

March 13, 1962

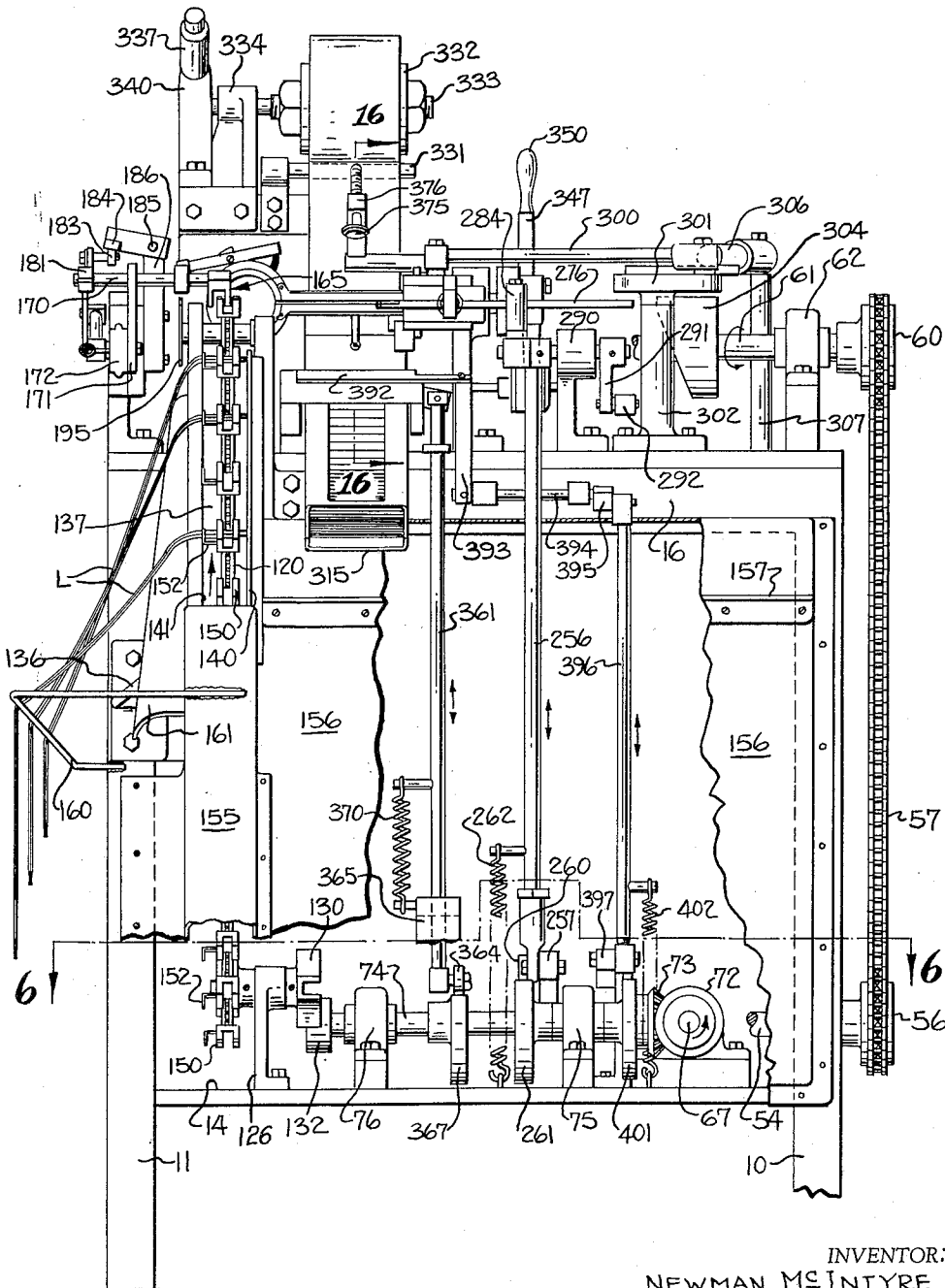
N. MCINTYRE

3,024,580

STRAND WINDING AND PACKAGING APPARATUS AND METHOD

Filed March 31, 1960

8 Sheets-Sheet 1



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Fig-1

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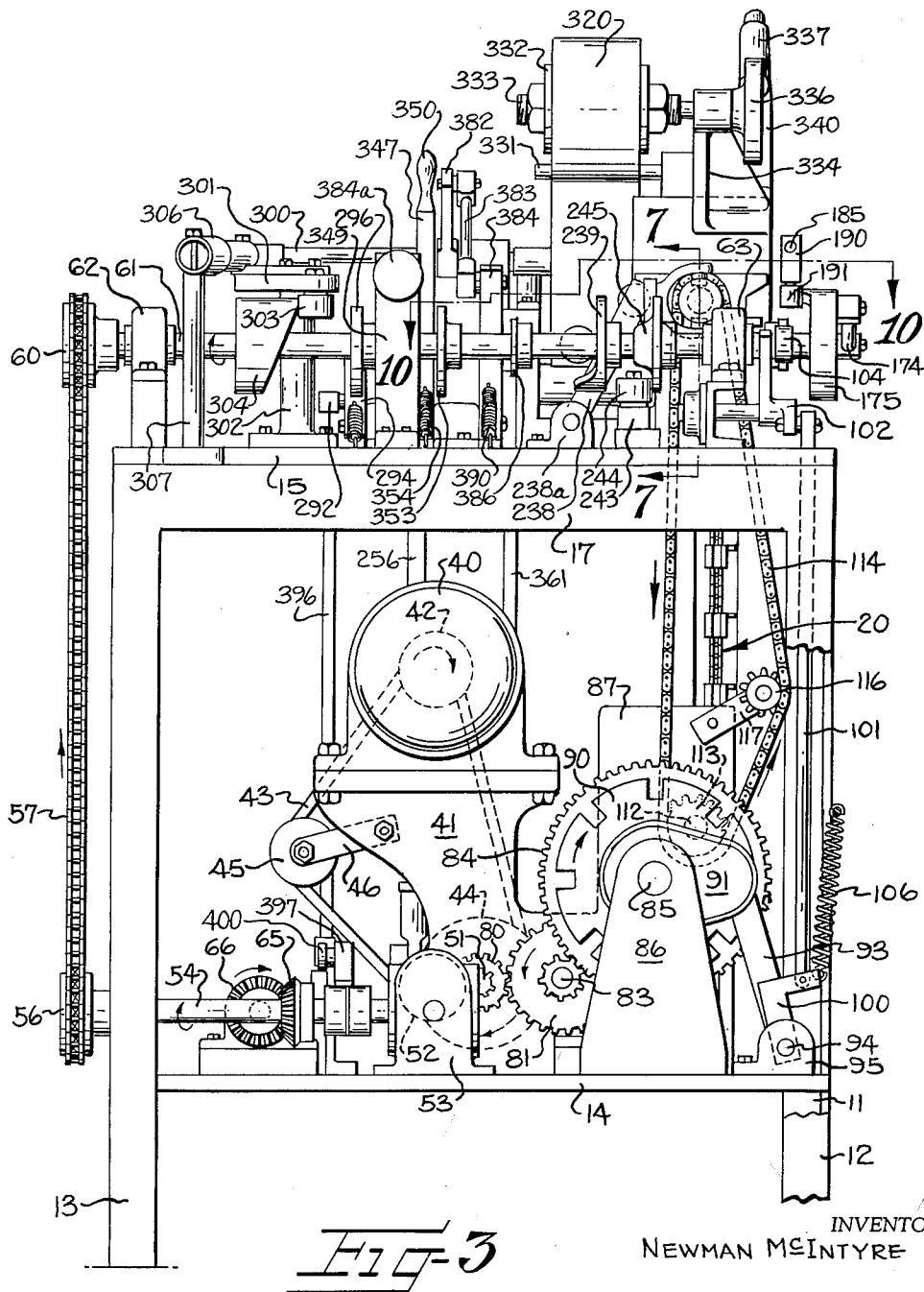
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Fig-4

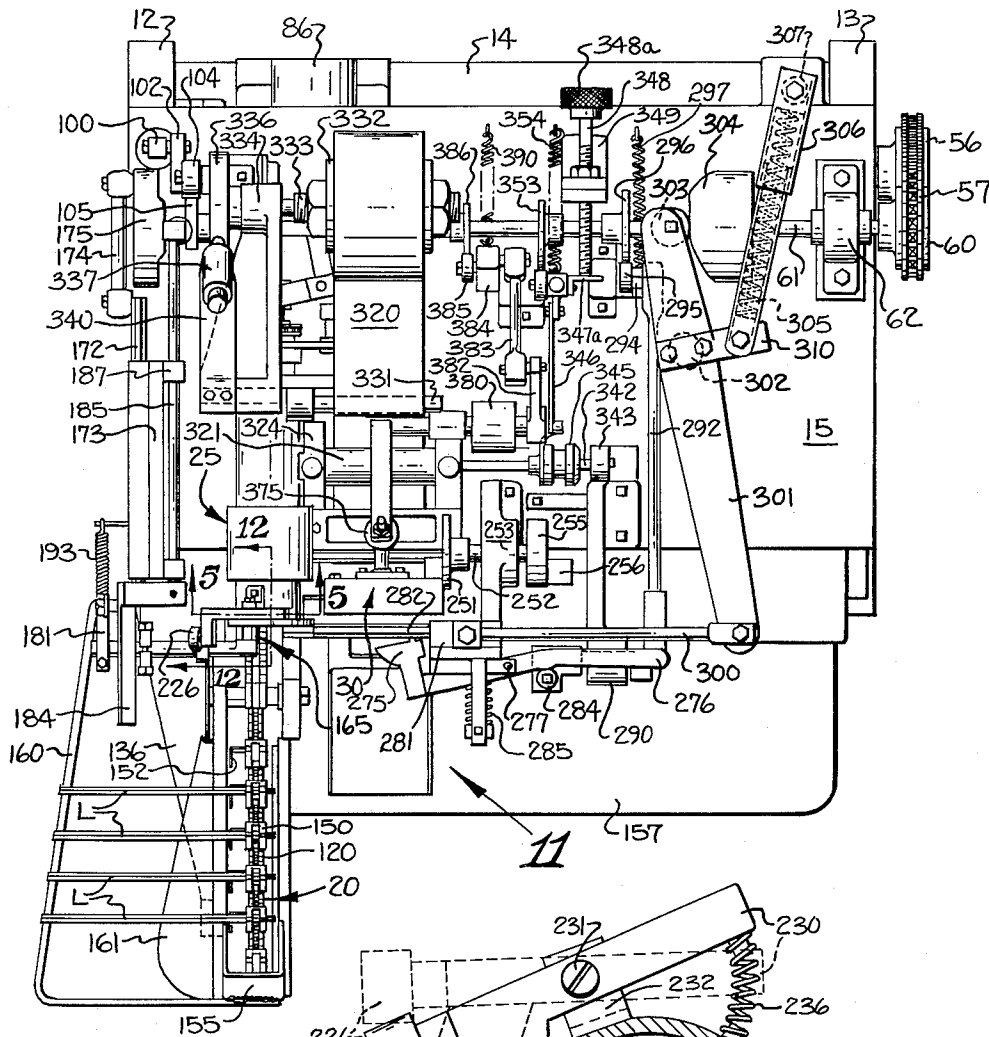
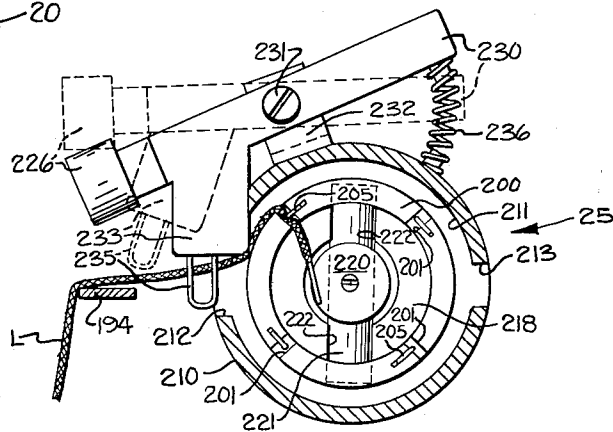


Fig-5



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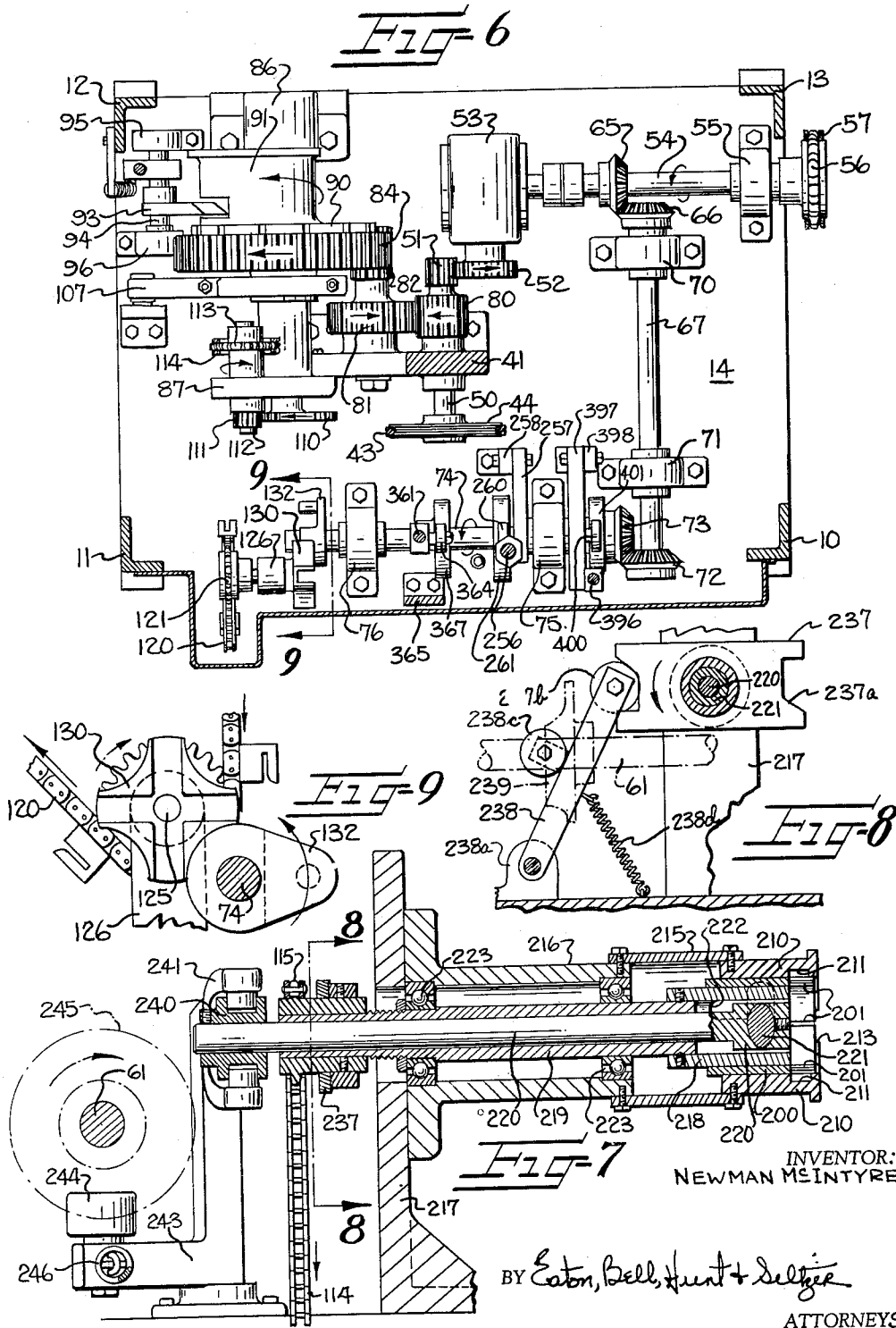
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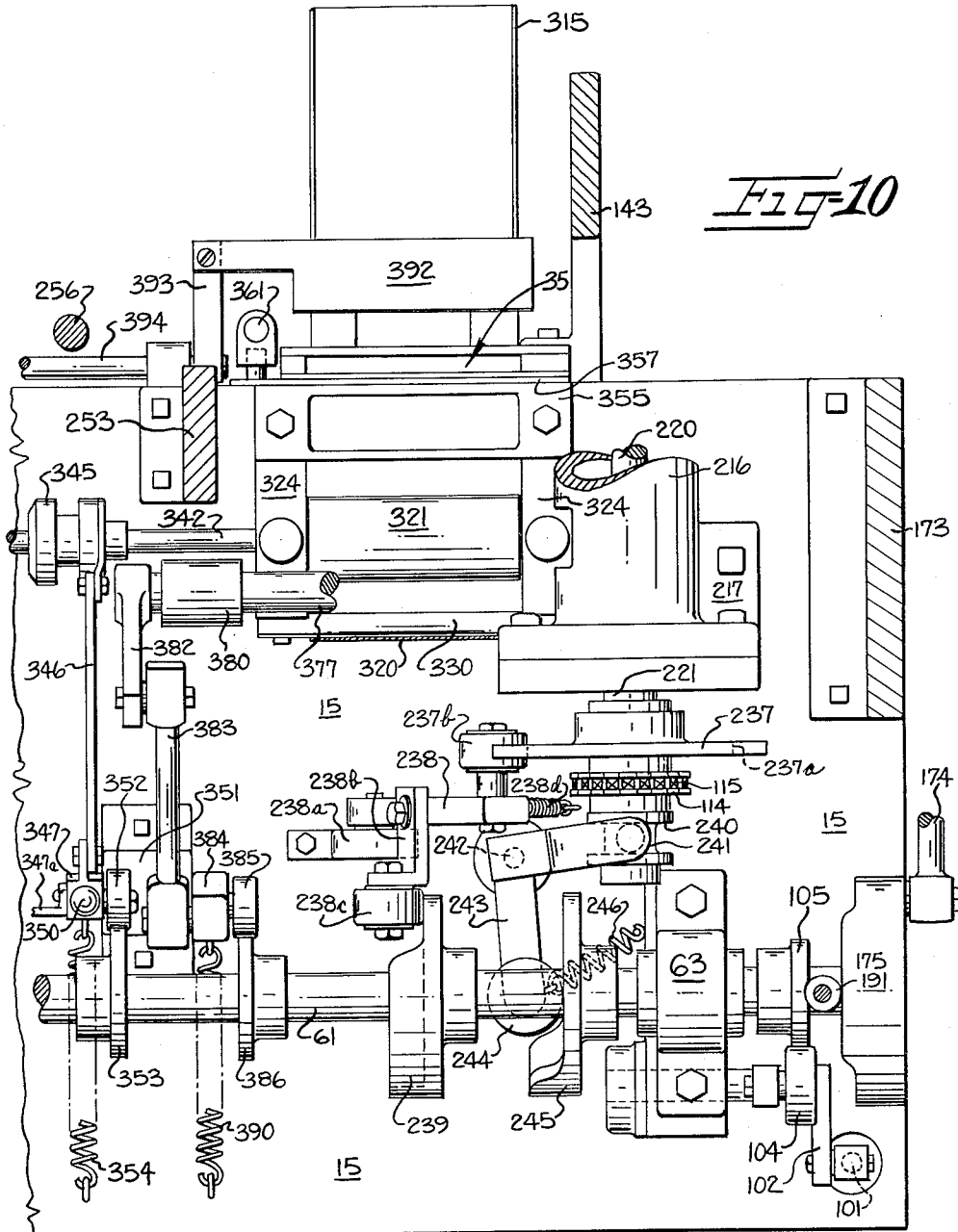
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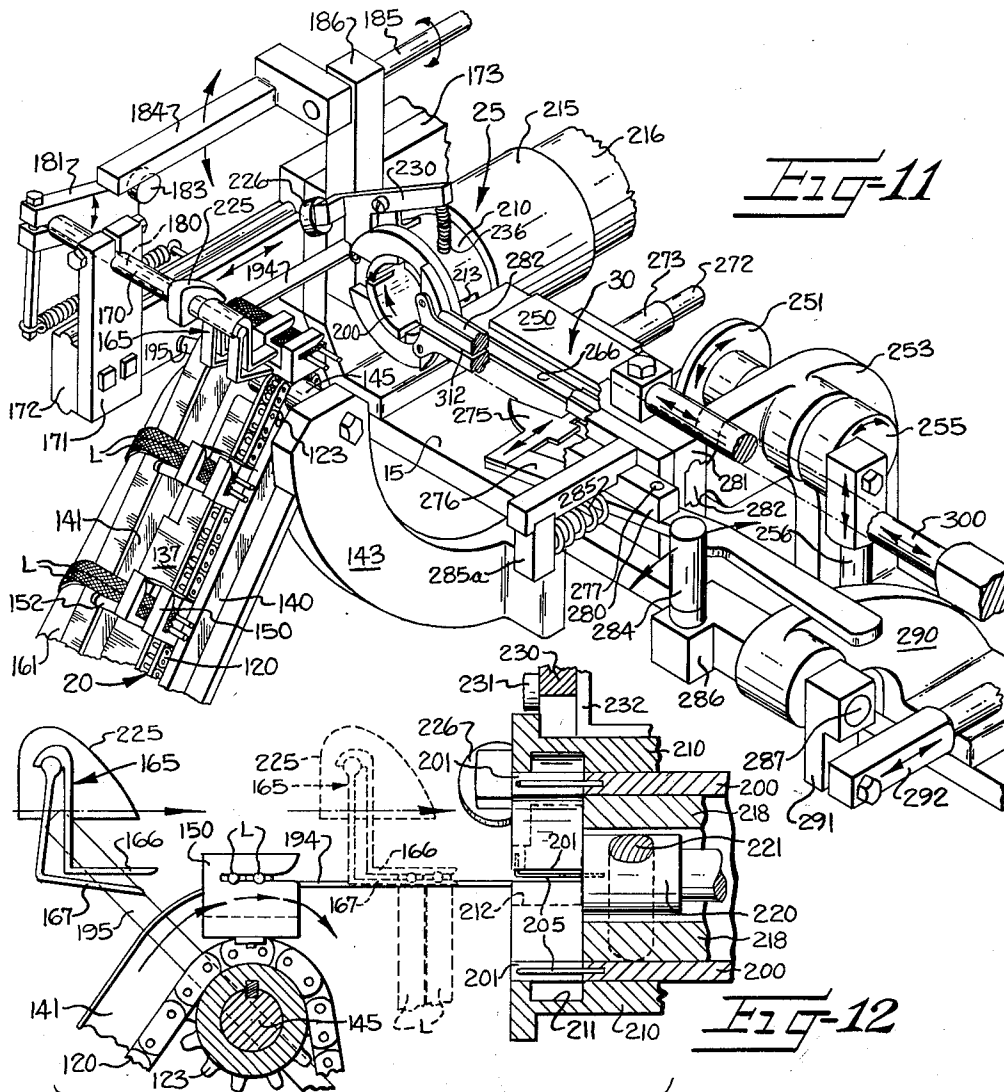
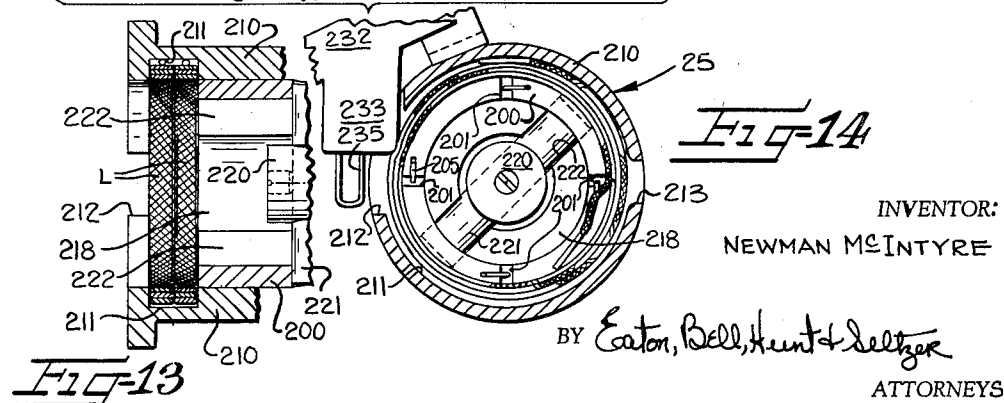
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3,024,580

STRAND WINDING AND PACKAGING APPARATUS AND METHOD

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13 Claims. (Cl. 53—24)

This invention relates to a method and apparatus for winding flexible elongated strands of material to facilitate packaging the same. The apparatus illustrated is particularly adapted for the formation of packages of shoelaces although the apparatus may be utilized to wind and package skeins or hanks of ribbon, yarn, rope or the like.

For many years, shoelaces have been packaged in a hand operation by utilizing a hand rotated reel having a pair of spaced apart upstanding legs carried on the reel. In this hand method, the operator first attaches one end of a pair of shoelaces to one of the upstanding legs and then rotates the reel so that the shoelaces form an elongated coil, hank, skein or the like. While the elongated coil is still supported at opposite ends on the upstanding legs of the reel, the operator applies a label or wrapper around the shoelaces to hold them in an elongated coil. The packaged shoelaces are then removed from the reel by raising the same upwardly so that opposite ends slide off of the upper ends of the upstanding legs.

Because of the high cost and slow production of this hand method of packaging shoelaces, machines have been provided for automatically forming packages of shoelaces. However, as far as is known, all automatic machines heretofore produced still utilize the same principle employed in the hand packaging method in that they all contain a rotatable reel having a pair of spaced apart upstanding legs about which the shoelaces are wound to form an elongated coil. These machines are very complicated because they must provide means for accurately positioning and holding the ends of the shoelaces in one of the upstanding legs, rotating the reel, applying a wrapper to the shoelaces, and removing the shoelaces from the legs of the reel. This type machine has proved to be troublesome because in many instances, the laces are not properly positioned on the legs of the reel or they may uncoil when they are removed therefrom, with the result that the loose shoelaces become entangled in the machine and cause a jam-up. Also, production of this machine is limited because the shoelaces must be wound around the spaced apart legs of the reel.

With the foregoing in mind, it is a primary object of the present invention to provide an apparatus and method of winding elongated strands, such as shoelaces and the like, in which the laces are first wound into a circular coil and then the circular coil is flattened to provide an elongated package.

It is another object of the present invention to provide a winding apparatus and method of the type described whereby shoelaces and the like may be packaged in a fast and efficient manner.

It is another object of the present invention to provide a strand winding apparatus which is adaptable for use in conjunction with automatic means for successively feeding shoelaces or the like to the winding apparatus and means for automatically applying labels or wrappers about the elongated coils after they are removed from the winding apparatus.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which:

FIGURE 1 is a front elevation of the strand winding

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machine with portions of the lower cover panel broken away for purposes of clarity;

FIGURE 2 is an elevation of the left-hand side of the machine as shown in FIGURE 1;

FIGURE 3 is a rear elevation of the machine, looking at the left-hand side of FIGURE 2;

FIGURE 4 is a top plan view of the machine shown in FIGURE 1;

FIGURE 5 is an enlarged transverse vertical sectional view through the forward end of the winding mandrel and shoelace confining sleeve, taken substantially along the line 5—5 in FIGURE 4 and showing the parts in a different position from that shown in FIGURE 4;

FIGURE 6 is a horizontal sectional view taken substantially along the line 6—6 in FIGURE 1;

FIGURE 7 is an enlarged longitudinal vertical sectional view through the winding mandrel of the machine and being taken substantially along the line 7—7 in FIGURE 3;

FIGURE 8 is a fragmentary vertical sectional view of the mandrel stop means and being taken substantially along line 8—8 in FIGURE 7;

FIGURE 9 is an enlarged fragmentary vertical sectional view illustrating a portion of the conveying means of the machine, being taken substantially along the line 9—9 in FIGURE 6;

FIGURE 10 is an enlarged fragmentary horizontal sectional view taken substantially along the line 10—10 in FIGURE 3;

FIGURE 11 is an enlarged isometric view of the forward end of the winding mandrel and associated parts and being taken looking in the direction of the arrow 11 in FIGURE 4;

FIGURE 12 is an enlarged fragmentary longitudinal vertical sectional view through the forward end of the mandrel, illustrating how the strand material is fed to the mandrel and being taken substantially along the line 12—12 in FIGURE 4;

FIGURE 13 is a view similar to the right-hand portion of FIGURE 12 except showing a pair of shoelaces positioned in the confining sleeve and the mandrel moved rearwardly;

FIGURE 14 is a transverse vertical sectional view through the forward end of the confining sleeve, showing a pair of shoelaces confined therein and the mandrel in rearmost or withdrawn position;

FIGURE 15 is a transverse vertical sectional view through the forward end of the mandrel, similar to FIGURE 5, and schematically illustrating how the coiled shoelace is pulled from inside of the confining sleeve and formed into an elongated package;

FIGURE 16 is an enlarged fragmentary vertical sectional view through the shoelace receiving and label applying station, taken substantially along the line 16—16 in FIGURE 1;

FIGURE 17 is a fragmentary vertical sectional view taken substantially along the line 17—17 in FIGURE 16;

FIGURE 18 is an enlarged view of the upper portion of FIGURE 16 except showing the parts in a different position.

Referring to the drawings, the machine illustrated is particularly adapted for winding and packaging shoelaces in pairs of flat elongated hanks or coils, however, it is to be understood that the present machine may be easily adapted to wind and package other strand material. The machine will first be described in general terms, generally pointing out the primary elements and then these elements and other parts of the machine will be described in detail.

Generally, the machine includes a frame having a pair of upstanding front legs 10, 11 and a pair of up-

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standing rear legs 12, 13 (FIGURE 6) which support a lower support plate 14 intermediate their ends and an upper support plate 15 at their upper ends. The upper ends of the front legs are joined by a web 16 (FIGURE 1) and the upper ends of the rear legs are joined by a web 17 (FIGURE 3). A conveying mechanism indicated broadly at 20 (FIGURE 2) operates to feed successive pairs of shoelaces to a winding mechanism broadly indicated at 25 (FIGURE 11) where the side-by-side shoelaces are wound around a mandrel to form a circular coil. The circularly coiled shoelaces are then removed from the winding mechanism 25 and formed into an elongated or flat coil as they are drawn through a restricted opening and into a shoelace receiving station broadly indicated at 30 (FIGURE 11). The pairs of shoelaces are then transferred from the shoelace receiving station 30 to a packaging and labeling station broadly indicated at 35 (FIGURES 16 and 18) where a label or wrapper is secured therearound to hold the shoelaces in an elongated coiled condition.

Driving Means

The machine is driven by an electric motor 40 which is supported on the upper end of a support bracket 41 (FIGURES 2 and 3), the lower end of which is fixed on the lower support plate 14. The motor 40 is provided with a variable speed driving pulley 42 which engages an endless belt 43 to drive a pulley 44 and an idler pulley 45 (FIGURE 3). The pulley 45 is rotatably supported at one end of a support arm 46, the other end of which is adjustably secured on the support bracket 41 to provide means for adjusting the tension of the belt 43 and to thereby change the speed thereof.

During operation of the machine, the motor 40 imparts continuous rotation to the pulley 44 which is fixed on one end of a shaft 50 (FIGURE 6) mounted for rotation in the lower portion of the bracket 41. A pinion 51 is fixed on the end of the shaft 50 opposite the pulley 44 and meshes with a gear 52 at the input side of a gear reduction unit 53. A shaft 54 is drivingly connected at one end to the gear reduction unit 53 and is rotatably supported adjacent its other end in a bearing 55 which is fixed on the lower support plate 14.

A sprocket 56 is fixed on the free end of the shaft 54 and drives an endless chain 57 which extends upwardly therefrom (FIGURES 1 and 3). The upper portion of the chain 57 drivingly engages a sprocket 60 which is fixed on one end of a main cam shaft 61. The main cam shaft 61 is supported for rotation adjacent opposite ends in bearings 62 and 63 (FIGURE 3) and is continuously rotated to operate various elements of the machine, in a manner to be later described.

Referring to FIGURE 6, the shaft 54 has a bevel gear 65 fixed thereon and the gear 65 mates with and drives a bevel gear 66 fixed on one end of a shaft 67. The shaft 67 is supported for rotation in a pair of bearing members 70 and 71 and has another bevel gear 72 fixed on the forward end thereof. The bevel gear 72 mates with and drives a bevel gear 73 which is fixed on one end of an auxiliary cam shaft 74 which is supported for rotation in bearing members 75 and 76 mounted on the lower support plate 14. The auxiliary cam shaft 74 is continually rotated during operation of the machine to operate various elements of the machine, in a manner to be later described.

Referring again to FIGURE 6, it will be noted that a pinion 80 is fixed intermediate the ends of the shaft 50 and mates with and drives a gear 81 having an integral pinion 82. The gear 81 and pinion 82 are mounted for rotation on a stub shaft 83 (FIGURE 3) which is supported at one end in the bracket 41. The pinion 82 drivingly engages a large gear 84 (FIGURE 6) which is rotatably supported on a shaft 85 (FIGURE 3). The shaft 85 is rotatably supported at its rear end in an upstanding bearing 86 supported at its lower end on the support

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plate 14 (FIGURE 3) and the forward end of the shaft 85 is rotatably supported in a plate 87 which is secured to the support bracket 41 (FIGURE 6).

A clutch plate 90 is fixed on the rear face of the gear 84 and has a plurality of notches around its outer periphery which are adapted to be at times engaged by a clutch dog, not shown, carried by a clutch element 91 which is fixedly secured on the shaft 85. A clutch actuating arm 93 (FIGURES 2, 3 and 6) is adapted to at times disengage the clutch dog of the clutch element 91 from the clutch plate 90 so that the gear 84 will rotate on the shaft 85. When the arm 93 is moved outwardly from the position shown in FIGURE 3, the clutch dog carried by the clutch element 91 will engage one of the notches in the plate 90 so that the gear 84 will impart rotation to the shaft 85. The lower end of the clutch actuating arm 93 is fixed on a shaft 94 which is supported for oscillation in bearings 95 and 96 (FIGURES 2 and 6).

The lower end of an actuating arm 100 is fixed on the shaft 94 and the upper end thereof is suitably connected to the lower end of a control link 101, the upper end of which is suitably connected to the rear end of a crank arm 102 (FIGURE 2). The crank arm 102 is mounted for oscillation on a stub shaft 103 and its upper end is provided with a cam follower 104 which is adapted to engage a cam wheel 105 fixed on the main cam shaft 61. The cam follower 104 is resiliently urged into engagement with the cam wheel 105 by a spring 106 (FIGURE 3), one end of which is connected to the arm 100 and the other end is connected to the rear leg 12.

As heretofore described, the main cam shaft 61 is continuously rotated and when the high point of the cam wheel 105 engages the follower 104, the crank arm 102 will be oscillated in a counterclockwise direction in FIGURE 2 to lower the control link 101 and oscillate the lever 100. Movement of the lever 100 will oscillate the shaft 94 and the clutch actuating arm 93 to move the same out of engagement with the clutch element 91 so that the clutch dog will engage one of the notches in the clutch plate 90 and impart rotation to the shaft 85. As the main cam shaft 61 continues to rotate, the follower 104 will move off of the high spot on the cam wheel 105 so that the clutch actuating arm 93 will move back into the position shown in FIGURE 3 to disengage the clutch element 91 from the clutch plate 90 and stop rotation of the shaft 85. A brake band element 107 (FIGURES 2 and 6) surrounds the shaft 85 and prevents further rotation of the shaft 85 after the clutch element 91 is disengaged from the clutch plate 90.

The forward end of the shaft 85 has a gear 110 fixed thereon (FIGURE 6) which drivingly engages a pinion 111. The pinion 111 is fixed on the front end of a shaft 112 which is mounted for rotation in the plate 87 and the shaft 112 has a chain sprocket 113 fixed on its rear end. The sprocket 113 drivingly engages the lower portion of an endless chain 114 (FIGURE 3) which extends upwardly therefrom and passes through the upper support plate 15. The chain drivingly engages a sprocket 115 adapted to impart rotation to a winding mandrel, to be later described. The chain 114 also passes over an idler sprocket 116 (FIGURE 3) which is rotatably mounted on the free end of a support arm 117 and the other end of the arm 117 is suitably secured to the plate 87. Intermittent rotation is imparted to the sprocket 115 by operation of the clutch element 91 and the sprocket 115 is rotated in timed relationship to operation of the machine by the cam wheel 105 on the main cam shaft 61.

The driving means heretofore described includes the continuously rotated main cam shaft 61, the continuously rotated auxiliary cam shaft 74 and the intermittently rotated sprocket 115 which imparts rotation to the winding mandrel, in a manner to be later described.

Conveyor Mechanism

The conveyor mechanism includes an endless conveyor

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chain 120 (FIGURE 2) which engages and partially surrounds a driving sprocket 121, an idler sprocket 122, an idler sprocket 123 and a chain tension adjusting idler sprocket 124. The driving sprocket 121 is fixed on one end of a shaft 125 which is mounted for rotation in a bearing 126 (FIGURE 1) and the other end of the shaft 125 has an intermittently rotated element 130 of a conventional Geneva motion fixed thereto. A continually rotated element 132 of the Geneva motion (FIGURE 9) is fixed on the end of the auxiliary cam shaft 74. The continually rotated element 132 imparts intermittent or step-by-step rotation to the element 130 to thereby impart one-quarter of a revolution to the sprocket 121 with each revolution of the auxiliary cam shaft 74. Thus, the step-by-step movement is imparted to the conveyor chain 120 as long as the machine is in operation.

The idler sprocket 122 is mounted for rotation on a stub shaft supported in the forward end of a support arm 136 (FIGURE 2), the rear end of which is secured to the front leg 11 of the machine. As chain 120 moves upwardly from the sprocket 122, it slidably engages a base bar 137 provided with upstanding spaced apart side rails 140 and 141 (FIGURE 11) which together form a trough in which the chain 120 moves.

The lower end of the base bar 137 is suitably supported on the arm 136 and the upper end thereof is suitably secured on the upper end of an arcuate bracket 143 (FIGURE 11). The lower end of the bracket 143 is suitably secured on the web 16 extending between the front legs 10 and 11 of the machine. The upper end of the arcuate bracket 143 and the side rail 141 rotatably support a shaft 145 on which the sprocket 123 is fixed. The sprocket 124 (FIGURE 2) is rotatably mounted on one end of an arm 147 and the other end of which is adjustably supported on the arm 136.

A plurality of shoelace carrying blocks 150 are fixed in equally spaced apart relationship along the chain 120. Each of the blocks 150 (FIGURE 11) is bifurcated at its upper end to form upstanding spaced apart lace engaging jaws and each of the jaws has a transverse lace receiving slot. The lace receiving slots are of sufficient width to frictionally hold one end of a pair of side-by-side shoelaces L placed therein by an operator (FIGURE 11). Each of the blocks 150 has one end of an L-shaped clip 152 fixed to one side thereof and the free end extends upwardly adjacent the side rail 141. The upstanding free ends of the clips 152 engage the rear or trailing edges of the pairs of shoelaces L carried by the blocks 150 and keep them from dragging behind as the shoelaces are carried upwardly by the blocks 150.

The forward portion of the chain 120 is provided with a cover 155 which protects the operator from entanglement with the chain 120. The front of the machine has a cover plate 156 (FIGURE 1) which is suitably secured to the front of the machine frame and the cover plate 156 supports a forwardly extending shelf 157 (FIGURES 1 and 4) which is utilized to support boxes into which the packaged shoelaces may be placed.

The Geneva motion which imparts step-by-step movement to the conveyor chain 120 is operated in timed relationship to the operation of the machine through the auxiliary cam shaft 74 and each step in movement of the chain 120 positions the next adjacent shoelace block 150 in uppermost position above the sprocket 123, as shown in FIGURES 2, 11 and 12. The blocks 150 remain in this position until another step in movement is imparted to the sprocket chain 120. An operator positions one end of successive pairs of side-by-side laces L in each of the blocks 150 as they move up the inclined chain support plate 137 (FIGURE 11) and as the shoelaces L are carried upwardly by the blocks 150 and chain 120, their trailing ends drape downwardly as indicated in FIGURE 1 and engage a lace guiding rod 160. The front end of the guide rod 160 is suitably secured to the cover plate 155 and the rear end is suitably secured to the front

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leg 11 so that the lower or trailing ends of the shoelaces L are slidably guided therealong in a parallel relationship with each other. The shoelaces also engage and slide along a curved plate 161 (FIGURE 1) which is fixedly secured to one side of the side rail 141. The plate 161 is preferably formed of a relatively smooth or polished metal to offer little resistance to the shoelaces as they are drawn therealong by the block 150 and chain 120.

As each succeeding block 150 is moved upwardly to its uppermost position above the sprocket 123, as shown in FIGURE 11, movement of the chain 120 is stopped and the shoelaces L are removed by a shoelace gripping and transporting member indicated broadly at 165 (FIGURES 11 and 12) which carries the shoelaces to the winding mandrel, to be later described.

The shoelace transporting member 165 includes a pair of spaced apart fixed upper jaws 166 and a pair of movable lower mating jaws 167. The upper ends of the jaws 166 are fixed on one end of a sleeve 170 which is supported in the upper end of a bracket 171 (FIGURE 11). The lower end of the bracket 171 is fixed on the forward end of a slide 172 which is mounted for forward and rearward sliding movement in an upstanding support bracket 173, the lower end of which is fixed on the upper support plate 15 (FIGURES 2, 4 and 11). The slide 172 is moved forwardly and rearwardly by means of a connecting link 174 (FIGURES 2 and 4) which is connected at one end to the rear end of the slide 172 and its other end is connected to the outer face of a rotating cam wheel 175. The cam wheel is fixed on one end of the main cam shaft 61 and with rotation of the cam shaft 61 and the cam wheel 175, the link 174 will move the slide 172 forwardly and rearwardly whereby the lace transporting jaws 165 will move from the solid line position shown in FIGURE 12 to a position rearwardly beyond the dotted line position shown in FIGURE 12.

The lower movable jaws 167 are fixed at their upper ends on a shaft 180 (FIGURE 11) which is mounted for oscillation inside of the sleeve 170. The shaft 180 extends outwardly beyond the end of the sleeve 170 and has the front end of a control arm 181 fixed thereto. The rear end of the arm 181 is provided with a roller 183 which engages the lower surface of a forwardly extending arm 184. The rear end of the arm 184 is connected to the front end of a control shaft 185 which is mounted for oscillation in upstanding bearing members 186 and 187 (FIGURE 2). The lower ends of the upstanding bearing members 186 and 187 are supported on the slide support bracket 173. The control shaft 185 extends rearwardly beyond the support bracket 187 and has the upper end of an arm 190 fixed thereto, the lower end of which is provided with a cam follower 191 adapted to ride against the cam surface on the inner face of the cam wheel 175. The cam follower 191 is resiliently urged into engagement with the cam surface of the cam wheel 175 by a spring 193, one end of which is connected to a spring perch carried by the arm 181 and the other end of the spring 193 is connected to a spring perch carried by the slide 172.

The cam surface on the inner face of the cam wheel 175 is shaped in such a manner that as the jaws 165 (FIGURE 12) are moved forwardly to the solid line position, the lower movable jaws 167 will move downwardly away from the upper fixed jaws 166 by oscillation of the control shaft 185. As the slide 172 starts rearwardly, the clamping jaws 165 will move rearwardly and pass the upper lace support block 150 (FIGURE 12). The shoelaces L will then be picked up between the jaws 166 and 167 and the shaft 185 will oscillate to close the jaws and clamp the shoelaces therebetween to carry the same rearwardly. As the shoelaces L are removed from the block 150 and carried rearwardly by the jaws 165, they slide along and are supported by a guide plate 194 which is carried by the side rail 141 (FIGURE 11).

The end of the shaft 145, remote from the arcuate

bracket 143, is provided with a shoelace positioning wiper arm 195 (FIGURES 1, 2, 11 and 12) which is fixedly secured intermediate its ends on the end of the shaft 145 and extends outwardly in opposite directions therefrom. As the laces L are removed from the block 150 and moved forwardly by the jaws 165, the chain 120 will move a step in rotation to bring the next succeeding block 150 upwardly to a position above the sprocket 123. Movement of the chain 120 will cause one end of the shoelace positioning arm 195 to engage and advance the shoelaces L adjacent the guide plate 194 so that they remain in parallel relationship and at right angles to the shoelace transporting jaws 65 as they are carried rearwardly to the winding mandrel, to be presently described.

Winding Mechanism

As the jaws 165 carry a pair of side-by-side shoelaces L rearwardly, the spaced apart upper and lower jaws 166 and 167 straddle the forward edge of a tubular winding mandrel 200 and carry the portion of the shoelaces L positioned between the upper and lower jaws 166 and 167 into shoelace receiving slot 201 formed in the front edge of the tubular mandrel 200 (FIGURE 12). The mandrel 200 is also provided with three other shoelace receiving slots 201 which are positioned 90 degrees apart (FIGURE 14). Each of the slots 201 is provided with a spring member 205, the rear end of which is embedded in the bottom of the slots and the front end of which is embedded for movement in the side of the slots. The spring members 205 frictionally engage and hold the shoelaces L as they are placed in the slots by the shoelace carrying jaws 165. After the shoelaces L are carried into the slot 201, the lower jaw 167 moves away from the upper jaw 166 and they are both then moved forwardly, leaving the leading end of the pair of side-by-side shoelaces L disposed in the slot 201 at the forward end of the mandrel 200.

The mandrel 200 is mounted for rotation in a shoelace confining sleeve 210 (FIGURE 7) having an internal peripheral groove 211 provided for reception of the shoelaces L, as they are wound about the mandrel, in a manner to be later described. The forward end of the sleeve 210 has a shoelace entrance slot 212 and a shoelace exit slot 213 which are positioned diametrically opposite each other (FIGURE 5) for purposes to be later described.

The forward end of the sleeve 210 terminates substantially flush with the forward end of the mandrel 200 and its rear end is connected to the front end of a connector sleeve 215 (FIGURE 7), the rear end of which is suitably connected to the front end of a cylindrical support member 216. The rear end of the support 216 is fixed on an upstanding support bracket 217, the lower portion of which is suitably secured to the upper support plate 15 (FIGURES 7 and 10).

The mandrel 200 is mounted for longitudinal movement on the forward end of a shoelace doffing sleeve 218 (FIGURE 7) and the rear end of the sleeve 218 is fixed on the forward end of a tubular drive shaft 219. A mandrel shifting shaft 220 (FIGURE 7) is supported for longitudinal movement in the tubular shaft 219 and a pin 221 is fixed in the enlarged forward end of the shaft 220 (FIGURE 7). The pin 221 passes through slots 222 (FIGURE 5) in the doffing sleeve 218 and opposite ends of the pin 221 are embedded in the mandrel 200.

The tubular drive shaft 219 is fixed against longitudinal movement and supported for rotation in anti-friction bearings 223 which are in turn supported in the cylindrical support member 216. The sprocket 115 is fixed on the rear end of the tubular drive shaft 219 so that when motion is imparted to the chain 114 and sprocket 115, rotation will be imparted to the doffing sleeve 218 which will in turn rotate the mandrel 200 and mandrel shifting shaft 220 by means of the pin 221.

It will be noted in FIGURES 11 and 12 that a cam member 225 is fixed on the sleeve 180 and as the jaws 165 move rearwardly, the cam member 225 will engage and raise a roller 226 mounted on a shoelace guiding and tensioning arm 230 (FIGURES 5 and 11). The arm 230 is oscillatably mounted, as at 231, on an angle bracket 232 which is fixed to the forward portion of the sleeve 210. The arm 230 has a downwardly depending arm 233 which extends downwardly into the shoelace receiving slot 212 in the sleeve 210 and is provided with a shoelace guide 235 and the inner portion of the arm 233 is adapted to frictionally engage the shoelaces as they are wound around the mandrel 200, as shown in FIGURE 5. The arm 230 is normally urged in a counterclockwise direction in FIGURE 5 by a compression spring 236, one end of which is supported on the outer surface of the sleeve 210 and the other end of which is supported at the free end of the lever 230. When the cam member 225 engages the roller 226, it will raise the arm 230 to the dotted line position shown in FIGURE 5 so that the shoelaces may be carried into the shoelace receiving slot 212 of the sleeve 210 and the shoelace receiving slot 201 of the mandrel 200 which is positioned in alignment therewith. As the cam member 225 and jaws 165 are moved forwardly again, after the shoelaces L have been deposited in the slot 201 of the mandrel 200, the spring 236 will lower the arm 230 to the position shown in solid lines in FIGURE 5 so that the shoelace guide 235 moves between the pair of side-by-side shoelaces to keep the same in their side-by-side relationship as they are wound onto the mandrel 200.

In order to insure that the tubular shaft 219 and mandrel 200 are held in a stationary position while the shoelaces are placed in the slot 201, a stop plate 237 is fixed on the hub of the sprocket 115 (FIGURES 7, 8 and 10). The plate rotates with the mandrel and stops in a horizontal position when the mandrel 200 stops. Opposite ends of the plate 237 are provided with notches 237a (FIGURE 8) which are alternately engaged by a roller 237b carried on the upper end of a lever 238. The lower end of the lever 238 is oscillatably supported in a bearing 238a secured to the upper surface of the upper support plate 15. A bracket 238b is connected at one end to the medial portion of the lever 238 and extends rearwardly therefrom where it supports a cam follower roller 238c (FIGURE 10). A spring 238d is connected at one end to the lever 238 and at its other end to the support plate 15 (FIGURE 8) and resiliently urges the roller 238c into engagement with one face of a cam wheel 239 which is fixed on the auxiliary cam shaft 61. With rotation of the cam shaft 61, the cam wheel 239 will cause the roller 237b to move out of the notch 237a in the plate 237 just prior to rotation being imparted to the sprocket 115 by the chain 114. Immediately upon completion of rotation of the mandrel 200, the cam wheel 239 will allow the roller 237b to move into engagement with one of the notches 237a on the ends of the plate 237 and prevent any rotational movement of the mandrel 200 while the shoelaces are being positioned in the slot 201.

After the shoelaces L are deposited in the slot 201 of the mandrel 200, the mandrel 200 is rotated in a clockwise direction in FIGURE 5 to wrap or wind the shoelaces L around the forward end of the mandrel 200. The mandrel 200 may be rotated any number of revolutions, according to the length of the shoelaces being packaged, and in the present instance, the mandrel 200 makes two and one-half revolutions and stops in the position shown in FIGURE 14. In this position the pair of side-by-side shoelaces are wound around the mandrel 200 and confined in the groove 211 of the shoelace confining sleeve 210.

Referring to FIGURE 7, it will be noted that the rear end of the shaft 220 has a shaft shifting collar 240 fixed thereon which is shifted by a yoke member 241. The yoke member 241 is oscillatory mounted as at 242

(FIGURE 10) on the upper support plate 15 and has a rearwardly extending arm 243 which rotatably supports a cam follower roller 244. The cam follower roller 244 rides against one face of a cam wheel 245 fixed on the main cam shaft 61.

The mandrel 200 is normally urged to its extreme forward position, as shown in FIGURE 7, by a tension spring 246 (FIGURES 7 and 10), one of which is connected to the rear end of the arm 243 and the other end of which is fixed on the upper support plate 15. The cam wheel 245 is provided with a high portion which engages the follower 244 in timed relation to operation of the machine and moves the shaft 220 rearwardly from the position shown in FIGURE 7.

With rearward movement of the shaft 220, the pin 221 will move rearwardly in the slots 222 of the doffing sleeve 218 and move the mandrel 200 rearwardly to a position where the forward end of the mandrel 200 is positioned rearwardly of the shoelace confining groove 211 in the sleeve 210, as shown in FIGURE 13. Since the doffing sleeve 218 remains stationary during rearward movement of the mandrel 200, the forward end of the sleeve 218 will engage and force the leading end or tips of the shoelaces out of the slot 201 in the mandrel 200. With the mandrel 200 in rearmost position, the pair of side-by-side shoelaces are in a circular coil and positioned in the groove 211 in the shoelace confining sleeve 210, substantially as shown in FIGURES 13 and 14. As the mandrel 200 is moved rearwardly, the shoelaces remain in a stationary position and slide off of the forward end and remain confined in the groove 211.

Shoelace Receiving Station

After the mandrel 200 has been moved to its rearmost position, the circular coiled shoelace L are drawn through the restricted exit slot 213 (FIGURE 15) by means to be presently described, to form the same into an elongated coil and position the same in the shoelace receiving station broadly indicated at 30 in FIGURE 11. The shoelace receiving station 30 includes a shoelace receiving housing 250 (FIGURES 16 and 18), one end of which is fixed to a wheel 251. The wheel 251 is fixed on one end of a shaft 252 (FIGURE 4) which is in turn oscillatably supported in the upper end of an upstanding bearing member 253 supported at its lower end on the upper support plate 15. A wheel 255 is fixed on the other end of the shaft 252 and is oscillated by a control link 256, which is connected at its upper end to the wheel 255 and extends downwardly (FIGURES 1 and 6). The lower end of the link 256 is connected to the front end of a lever 257 (FIGURES 1 and 6) and the rear end of the lever 257 is supported on a bracket 258 extending upwardly from the lower support plate 14.

The lever 257 is provided with a cam follower 260 which rides on a cam wheel 261, fixed on the auxiliary cam shaft 74. The cam follower 260 is urged downwardly into engagement with the cam wheel 261 by a tension spring 262 (FIGURE 1) the upper end of which is connected to the control link 256 and the lower end of which is connected to the lower support plate 14. When the cam follower 260 is on the high portion of the cam wheel 261, the shoelace receiving housing 250 will occupy substantially a horizontal position, as shown in FIGURES 11 and 16. With rotation of the auxiliary cam shaft 74, the cam follower 260 will move onto the lower portion of the cam wheel 261 and the shoelace receiving housing 250 will swing to substantially a vertical position, as shown in FIGURE 18, for purposes to be later described.

The housing 250 is provided with a pair of spaced apart shoelace receiving plates 265 (FIGURE 15) which define a shoelace receiving slot 266 therebetween. The housing 250 contains a shoelace removing plunger 267 (FIGURE 18) which is mounted for sliding movement between the plate members 265 and has an

upstanding stem 270. The stem 270 extends outwardly beyond the housing 250 and is surrounded by a compression spring 271 which bears against the plate members 265 and a knob 272 fixed to the upper end of the stem 270. The knob 272, stem 270 and compression spring 271 are enclosed by a sleeve member 273 which is open at its outer end and its inner end is fixed on the housing 250 (FIGURE 18). The compression spring 271 normally urges the plunger 267 upwardly in FIGURE 18 or to the left in FIGURE 16 so that coiled elongated shoelaces may be frictionally held in the slot 266 between the plates 265.

When the housing 250 is disposed in a horizontal position, as shown in FIGURES 11, 15 and 16, the shoelace receiving slot 266 is positioned in alignment with the exit slot 213 of the sleeve 210 so that when a pair of shoelaces is removed therefrom, they pass into the slot 266, as shown in FIGURE 15. The shoelaces are drawn or pulled through the exit slot 213 by a shoelace engaging and withdrawing plate 275 (FIGURE 11) which is fixed on one end of a control lever 276. The lever 276 is oscillatably mounted intermediate its ends as at 277 on an arm 280. The arm 280 is fixed to the front surface of a slide 281 (FIGURE 18) which is mounted for horizontal sliding movement along a guide 282. One end of the guide 282 is supported on the forward end of the bearing bracket 253 and the other end is suitably supported on the forward end of the sleeve 210 (FIGURE 11).

The end of the lever 276 opposite the shoelace removing plate 275 is urged into engagement with the upper end of an actuating roller 284 by a compression spring 285 (FIGURES 11 and 18), one end of which engages the lever 276 and the other end of which is supported on a spring perch 285a carried by the slide 281. The lower end of the roller 284 is supported in the free end of a rocking arm 286. The other end of the rocking arm 286 is fixed to one end of a shaft 287 (FIGURE 11) which is oscillatably supported in the forward end of a bearing bracket 290 and the rear end of the bearing bracket 290 is suitably secured to the upper surface of the upper support plate 15. The opposite end of the shaft 287 has the upper end of a lever arm 291 fixed thereto and the lower end of the arm 291 is connected to the forward end of a control link 292. The control link 292 extends rearwardly, in FIGURE 4, and its rear end is connected intermediate the ends of a vertically disposed lever 294 (FIGURE 3). The lower end of the lever 294 is oscillatably supported in a bearing fixed on the upper surface of the upper support plate 15 and the upper end of the lever 294 supports a cam follower 295 (FIGURE 4) which engages the outer periphery of a cam wheel 296 fixed on the main cam shaft 61 (FIGURES 3 and 4). A spring 297 (FIGURE 4) is connected to the lever 294 and the upper plate 15 to resiliently urge the follower 295 into engagement with the cam wheel 296. The cam wheel 296 is provided with high and low cam surfaces which impart forward and rearward movement to the control link 292 (FIGURE 11) to rock the upper end of the roller 284 rearwardly and forwardly to thereby impart forward and rearward movement to the shoelace engaging plate 275, for purposes to be presently described.

Motion is imparted to the slide 281 to move the same along the guide 282 by means of a link 300, one end of which is connected to the slide 281 (FIGURE 4) and the other end of which is connected to the forward end of a lever 301. The lever 301 is oscillatably supported intermediate its ends on the upper end of a standard 302 supported at its lower end on the plate 15. The rear end of the lever 301 has a cam follower 303 thereon and the cam follower 303 engages the cam surface of a cam wheel 304 which is fixed on the main cam shaft 61. The cam follower 303 is resiliently urged into engagement with the cam surface of the cam wheel 304 by a compression spring 305 enclosed in a telescoping sleeve 306. The

sleeve 306 is supported at its rear end on the upper end of a standard or post 307 (FIGURE 3) and its front end is connected to the outer end of an arm 310 fixed at its inner end on the lever 301 (FIGURE 4).

As the cam follower 303 engages the high portion of the cam wheel 304, the lever 301 will swing in a counter-clockwise direction in FIGURE 4 and move the slide 281 from left to right to substantially the position shown in FIGURE 4. As the cam follower 303 moves onto the low portion of the cam wheel 304, the lever 301 will swing in a clockwise direction in FIGURE 4 to move the slide 281 from right to left along the guide 282 and the shoelace withdrawing plate 275 will remain in a forward position, under control of the roller 284 engaging the right-hand end of the lever 276. The slide 281 will be moved to the left in FIGURE 4 until the shoelace withdrawing plate 275 is positioned in front of the mandrel 200. The roller 284 will then tilt forwardly to move the plate 275 rearwardly so that its inner portion will be disposed within the circular coiled shoelaces L which are held in the groove 211 of the lace confining sleeve 210. The slide 281 will then be moved from left to right in FIGURE 4 along the guide 282 so that the inner end of the plate 275 will engage the inner periphery of the circular coil of shoelaces L and draw the same through the restricted exit slot 213 in the sleeve 210, as shown in dotted lines in FIGURE 15. As the plate 275 draws the shoelaces out of the sleeve 210, it passes along a slot 312 which extends longitudinally of the guide 282 (FIGURES 11 and 18). With continued movement of the plate 275, the pair of shoelaces L will be drawn into the slot 266 between the plate members 265 to form an elongated or flattened coil with the shoelaces positioned in side-by-side coiled relationship to each other.

Upon the slide 281 reaching its right-hand position as shown in FIGURE 4, the pair of shoelaces will be disposed in the housing 250 and the plate 275 will be moved forwardly out of engagement with the shoelaces L by a rearward rocking movement imparted to the roller 284. Upon removal of the plate 275, the pair of elongated coiled shoelaces L will be supported in the slot 266 of the housing 250, substantially as shown in FIGURE 16. The housing 250 then swings from a horizontal to a vertical position by oscillation of the wheel 251 so that the shoelaces L and the slot 266 in the housing 250 are positioned in alinement above a shoelace receiving guide tube 315 (FIGURES 16 and 18) which forms a part of the shoelace packaging and labeling station 35 to be presently described. The shoelace receiving tube 315 is rectangular in cross-section and adapted to receive and frictionally retain the pairs of side-by-side shoelaces deposited therein in a manner to be later described.

Shoelace Packaging and Labeling Station

As the shoelace receiving housing 250 is moved to the vertical position shown in FIGURE 18, and before the shoelaces L are removed therefrom, a strip of label material 320 is fed between the lower end of the housing 250 and the upper end of the shoelace receiving tube 315 by means of label supplying means including respective upper and lower label feeding rolls 321 and 322. The lower feed roll 322 (FIGURES 16, 17 and 18) is rotatably mounted in the upstanding legs of a support bracket 324 and is driven in timed relation to operation of the machine in a manner to be later described. The upper feed roll 321 is rotatably supported in the bracket 324 and is resiliently urged into engagement with the upper surface of the label material 320 by springs 325 (FIGURE 17). The springs 325 are mounted in the upper legs of the bracket 324 and bear against bearing blocks to urge the same downwardly along with the roll 321.

The strip of label material 320 is fed to the feed rolls 321 and 322 and passes beneath a guide rod 330 (FIGURES 16 and 18), over a guide rod 331 (FIGURES

1 and 2) and from a spindle 332 which is fixed on a supply shaft 333. The supply shaft 333 is rotatably mounted in the rear end of a support arm 334, the front end of which is suitably secured to the upper edge of the mandrel support bracket 217 (FIGURE 2). The right-hand end of the supply shaft 333 in FIGURE 3 has a brake wheel 336 fixedly secured thereto and its outer periphery is engaged by a friction member 337 (FIGURE 2). The friction member 337 is adjustably supported to vary the frictional contact with the brake wheel 336 in the upper end of an arm 340, the lower end of which is suitably secured to the support arm 334.

The label feed roll 322 is driven in timed relationship to operation of the machine by a shaft 342 (FIGURE 10) connected at one end to the feed roll 322. The other end of the shaft 342 is rotatably supported in an upstanding bearing 343 (FIGURE 4) and has a one-way clutch element 345 mounted intermediate its ends (FIGURE 10). The lower end of an upstanding actuating arm is connected to the one-way clutch 345 and its upper end is connected to the forward end of a link 346. The rear end of the link 346 is connected to the medial portion of an upstanding lever 347 having a handle portion 350 at its extreme upper end (FIGURES 1 and 2). The lower end of the lever 347 is oscillatably supported in a bearing 351 secured to the upper support plate 15 and the lever 347 has a cam follower roller 352 rotatably supported intermediate its ends. The follower 352 is normally held in resilient engagement with a cam wheel 353 (FIGURE 10) by a spring 354 connected at one end to the lever 347 and at its other end to the plate 15. The cam wheel 353 is fixed on the main cam shaft 61 and rotation thereof will cause the cam follower 352 to reciprocate the lever 347 to thus impart step-by-step one-way rotation to the shaft 342 and feed roll 322. Thus, the label material 320 will be fed to the machine at the proper time. The handle portion 350 on the upper end of the lever 347 is provided so that the operator may actuate the lever 347 and manually feed the label material forwardly to thread the material prior to starting operation of the machine or to properly register the labels for feeding.

In order to adjust the amount of label material fed with each step in rotation of the feed roll 322, the lever arm 347 is provided with a stop member 347a a fixed thereto and extending outwardly from one side (FIGURE 4). The stop member 347a is positioned in alinement with and adapted to at times engage the forward end of a threaded screw 348 mounted for adjustment in the upper end of a support bracket 349, the lower end of which is fixed on the upper support plate 15. The threaded screw 348 has a knob 348a on its rear end which may be rotated to vary the limit of rearward oscillation of the lever 347 and thus reduce or increase the amount of step-by-step rotational movement imparted to the feed roll 322. Thus, the length of label material 320 fed by each step of rotation of the feed roll may be varied as desired.

As the trip of label material 320 is fed forwardly by the feed roll 322 in a step-by-step manner, it passes beneath a stationary cutter blade 355 and above a support plate 356 (FIGURE 18). The label material 320 also passes above a vertically movable cutter blade 357 (FIGURE 17) as the leading edge thereof passes between the upper end of the shoelace guide tube 315 and the lower edges of the spaced apart plates 265 in the housing 250. One end of the movable cutter blade 357 is oscillatably secured as at 360 to the bracket 324 (FIGURE 17) and the other end thereof is connected to the upper end of a control link 361. The control link 361 extends downwardly through a guide plate 362 fixed on the upper support plate 15 and the lower end of the link 361 has a cam follower roller 364 (FIGURE 1) rotatably secured thereto.

The lower end of the control link 361 is guided for

vertical movement in the horizontal upper portion of an upstanding support bracket 365, the lower end of which is fixed on the lower support plate 14. The cam follower roller 364 is resiliently urged into engagement with the upper surface of a cam wheel 367 (FIGURE 1) by a tension spring 370, the upper end of which is connected to the control link 361 and the lower end of which is suitably connected to the bracket 365. The cam wheel 367 is fixed on the auxiliary cam shaft 74 and the movable cutter blade 357 remains in the lowered position shown in FIGURE 17 until the high portion of the cam wheel 367 engages the follower 364. Then, the control link 361 will be raised to thus raise the right-hand end of the blade 357 and cut the label material 320.

Referring to FIGURES 16 and 18, it will be noted that a vertically adjustable bunter 375 threadably penetrates the forward end of an actuating arm 376. The rear end of the actuating arm 376 is fixed on one end of a shaft 377 which is mounted for oscillation in the upper end of an upstanding bearing 380 (FIGURE 10), the lower end of which is fixed on the upper support plate 15. The end of the shaft 377 opposite the actuating arm 376 has the lower end of a lever 382 fixed thereto and the upper end of the lever 382 is connected to the forward end of a link 383. The rear end of the link 383 is connected to the upper end of a lever 384 which is oscillatably supported at its lower end on the bearing 351. The medial portion of the lever 384 has a cam follower roller 385 rotatably mounted thereon and the roller 385 is resiliently urged into engagement with a cam wheel 386 which is fixed on the main cam shaft 61. The lever 384 is resiliently urged rearwardly at its upper end by a tension spring 390 (FIGURES 3 and 10), one end of which is connected to the lever 384 and the other end of which is connected to the upper support plate 15.

The cam wheel 386 has high and lower portions thereon which impart reciprocation to the bunter 375 to move the same from the position shown in FIGURE 16 to the position shown in FIGURE 18 in timed relationship to operation of the machine. The movement of the bunter 375 is so timed that when the housing 250 is moved to a vertical position and after a label has been fed between the lower edge thereof and the upper end of the shoelace guiding tube 315, the bunter 375 will move downwardly and depress the knob 272 to thereby lower the plunger 267 and force the pair of shoelaces outwardly from between the plates 265 and into the upper end of the shoelace receiving tube 315. As the shoelaces are forced into the tube 315, the leading portion of the label material will be forced into the tube 315 beneath the shoelaces to partially surround the same, substantially as shown in FIGURE 18.

Immediately after the plunger 267 has moved the shoelaces L into the upper end of the tube 315, the movable cutter blade 357 will swing upwardly to sever the label material 320. The bunter 375 will then be raised to allow the plunger 267 to retract into the housing 250 and the wheel 251 will be rotated one-quarter revolution in a counterclockwise direction in FIGURE 18 and thereby swing the housing 250 from its vertical position to the horizontal position shown in FIGURE 16.

During this counterclockwise rotation of the wheel 251, a label folding plate 392 (FIGURES 16 and 18) will move inwardly to fold over one leg of the label onto the upper edge of the upper pair of shoelaces L disposed in the tube 315. The label folding plate 392 is suitably secured to the upper end of an arm 393 (FIGURE 1), the lower end of which is fixed to one end of a shaft 394 suitably secured for rotation on the web 16 of the machine frame. An arm 395 is fixed at its rear end on the end of the shaft 394 and its front end is suitably connected to the upper end of a vertically disposed control link 396.

The control link 396 extends downwardly in FIGURE 1 and is connected to the forward end of a lever 397.

The lever 397 extends rearwardly in FIGURE 6 and its rearmost end is oscillatably supported in the upper end of an upstanding bearing 398 which is supported on the lower support plate 14. A cam follower roller 400 is rotatably mounted intermediate the ends of the lever 397 and engages the upper periphery of a cam wheel 401 (FIGURE 1) which is fixed on the auxiliary cam shaft 74. The cam follower roller 400 is resiliently urged into engagement with cam wheel 401 by a tension spring 402, the upper end of which is connected to the vertical control link 396 and the lower end of the spring 402 is connected to the lower support plate 14.

The cam wheel 401 is provided with low and high portions and when the follower 400 is in engagement with the low portions, the folding plate 392 will be positioned substantially as shown in FIGURES 16 and 18. When the high portion of the cam wheel 401 engages the roller 400, the arm 393 will be swung in a counterclockwise direction in FIGURES 16 and 18 to move the plate 392 inwardly or rearwardly and fold over one free end of the label on the top of the pair of shoelaces L confined in the upper end of the tube 315.

A combination folding member and heat-sealing bar 405 is oscillatably mounted as at 406 on the wheel 251 (FIGURES 16 and 18). The bar 405 is normally urged into engagement with a stop member 407 by a tension spring 408, one end of which is connected to the bar 405 and the other end of which is supported on a spring perch carried by the housing 250. As the wheel 251 is rotated in a counterclockwise direction from the position shown in FIGURE 18, the bar 405 will move downwardly and the leading lower edge thereof will engage and fold over the upstanding rear leg of the label on top of the plate 392.

The heater bar 405 has an outwardly extending arm 410 (FIGURES 16 and 18) on the outer free end of which a cam roller 411 is secured. As the wheel 251 oscillates in a counterclockwise direction, the cam roller 411 will engage an upstanding cam member 412 fixed on the right-hand leg of the support bracket 324. The cam 412 will cause the lower surface of heater bar 405 to pass above the folding plate 392 as it folds the rear upstanding leg of the label over onto the plate 392. The folding plate 392 will then be removed and the cam 412 will cause the lower surface of the heater bar 405 to move downwardly in pressure engagement against the upper surface of the folded over rear leg of the label and seal the same to the folded over front leg of the label positioned therebeneath. It is to be understood that the label material 320 may have heat sensitive adhesive applied thereto or it may be formed of synthetic material which will stick to itself when heat is applied to superposed portions.

As successive pairs of shoelaces L are removed from the housing 250 by the plunger 267, they will press against and push preceding pairs of labeled shoelaces downwardly in the tube 315. As the pairs of shoelaces L are moved to the lower free end of the tube 315 (FIGURE 16) an operator may easily remove the same and place them in boxes supported on the shelf 157.

Operation

The operation of the machine has already been given in connection with the detailed description of the parts, however, it is believed that a brief review of the operation of the basic components of the machine would be helpful to an understanding of the invention. In briefly describing the operation of the machine, it is believed that a sufficient understanding of the operation can be obtained by referring primarily to FIGURE 11. As step-by-step movement is imparted to the conveyor chain 120, an operator places the leading end of side-by-side pairs of shoelaces L in the blocks 150 as they are carried upwardly by the chain 120. As each block 150 stops in uppermost position, the shoelaces carried thereby will be

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picked up by the shoelace transporting jaws 165 and moved into one of the slots in the forward end of the mandrel 200 where they will be resiliently held. The shoelace guiding and tensioning lever 230 will be raised as the shoelaces are brought into the slot in the mandrel 200 and then lowered again as the lace transporting jaws 165 are moved forwardly so that the shoelace guiding clip 235 will be positioned between the side-by-side pair of shoelaces to prevent their overlapping as they are wound onto the mandrel.

Rotation is then imparted to the mandrel 200 and the shoelaces L will be wound therearound and confined in the groove 211 of the shoelace confining sleeve 210. When rotation of the mandrel 200 is stopped, the mandrel is withdrawn rearwardly to leave the shoelaces in side-by-side relationship and in a circular coil within the groove 211 of the sleeve 210. The shoelace removing plate 275 is then moved into a position inside of the circularly coiled shoelaces. The shoelace removing plate 275 is then moved from left to right in FIGURES 11 and 15 to draw or pull the circularly coiled shoelaces through the restricted exit slot 213 in the sleeve 210 to form the shoelaces into an elongated or flattened coil. As the shoelaces L are drawn through the slot 213 (FIGURE 15), they are drawn into and confined in the slot 266 in the housing 250.

The pair of shoelaces L are then carried to the packaging and labeling station 35 by swinging the housing 250 from a horizontal position (FIGURE 16) to a vertical position (FIGURE 18). During this downward swing of the housing 250, the strip of label material 320 is moved forwardly to position a label above the upper end of the receiving tube 315. When the housing reaches the vertical position, plunger 267 is then actuated to force the pair of shoelaces out of the groove 266 and into the upper end of the shoelace receiving tube 315. When the housing 250 is swung back to its horizontal position, the label is folded around and adhesively secured in position to surround at least a medial portion of the pair of shoelaces L.

Although only one of the slots 201 is used each time a pair of shoelaces is wound onto the mandrel 200, the four slots 201 are provided so that shoelaces of different lengths can be wound merely by changing the number of revolutions made by the mandrel 200. It is preferred that the mandrel be stopped with the tips at the leading ends of the shoelaces in the lower half of the circular coil and the tips at the trailing ends of the shoelaces in the upper half of the circular coil.

The shoelace winding and packaging machine of the present invention thus utilizes a rotatable mandrel about which the pairs of shoelaces are first wound in a circular coil and then the shoelaces are removed from the mandrel and formed into an elongated coil for easy packaging and display purposes. While the machine and method disclosed is particularly adapted for winding and packaging shoelaces, it should be readily apparent that the principles of the present invention may be utilized to wind and package a wide variety of other types of strand material. Also, the various mechanisms of the machine may be operated by means other than that shown without departing from the spirit of the invention.

In the drawings and specification there has been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. The method of preparing strand material such as shoelaces for packaging which comprises the steps of winding the strand material to form a circular coil, and drawing the circularly coiled strand material through a restricted opening to flatten the same and form an elongated coil.

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2. A machine for preparing strand material such as shoelaces for packaging comprising a tubular mandrel, means for imparting rotation to said mandrel to wind said strand material on said mandrel in a circular coil, confining means surrounding said mandrel for maintaining said strand material in said circular coil while removing the same from said mandrel, and means operatively connected with said winding means for flattening the circular coil of strand material to form an elongated coil of strand material.

3. A machine for preparing shoelaces for packaging comprising a tubular mandrel, means for attaching one end of a pair of side-by-side shoelaces to said mandrel, means for imparting rotation to said mandrel to wind said shoelaces about said mandrel and form a circular coil, means for removing said shoelaces from said mandrel while maintaining the same in a circular coil, and means operatively connected with said winding means for flattening the circular coil to form an elongated coil of the side-by-side shoelaces.

4. A machine for preparing shoelaces for packaging comprising a tubular mandrel, conveyor means for successively presenting one end of pairs of side-by-side shoelaces to said mandrel, means for attaching one end of the pairs of side-by-side shoelaces to said mandrel as they are presented thereto by said conveyor means, means for imparting rotation to said mandrel to wind said shoelaces about said mandrel and form a circular coil, means for removing said shoelaces from said mandrel while maintaining the same in a circular coil, and means operatively connected with said winding means for flattening the circular coil to form an elongated coil of the side-by-side shoelaces.

5. A machine for preparing shoelaces for packaging comprising a tubular mandrel, conveyor means for successively presenting one end of pairs of side-by-side shoelaces to said mandrel, said tubular mandrel having a longitudinally extending slot adapted to receive shoelaces positioned therein by said conveyor means, spring means in the slot for resiliently holding shoelaces positioned therein, means for imparting rotation to said mandrel to wind said shoelaces about said mandrel and form a circular coil, means for removing said shoelaces from said mandrel while maintaining the same in a circular coil, and means operatively connected with said winding means for flattening the circular coil to form an elongated coil of the side-by-side shoelaces.

6. A machine for packaging shoelaces in elongated coils comprising a tubular mandrel, means for attaching one end of a pair of side-by-side shoelaces to said mandrel, means for imparting rotation to said mandrel to wind said shoelaces about the same and form a circular coil, means operatively connected with said winding means for flattening the circularly coiled shoelaces to form an elongated coil, and means operating in timed relationship with said flattening means for applying a retaining label around at least a medial portion of the elongated coil of shoelaces.

7. A machine for packaging shoelaces comprising a rotatable mandrel, conveyor means for successively presenting one end of pairs of side-by-side shoelaces to said mandrel, shoelace holding means carried by said mandrel for receiving the end of a pair of shoelaces presented thereto by said conveyor means, means for rotating said mandrel to wind the shoelaces in a circular coil thereon, means for guiding and tensioning the shoelaces as they are wound onto said mandrel, means for holding the mandrel stationary upon completion of the winding operation, means for removing the shoelaces from said mandrel, means operatively connected with said mandrel rotating means for flattening the circularly coiled shoelaces to form an elongated coil, and means operating in timed relationship with said flattening means for positioning a label around at least the central portion of the elongated coil of shoelaces.

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8. A machine for packaging shoelaces comprising a rotatable mandrel, a conveyor chain, means for imparting step-by-step movement to said chain, a plurality of spaced apart shoelace transporting blocks carried by said chain, means on each of said blocks for resiliently retaining the ends of a pair of side-by-side shoelaces placed therein, said blocks adapted to transport said shoelaces to a point spaced from said mandrel, gripper means for removing said shoelaces from said blocks and successively presenting one end of the pairs of side-by-side shoelaces to said mandrel, shoelace holding means carried by said mandrel for receiving the end of a pair of shoelaces presented thereto by said gripper means, means for rotating said mandrel to wind the shoelaces in a circular coil thereon, means for guiding and tensioning the shoelaces as they are wound onto said mandrel, means for holding the mandrel stationary upon completion of the winding operation, means for removing the shoelaces from said mandrel, means operatively connected with said mandrel rotating means for flattening the circularly coiled shoelaces to form an elongated coil, and means operating in timed relationship with said flattening means for positioning a label around at least the central portion of the elongated coil of shoelaces.

9. A machine for packaging shoelaces comprising a rotatable mandrel, conveyor means for successively presenting one end of pairs of side-by-side shoelaces to said mandrel, shoelace holding means carried by said mandrel for receiving the end of a pair of shoelaces presented thereto by said conveyor means, means for rotating said mandrel to wind the shoelaces in a circular coil thereon, means for guiding and tensioning the shoelaces as they are wound onto said mandrel, means for holding the mandrel stationary upon completion of the winding operation, shoelace confining means surrounding said mandrel, means for moving said mandrel axially to remove the shoelaces from the mandrel, said shoelace confining means having a restricted opening therein, means operatively connected with said mandrel rotating means for drawing the circularly coiled shoelaces through the opening to form an elongated coil, means for maintaining the shoelaces in an elongated coil as they are drawn through the opening, and means operating in timed relationship with said drawing means for positioning a label around at least the central portion of the elongated coil of shoelaces.

10. A machine for packaging shoelaces comprising a tubular rotatable mandrel, a non-rotating sleeve surrounding said mandrel, said sleeve having an annular groove formed in the interior thereof for receiving and confining shoelaces therein, around its inner periphery, said sleeve also having a shoelace exit slot spaced from the shoelace entrance slot and communicating with the shoelace confining groove, shoelace holding means carried by said mandrel for receiving the end of a pair of shoelaces presented thereto, means for rotating said mandrel to draw the shoelaces through the shoelace entrance slot and wind the shoelaces in a circular coil about said mandrel, a doffing sleeve positioned inside of said tubular mandrel, means for effecting relative axial movement between said mandrel and said non-rotating and doffing sleeves and to remove the shoelaces from the mandrel, means operatively connected with said mandrel rotating means for drawing the circularly coiled shoelaces through the shoelace exit slot to form an elongated coil, and means operating in timed relationship with said drawing means for positioning a label around at least the central portion of the elongated coil of shoelaces.

11. A machine for packaging shoelaces comprising a tubular rotatable mandrel, a non-rotating sleeve surrounding said mandrel, said sleeve having an annular groove formed in the interior thereof for receiving and confining shoelaces therein, said sleeve having a shoelace entrance slot communicating with the shoelace confining groove,

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said sleeve also having a shoelace exit slot spaced from the shoelace entrance slot and communicating with the shoelace confining groove, conveyor means for successively presenting one end of pairs of side-by-side shoelaces to said mandrel, shoelace holding means carried by said mandrel for receiving the end of a pair of shoelaces presented thereto by said conveyor means, means for rotating said mandrel to draw the shoelaces through the shoelace entrance slot and wind the shoelaces in a circular coil about said mandrel, means for guiding and tensioning the shoelaces as they pass through the shoelace entrance slot and are wound onto said mandrel, means for holding the mandrel in non-rotating position upon completion of the winding operation, a doffing sleeve positioned inside of said tubular mandrel, means for effecting relative axial movement between said mandrel and said non-rotating and doffing sleeves and to remove the shoelaces from the mandrel, means operatively connected with said mandrel rotating means for drawing the circularly coiled shoelaces through the shoelace exit slot to form an elongated coil, and means operating in timed relationship with said drawing means for positioning a label around at least the central portion of the elongated coil of shoelaces.

12. A machine for packaging shoelaces comprising a tubular rotatable mandrel, a non-rotating sleeve surrounding said mandrel, said sleeve having an annular groove formed in the interior thereof for receiving and confining shoelaces therein, said sleeve having a shoelace entrance slot communicating with the shoelace confining groove, said sleeve also having a shoelace exit slot spaced from the shoelace entrance slot and communicating with the shoelace confining groove, conveyor means for successively presenting one end of pairs of side-by-side shoelaces to said mandrel, shoelace holding means carried by said mandrel for receiving the end of a pair of shoelaces presented thereto by said conveyor means, means for rotating said mandrel to draw the shoelaces through the shoelace entrance slot and wind the shoelaces in a circular coil about said mandrel, a doffing sleeve positioned inside of said tubular mandrel, means for guiding and tensioning the shoelaces as they pass through the shoelace entrance slot and are wound onto said mandrel, means for holding the mandrel in non-rotating position upon completion of the winding operation, means for imparting axial movement to said mandrel while maintaining said non-rotating sleeve and said doffing sleeve in a stationary position and to remove the shoelaces from the mandrel, means operatively connected with said mandrel rotating means for drawing the circularly coiled shoelaces through the shoelace exit slot to form an elongated coil, shoelace receiving means normally positioned to receive the elongated shoelaces from the shoelace exit slot and maintain the same in elongated form, label applying means operating in timed relationship with said drawing means and spaced from said shoelace receiving means, means for swinging said shoelace receiving means from shoelace receiving position to a position adjacent said label applying means, and means for transferring the shoelaces from said shoelace receiving means to said label applying means.

13. A machine for winding strand material comprising a tubular mandrel, a non-rotating sleeve surrounding said mandrel, said tubular mandrel having slots at one end for resiliently holding the strand material adjacent one end with the free end thereof extending inside of said tubular mandrel, said non-rotating sleeve having an annular groove formed in the interior thereof for receiving and confining the strand material therein, means for rotating said mandrel to wind the strand material thereabout and position the same in the annular groove of said non-rotating sleeve, a doffing sleeve positioned inside of said tubular mandrel, means for imparting axial movement to

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said tubular mandrel while maintaining said non-rotating sleeve and said doffing sleeve in a stationary position and to remove the coiled strand material from said mandrel, and means operable in timed relation to axial movement of said mandrel to flatten the circular coil of strand material and form an elongated coil thereof.

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