric with said carrier for operating said movable tip forming element of the die to mold a lace tip therein, a cam for driving said die operating cam and connections therebetween, said driving cam being of such proportions that the die operating cam is rotated quickly to close the die upon leaving its receiving position and thereafter to retract said die operating cam gradually to its initial position without releasing said movable tip forming element.

23. In a lace tipping machine, a molding die comprising relatively movable and fixed tip forming elements, a rotatable carrier for supporting said die, a cam for operating said movable tip forming element rotatable in a direction opposite to that of the rotation of said carrier to close the die, a cam for driving said die operating cam and driving connections therebetween, said driving cam being so proportioned that said operating cam may be rotated quickly to close the tip molding die upon leaving that position in which it receives laces thereby to insure a relatively long molding period.

24. In a lace tipping machine, a tip molding die comprising relatively movable and fixed tip forming elements, a rotatable carrier for supporting said die, a cam for operating said relatively movable tip forming element to close the die, a driving cam and connections between it and the die operating cam for rotating said latter cam quickly in a direction opposite to that of the rotation of the carrier to close the die and thereafter gradually to rotate said die operating cam in the opposite direction to its initial position without releasing said die elements.

25. In a lace tipping machine, a plurality of tip forming dies radially mounted on a continuously rotatable carrier, said dies comprising relatively fixed and movable tip forming elements, a cam for operating said movable tip forming elements, a driving cam and connections between it and the operating cam, said driving cam being so proportioned that the operating cam shall quickly move said movable tip forming elements to mold tips on laces as said carrier is rotated and to retract said operating cam to its initial position gradually without releasing those dies between the lace receiving position and discharge position.

26. In a lace tipping machine having a tipping device and means for collecting tipped laces comprising a plurality of holders, means for transferring laces from the tipping device to the collecting means, means for intermittently operating said lace collecting means to bring its holders successively into position to receive the tipped laces, and means controlled by said laces for causing said transferring means to actuate said operating means.

27. In a lace tipping machine having a tipping device and means for collecting tipped laces comprising a plurality of holders, means for transferring laces from the tipping device to the collecting means, means for intermittently operating said lace collecting means to bring its holders successively into position to receive the tipped laces, and means operated only when a lace is received by said collecting means for causing said transferring means to actuate said operating means.

28. In a lace tipping machine, means for collecting tipped laces comprising a plurality of holders, means for operating said lace collecting means after a predetermined number of laces have been deposited on one of said holders to bring an empty holder into lace receiving position, means for actuating said operating means and being normally disconnected therefrom, and means for establishing a driving connection between said actuating means and operating means when a lace is received on the collecting means.

29. In a lace tipping machine having a moving tipping device, means for collecting tipped laces comprising a plurality of holders, means for operating said collecting means to bring an empty holder into lace receiving position after a predecessor has received a predetermined number of laces, means moving with said tipping device for carrying laces to said collecting means, means adapted to be connected with said lace carrying means for actuating said operating means, and lace engaging means constructed and arranged to establish a driving connection between said actuating means and said lace carrying means whenever a lace is received on the collecting means.

30. In a lace tipping machine, a plurality of holders for collecting tipped laces, means for intermittently operating said holders to bring them successively into position to receive tipped laces, a pawl and ratchet mechanism for operating said last-mentioned means and being normally disconnected therefrom, means for driving said pawl and ratchet mechanism, and lace operated means for causing said pawl and ratchet mechanism to be connected with said driving means only when a lace is received on a holder.

31. In a lace tipping machine having a tip forming device and lace collecting means comprising a plurality of holders for receiving tipped laces, means for transferring laces from the tip forming device to the collecting means, means for operating said collecting means after a predetermined number of laces

have been deposited on one of said holders to bring an empty holder into lace receiving position, and means for positively actuating said operating means comprising mechanism controlled by said laces for establishing a driving connection between said operating means and said transferring means whenever a lace is received on said collecting means.

32. In a lace tipping machine having a tip forming device and a lace collecting means comprising a plurality of holders for collecting tipped laces, means for transferring laces from the tip forming device to the collecting means, means for operating said collecting means to bring an empty holder into lace receiving position after a predecessor has received a predetermined number of laces, connections between said transferring means and said operating means, and lace operated means for moving one element of said connections into the path of movement of said transferring means whenever a lace is received in said collecting means whereby the movement of the transferring means is imparted to the operating means.

33. In a lace tipping machine, a rotatable reel comprising a plurality of holders for collecting tipped laces, means for intermittently rotating and limiting the rotation of said reel to bring its holders successively into position to receive the tipped laces, means for locking said reel as its holders are brought successively into lace receiving position, and means controlled by said laces for actuating said operating means.

34. In a lace tipping machine having a tipping device and a rotatable reel comprising a plurality of holders for collecting tipped laces, means for transferring laces from said tipping means to said holders, means for rotating said reel to bring an empty holder into lace receiving position after a predecessor has received a predetermined number of laces, driving means associated with said reel rotating means constructed and arranged to be supported either within or outside of the path of movement of said transferring means, and lace controlled means for supporting said driving means within the path of rotation of said transferring means as a lace is received on said reel to cause said driving means to be operated by said transferring means.

35. In a lace tipping machine wherein a continuous length of lacing is formed into a plurality of loops which are successively fed to a die for molding tips intermediate between the vertices of the loops, means for grasping the loops constructed and arranged to carry them from their position when received by the die to that in which they are discharged therefrom, means for collecting the tipped laces, and means cooperating with said collecting means and grasping means for guiding the laces as they pass to said collecting means.

36. In a lace tipping machine, lace collecting means comprising a plurality of holders, means for operating said collecting means to bring the holders successively into position to receive a predetermined quantity of laces, said means comprising a cam, a follower for said cam, a pawl and ratchet associated with said collecting means, connections between said follower and said pawl and ratchet, and means for operating said cam through one cycle while said predetermined number of laces are being collected on a holder of said collecting means whereby an empty holder is brought into lace receiving position.

37. In a lace tipping machine, lace collecting means comprising a plurality of holders for receiving laces in a predetermined quantity, means for operating said collecting means to cause said holders to be brought successively into lace receiving position comprising a cam, a follower for said cam, a pawl and ratchet associated with said collecting means, a link connecting said follower and pawl and ratchet, said connecting link having a lug thereon, a pin for each of said arms on said lace collecting means arranged to engage said lug upon the completion of the rotation of the collecting means to prevent rotation of said collecting means past that position in which an empty holder of said collecting means is in the lace receiving position, and means for operating said cam through one cycle once while said predetermined number of laces are being fed to the holder on said collecting means which is in lace receiving position.

38. In a lace tipping machine, lace collecting means comprising a plurality of holders for receiving laces in a predetermined quantity, means for operating said collecting means to cause said holders to be brought successively into lace receiving position comprising a cam, a follower for said cam, a pawl and ratchet associated with said collecting means, a link connecting said follower and said pawl and ratchet having a lug thereon, a pin for each of said arms on said lace collecting means arranged to engage said lug upon the completion of the rotation of the collecting means to prevent rotation of said collecting means past that position in which an empty holder of said collecting means is in its lace receiving position, a latch for locking said collecting means when a holder thereof is in lace receiving position, a finger on said link for releasing said latch before said collecting means is rotated to bring an empty holder into lace receiving position, and means for operating said cam through one cycle once while said predetermined number of laces are being fed to the holder on said collecting means which is in lace receiving position.

39. In a lace tipping machine wherein a continuous length of lacing is formed into a plurality of loops which are successively fed to a die for molding tips intermediate between the vertices of the loops, means for grasping the loops constructed and arranged to carry them from their position when received by the die to that in which they are discharged therefrom, a collecting means comprising a plurality of holders, and means for actuating said collecting means to cause said holders to be brought successively into lace receiving position comprising connections between said lace grasping means and said lace collecting means constructed and arranged to be operated positively whenever a lace is transferred from said lace grasping means to said collecting means.

40. In a lace tipping machine wherein a continuous length of lacing is formed into a plurality of loops which are successively fed to a die for molding tips intermediate between the vertices of the loops, means for grasping the loops constructed and arranged to carry them from their position in which they are received by the die to that in which it is discharged to a collecting means comprising a plurality of holders, means for actuating said collecting means to cause said holders to be brought successively into position to receive laces, a pawl and ratchet mechanism for intermittently operating said means for actuating said lace collecting means, a pin associated with said lace grasping means, an arm associated with said ratchet mechanism, and mechanism controlled by the lace being transferred from said grasping means to said collecing means for holding said arm within the path of movement of said pin on the grasping means to cause said pawl and ratchet mechanism to be operated as laces are transferred to the collecting means.

41. In a lace tipping machine wherein a continuous length of lacing is formed into a plurality of loops which are successively fed to a die for molding tips intermediate between the vertices of the loops, means for grasping the loops constructed and arranged to carry them from their position when received by the die to that in which they are discharged to a collecting means comprising a plurality of holders, means for actuating said collecting means to cause its holders to be brought successively into lace receiving position, a pawl and ratchet mechanism for intermittently operating said means for actuating the lace collecting means, an arm associated with said ratchet mechanism, and means for holding said arm either within or outside the path of said grasping means operated by that lace being transferred from said grasping means to said collecting means.

42. In a lace tipping machine wherein a continuous length of lacing is formed into a plurality of loops which are successively fed to a die for molding tips intermediate between the vertices of the loops, means for grasping the loops constructed and arranged to carry them from their position in which they are received by the die to that in which they are discharged to a collecting means comprising a plurality of holders, means for actuating said collecting means to cause its holders to be brought successively into lace receiving position, a pawl and ratchet mechanism for intermittently operating said means for actuating the lace collecting means, an arm associated with said ratchet mechanism, means for holding said arm resiliently either within or outside of the path of movement of said grasping means, a lever in the path of laces held by the grasping means, and connections between said lever and said last-mentioned means operated by the lace as it is transferred to said collecting means for moving said arm into the path of the grasping means to cause said pawl and ratchet mechanism to be operated as laces are transferred to the collecting means.

In testimony whereof I have signed my name to this specification.

CARL A. MATSON.