March 17, 1931. C. A. MATSON 1,797,173

PACKAGING MACHINE

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Fig. 1.

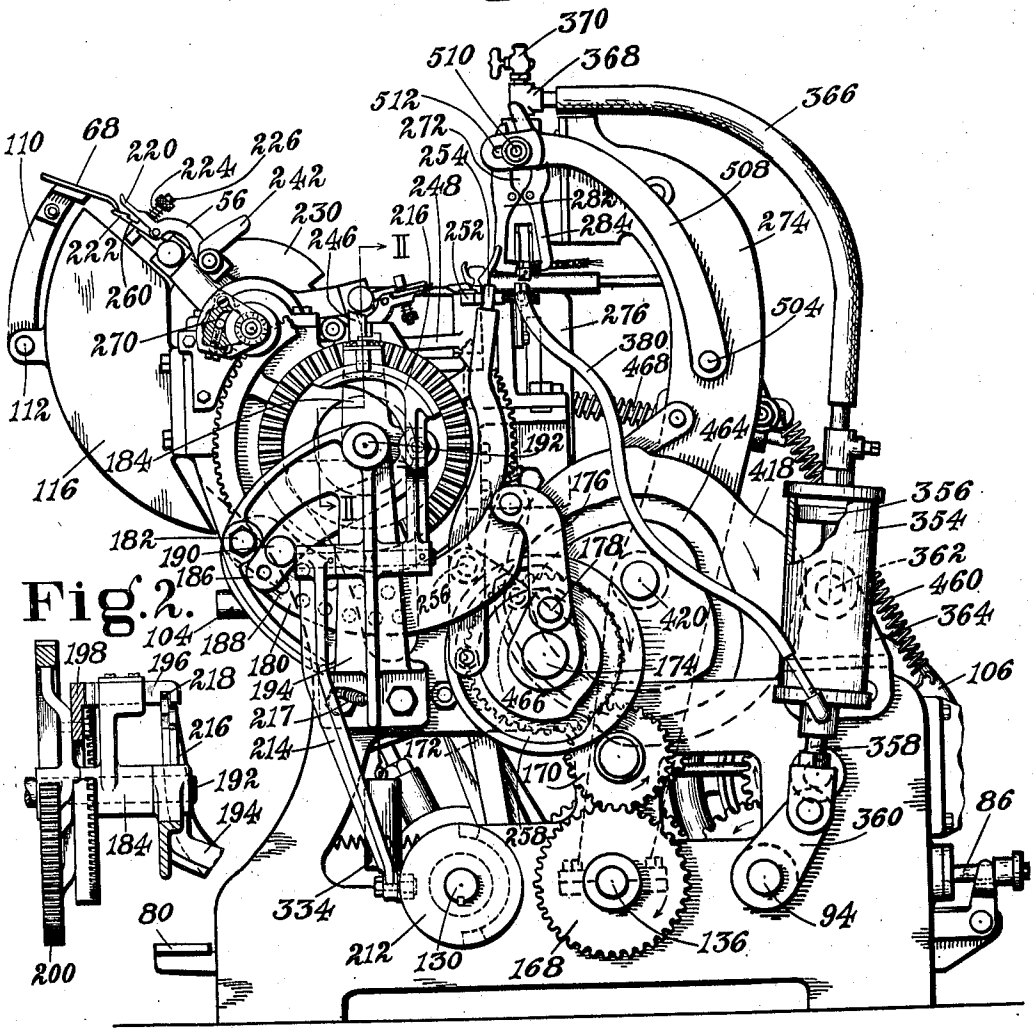


Fig. 2.

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PACKAGING MACHINE

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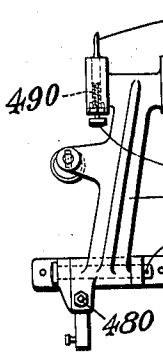


Fig. 9.

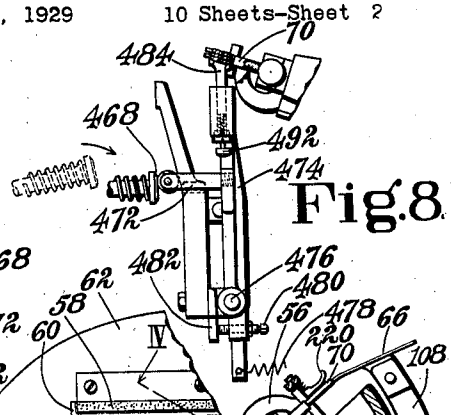


Fig. 8.




Fig. 3.

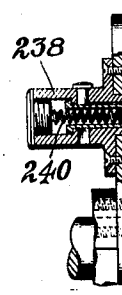


Fig. 4.

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PACKAGING MACHINE

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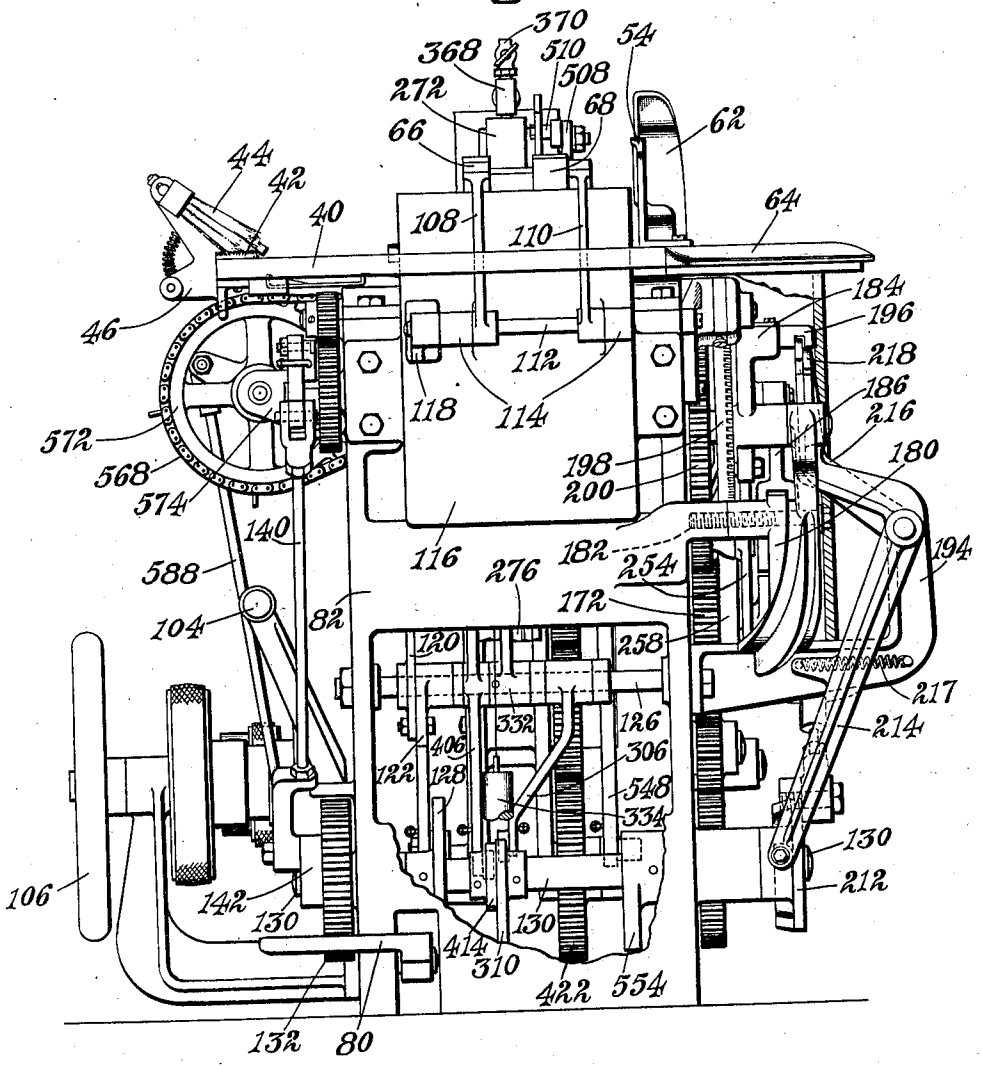
Fig. 5.

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PACKAGING MACHINE

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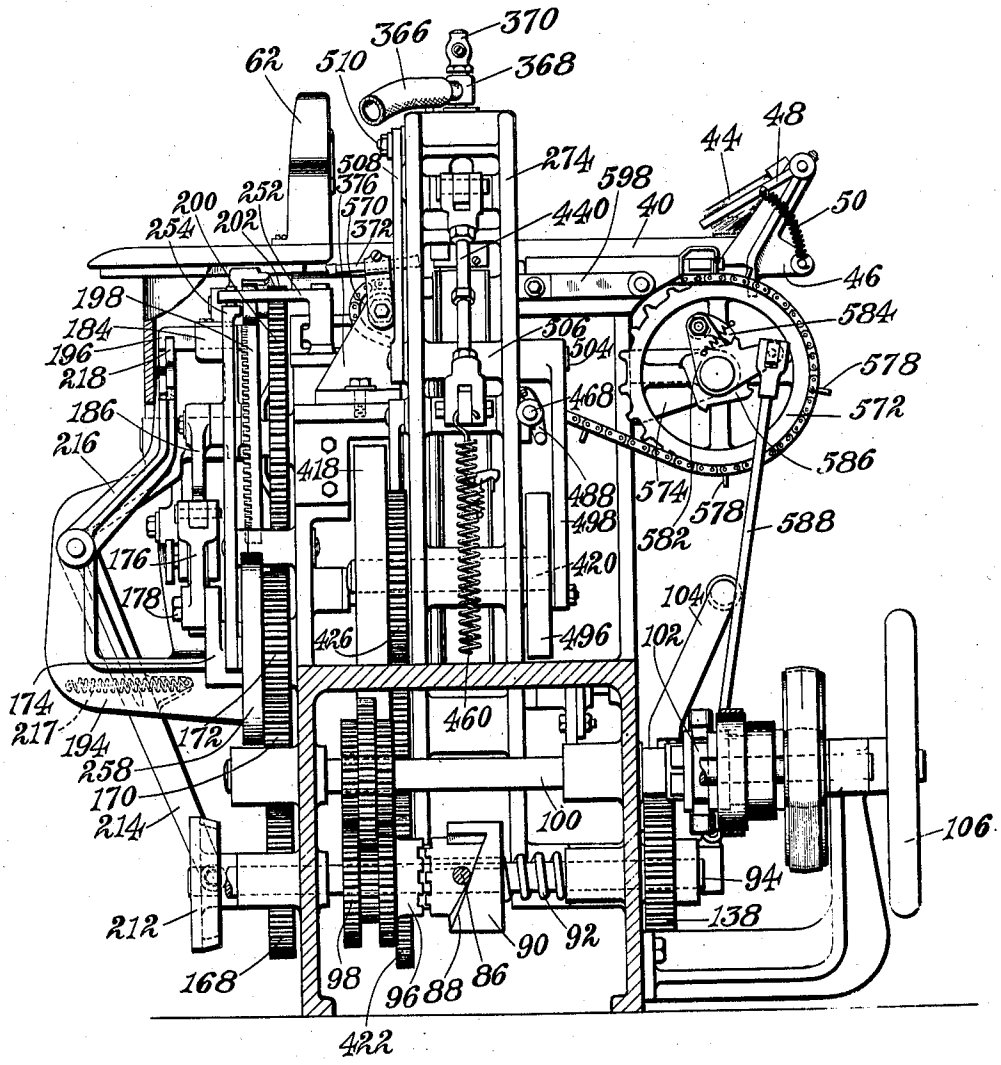
Fig. 6.

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PACKAGING MACHINE

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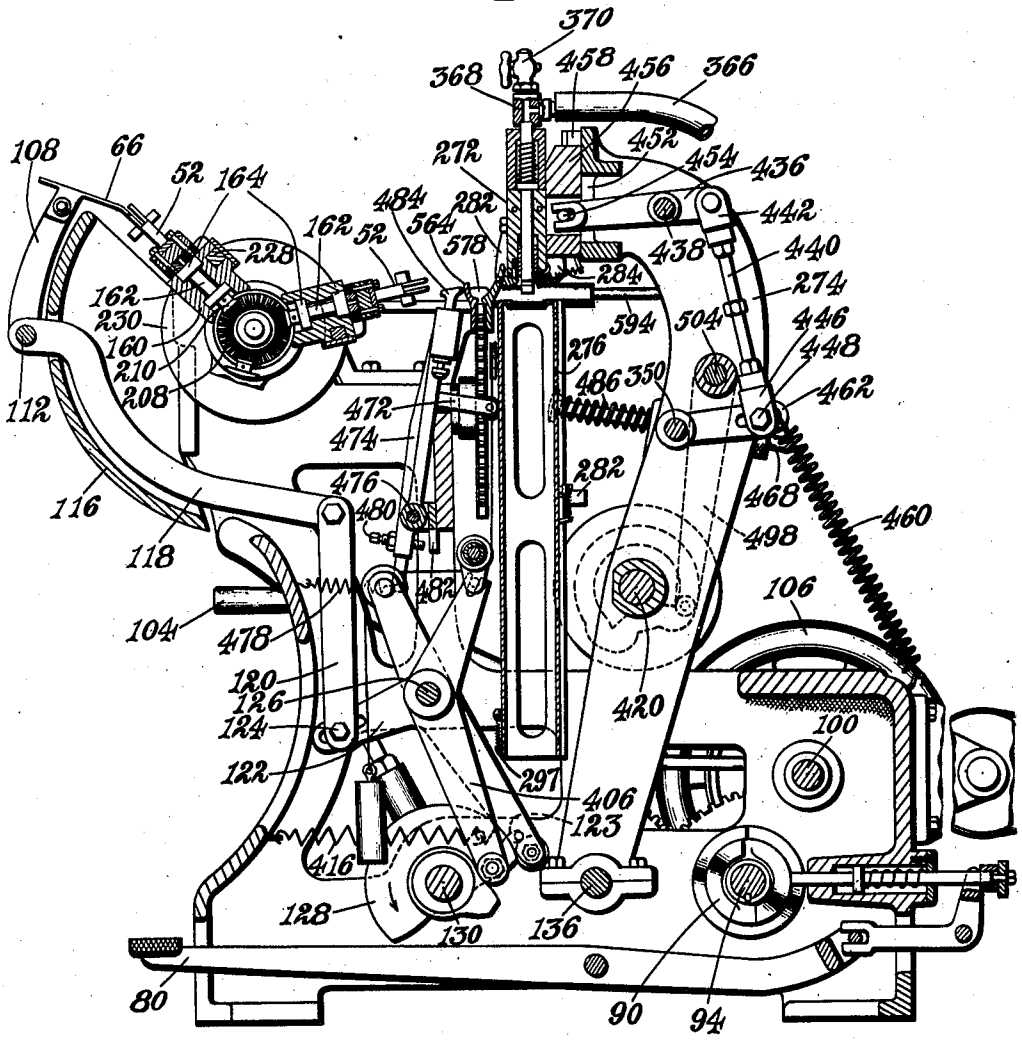
Fig. 7.

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PACKAGING MACHINE

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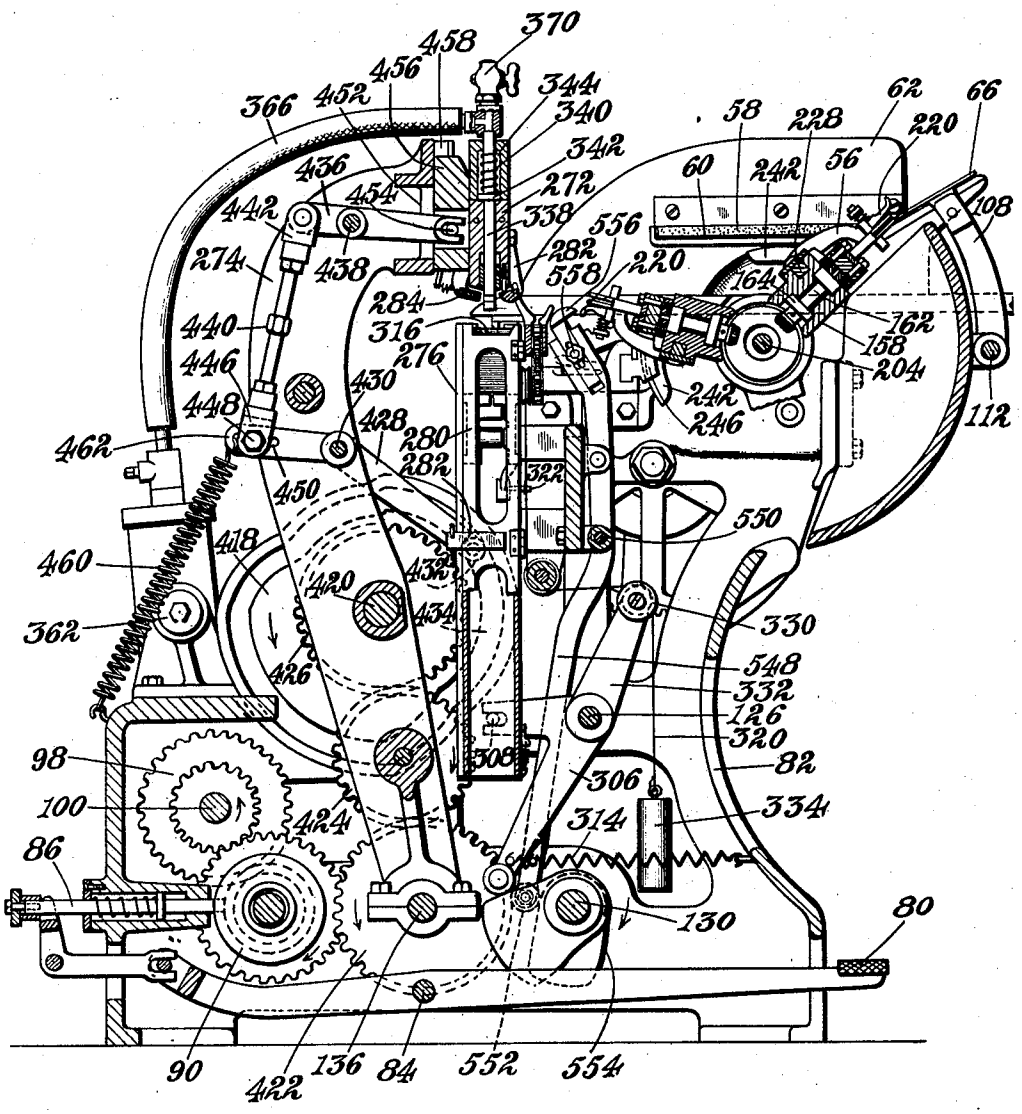
# Fig. 10.

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PACKAGING MACHINE

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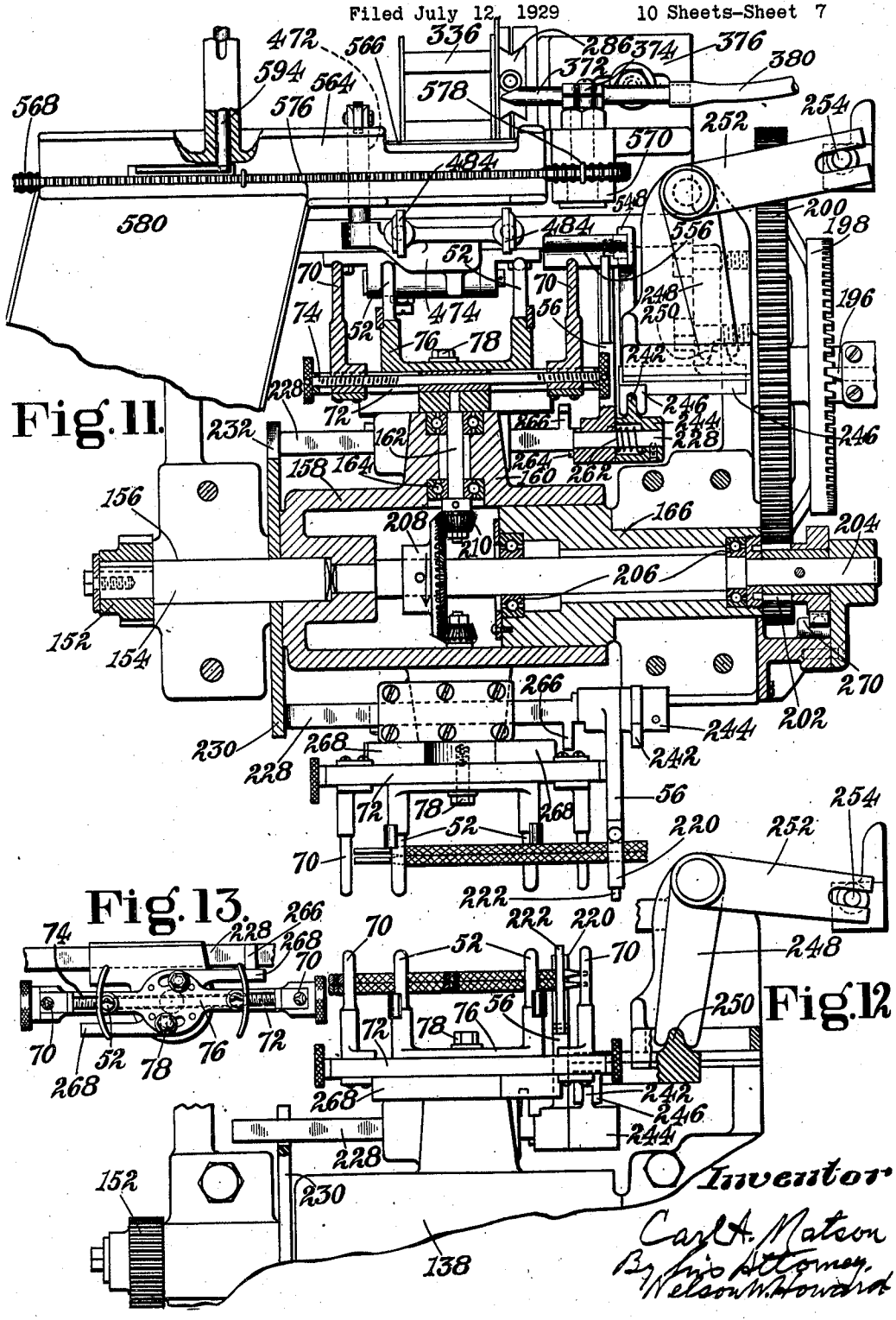


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PACKAGING MACHINE

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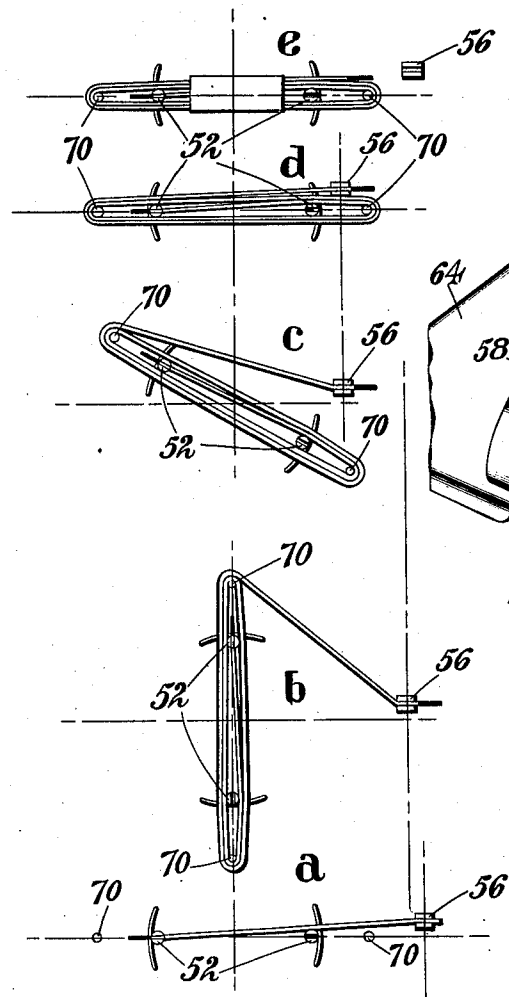


Fig. 15.

Fig. 14.

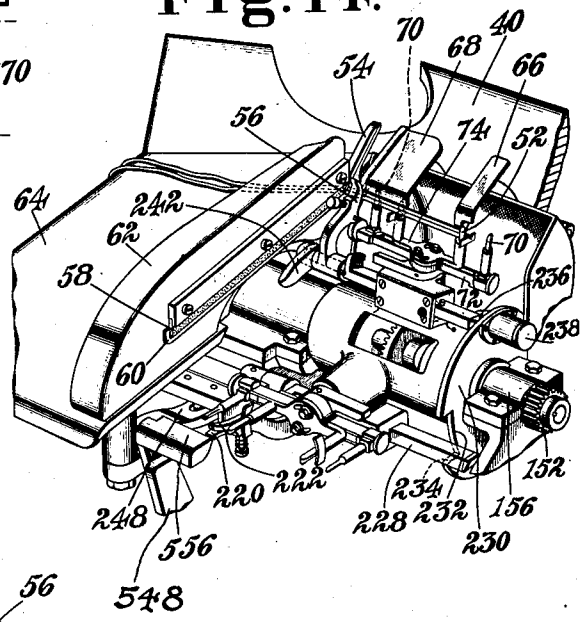


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Fig. 21.

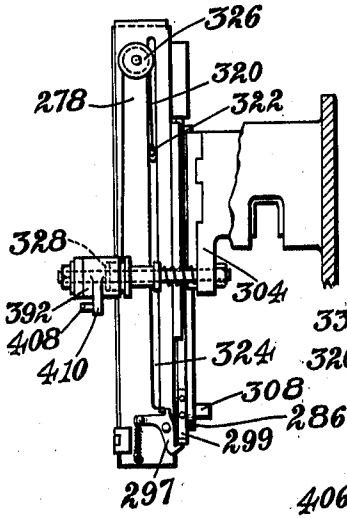


Fig. 18.

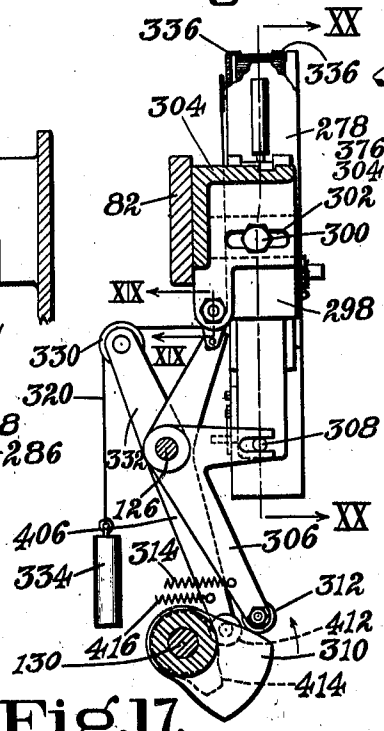


Fig. 16.

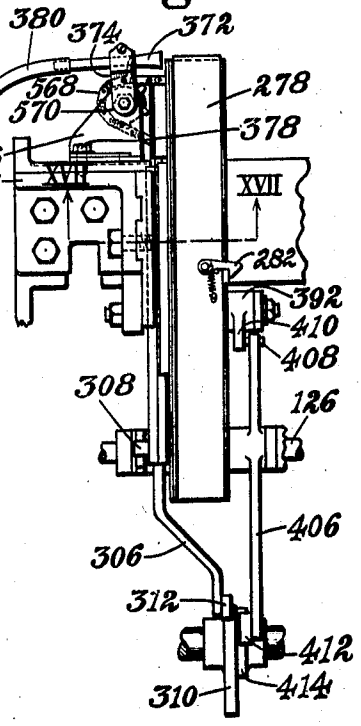


Fig. 20.

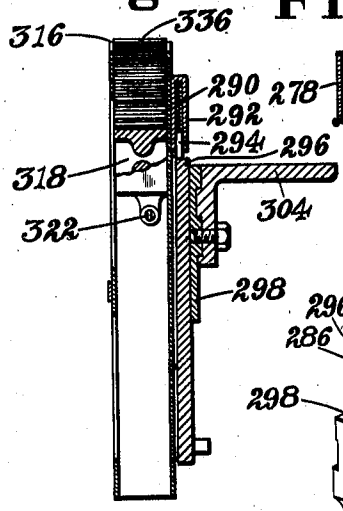


Fig. 17.

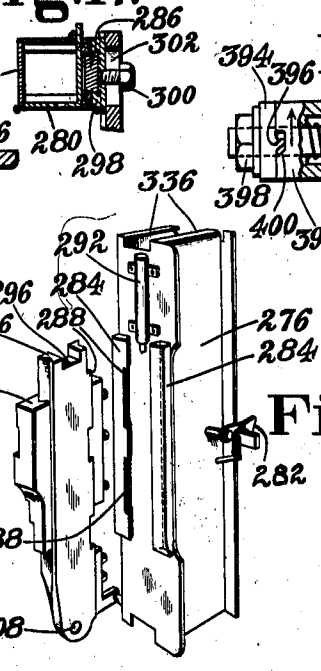


Fig. 19.

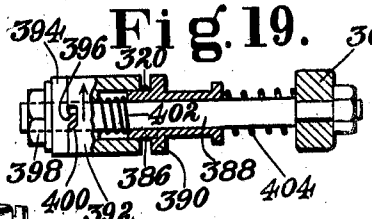


Fig. 22.

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PACKAGING MACHINE

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Fig.24.

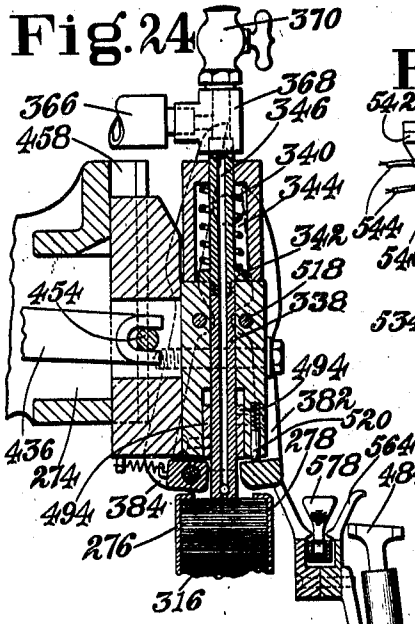



Fig.31.

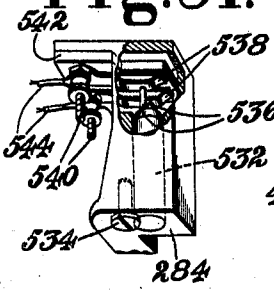



Fig.25.

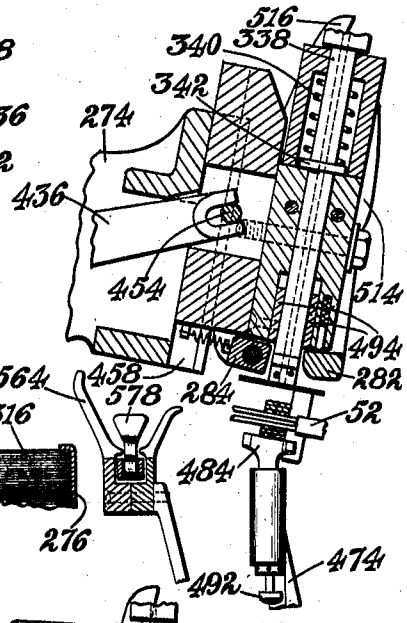



Fig.29.

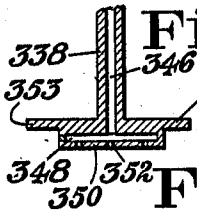



Fig.26.

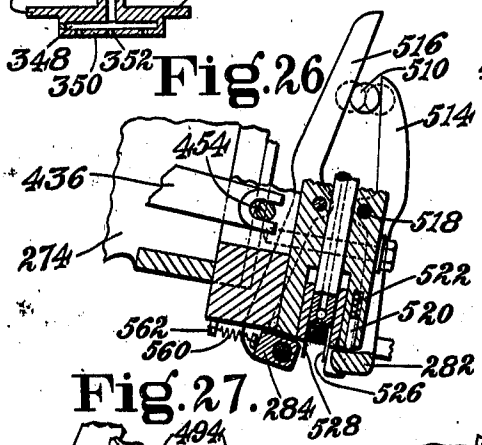



Fig.23.

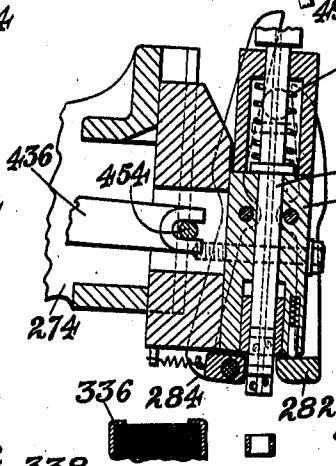



Fig.30

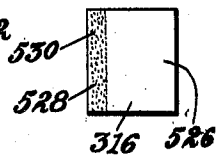
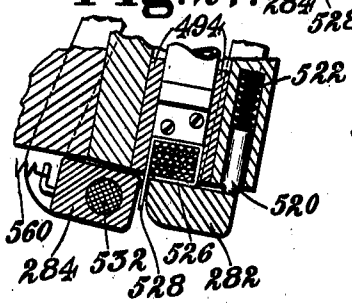



Fig.27.



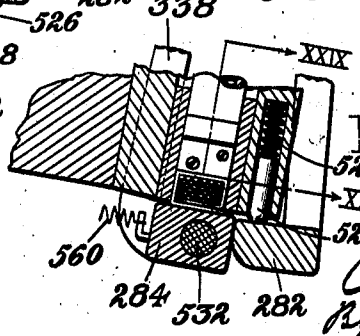




Fig.28.

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Patented Mar. 17, 1931 1,797,173

# UNITED STATES PATENT OFFICE

CARL A. MATSON, OF DANVERS, MASSACHUSETTS, ASSIGNOR TO SHOE LACE COMPANY, LTD., OF PROVIDENCE, RHODE ISLAND, A CORPORATION OF RHODE ISLAND

## PACKAGING MACHINE

Application filed July 12, 1929. Serial No. 377,794.

This invention relates to packaging machines and is illustrated herein as embodied in a machine of the type disclosed in my copending application Serial No. 72,474, filed on December 1, 1925, for winding pairs of laces into bundles and applying an adhesive band about them.

As in the machine disclosed in the above-mentioned application, the illustrated machine is provided with a bundling mechanism comprising a plurality of reels rotatable about their own axes in order that laces fed thereto may be wound into bundles thereon and rotatable intermittently about a common axis in order that the reels may be successively brought into a position in which wrappers may be folded into bands about the bundles. The reels in the machine disclosed in the above-mentioned copending application, and also in that disclosed in the present application, are provided with an adjustment whereby the outer ends of the bundled laces at the completion of their winding lie within the extremes of the bundle for the sake of neatness of its appearance. In order that the laces shall be wound on the reels tightly in a regular manner, means is provided for guiding and tensioning the laces as they are wound on the reels, which means is constructed and arranged to be moved into the path of rotation of the reels during the last half-revolution of their rotation in order that the outer ends of the laces in the bundle, which lie within the extremes thereof at the completion of the winding, will be supported during the banding operation.

One object of this invention is to provide an improved bundling mechanism of the kind described above, in conjunction with a mechanism for applying bands about bundles formed by the bundling mechanism. The invention, in this aspect, comprises the provision of improved means for guiding and tensioning the laces as they are wound on the reels. In accordance with this aspect of the invention the illustrated guiding and tensioning means is constructed and arranged to hold the outer ends of the bundled laces against the bundle when its winding is completed, thereby to insure compactness of the bundle. To this end the illustrated guiding and tensioning means is rotatably mounted on its support and resilient means connecting them is arranged yieldingly to urge the guiding and tensioning means against a completed bundle in banding position in order firmly to hold the outer ends of the bundle in juxtaposition thereto.

In accordance with another feature of this aspect of the invention and in order further to facilitate the winding of a regular bundle on the reels, means is provided for combing the laces being wound on a reel. In the illustrated construction the combing means operates on the laces before they pass to the guiding and tensioning means to assist the latter in freeing the laces of twists either in the individual laces or of one about another. To this end the illustrated means comprises an abutment and a cooperating yieldable flap, between which the laces are pulled, disposed in proximity to the path of the guiding and tensioning means and between the positions in which the laces are fed to the reels and the banding position thereof.

The completely formed bundles are encircled by bands by a banding device which is arranged to be oscillated intermittently between a magazine, from which it removes wrappers one by one, and the position in which the banding device applies the wrapper last removed from the magazine to a bundle on that reel which has been rotated into the banding position, as above described. Mechanism is also provided for imparting a translatory movement to the banding device at each end of its oscillatory movement, at one end outwardly from the axis of its oscillation so that it will clear the bundle in banding position when swung into juxtaposition therewith, and at the other end inwardly toward the axis of its oscillation to bring it into cooperative relation with the bundle in banding position, facilitating the folding of the wrapper into a band about said bundle.

It is desirable that the bundle in banding position shall be substantially in alinement with the banding device during its reciprocatory movement and when the bundle is being encircled by a band. Accordingly, a fea-

ture of the invention comprises means cooperating with the bundling reels for positively stopping their rotation in a predetermined position as they arrive at the banding position. Preferably the means for positively stopping the rotation of the reels as they come to the banding position is normally outside of the path of rotation of the reels but is brought within the path of rotation of the reels during the last half-revolution of the winding of the bundles on the reels. In the illustrated construction this means comprises an abutment fixed to a support for the guiding and tensioning means which, when the support is moved to its inner position during the last half-revolution of the reels, cooperates with a part of the reels positively to stop their rotation.

In the illustrated machine the reels are rotatably mounted in radially disposed arms of a spider which is also rotatable about a common perpendicular to the axes of rotation of the reels. The reels are brought successively into banding position by an intermittent rotation of the spider. In view of the foregoing, it is apparent that the alinement of the bundles on the reels in banding position with the banding device is also dependent upon the accurate positioning of the spider. In view of the above, it is another object of the invention to provide improved means for intermittently locking the spider from rotation in either direction as the reels carrying the bundles are successively brought into banding position. To this end the illustrated machine is provided with a plate in juxtaposition to said spider and normally in abutting relation with the ends of the supports for the guiding and tensioning means above referred to, this plate being constructed and arranged to cooperate with adjacent supports which are carried by the spider to prevent the rotation of the spider in either direction when a bundle is in banding position.

In the illustrated machine the reciprocatary motion of the banding device which results in the application of a band to a bundle is in a direction substantially tangent to the path of rotation of the bundle to be banded as it arrives at the banding position, and hence the direction of the reciprocatory motion of the banding device is laterally of the reel which supports the bundle. It is evident that the strands of the bundle which are uppermost with respect to the banding device will be supported by the reel against the pressure of the banding device as a wrapper is forced against and folded about the bundle; but the lower strands of the bundle, being beneath their supporting elements with respect to the banding device, are unsupported except by their own tension about the reel. Accordingly another feature of the invention comprises improved means for supporting the bundled laces during the banding thereof. To this end means is provided, independent of the reels, for supporting that bundle in banding position at its lowermost side during the banding operation. The illustrated support is constructed and arranged resiliently to resist the pressure of the bundle thereagainst during the banding operation adjacent to and at either side of the banding device.

The continuity of operation of machines in which labels or wrappers are removed one by one from a pile or stack is sometimes interrupted by faulty operation of the machine in this respect since two or more labels may adhere together, either temporarily, on account of atmospheric pressure holding them together, or more permanently on account of the adhesive matter thereon becoming partially fused. Wrappers are supplied to the banding device of the illustrated machine by bringing the banding device and the delivery end of the magazine into juxtaposition, it being understood that means is also provided for holding the wrappers in the magazine at the delivery end thereof. As the banding device is thus brought into contact with the endmost wrapper in the magazine, other mechanism becomes operative to produce a "partial vacuum" at the part of the banding device in abutting relation with the endmost wrapper in the magazine, thereby causing atmospheric pressure to retain the wrapper on the banding device when the banding device and magazine are brought out of juxtaposition.

Another important feature of the invention comprises improved mechanism for thus delivering wrappers one by one to the banding mechanism. It has been found that a relatively abrupt retraction of the banding device from the pile of wrappers is conducive to effective separation of wrappers singly from the pile. In accordance with this feature of the invention, means is provided for dropping the wrappers in the magazine with respect thereto as the magazine is brought out of juxtaposition with the banding device. In the illustrated construction this result is attained by employing a reciprocating magazine having a pulley arrangement connected with the wrapper support of the magazine. The wrapper support is operated in timed relation with the movement of the magazine and in the illustrated machine causes a dropping of the labels with respect to the magazine equal to the absolute velocity of the retraction of the magazine from the banding device. Hence, the absolute velocity with which the wrappers are dropped away from the banding device is twice that of the magazine.

The speed with which a wrapper may be removed from a pile is dependent, to some extent, upon the rapidity with which air may

enter the space between the wrapper being separated from the pile and the next to the top wrapper in the pile. In view of this and in accordance with another feature of the invention, the illustrated machine is provided with means for creating an air-blast edgewise of the wrappers at the delivery end of the magazine to assist in separating the endmost wrapper from the pile.

Still another object of the invention is to provide an improved means for automatically collecting the completely banded bundles which usually, but not necessarily, contain a pair of laces. As illustrated, this means comprises a trough disposed transversely of the direction of motion of the banding device between the bundling mechanism and the magazine, the banding device being constructed and arranged to discharge the banded bundles into the trough as it passes thereover. Upon being dropped into the trough a banded bundle is then carried to a collecting table adjacent to one end of the trough by means of an intermittently operated chain having cleats which extend into the trough through its vertex for positively engaging one end of the banded bundles. In order to remove from the trough the banded bundle last carried to the end of the trough adjacent to the collecting table, means is provided, intermittently operable in alternation with the operation of the chain, for pushing the banded bundle in the trough at the head of the collecting table off the chain and onto the table. As illustrated, this means comprises a push rod operated by a plunger carried by the oscillating arm which supports the banding device.

The laces to be packaged are brought to the illustrated machine in hanks containing a gross and each hank is deposited in a flattened heap on a table fixed to the rear part of the machine, that being a location from which the operator may transfer laces to the bundling means with ease. However, owing to the tendency of adjacent laces to cling together whether they are intertwined or not, it would be difficult for the operator, unassisted, to remove from the heap only the particular laces next to be operated upon in the machine. Accordingly it is another object of the invention to provide means for allowing the removal of only those laces which are selected by the operator to be fed to the bundling means. As illustrated, this means comprises a brush having a relatively large transverse area for engagement with the group of laces, thereby frictionally to resist their removal. Another brush is arranged resiliently to urge the group of laces against the first-mentioned brush more firmly to retain them on the supporting table.

These and other features of the invention will now be more fully described in connection with the illustrated machine in which the invention is shown as embodied and finally will be defined in the appended claims.

In the drawings,

Fig. 1 is an elevation of the right-hand side of the machine in which the present invention is illustrated as embodied;

Fig. 2 is a fragmentary section taken along the line II—II of Fig. 1;

Fig. 3 is a side elevational view of the left-hand side of the machine with parts broken away;

Fig. 4 is a fragmentary sectional view along the line IV—IV of Fig. 3;

Fig. 5 is a front elevation;

Fig. 6 is a rear elevation;

Fig. 7 is a sectional elevation as seen from the right-hand side of the machine, the section being taken through the central portion of the machine;

Figs. 8 and 9 are side and front elevations, respectively, of a bundle support shown also in side elevation in Fig. 7;

Fig. 10 is a sectional elevation as seen from the left-hand side of the machine, the section being taken through the central portion thereof;

Fig. 11 is a plan view partly in section of the bundling mechanism, wrapper magazine, and bundle collecting means;

Fig. 12 is a side view of one element of the bundling mechanism, the lace guiding and tensioning means of which is shown in its inner position;

Fig. 13 is a detailed end view of a bundling reel;

Fig. 14 is a view in perspective of the bundling mechanism;

Fig. 15 illustrates successive stages in the winding of a pair of laces into a bundle;

Fig. 16 is a rear elevational view of the wrapper magazine, its mounting and operating means;

Fig. 17 is a cross-section taken along the line XVII—XVII of Fig. 16;

Fig. 18 is an elevational view of the magazine and operating means as seen from the right-hand side of the machine;

Fig. 19 is a view partly in section of a fragment of the mechanism shown in Fig. 18, the section being taken along the line XIX—XIX;

Fig. 20 is a sectional elevation of the wrapper magazine, the section being taken along the line XX—XX of Fig. 18;

Fig. 21 is a front elevation of the wrapper magazine and its mounting on the frame;

Fig. 22 is a view in perspective of the wrapper magazine and its immediate support in disassembled relation;

Figs. 23, 24, 25, 26, 27 and 28 are sectional elevations illustrating the banding device and successive stages of its operation in folding a wrapper into a band about a bundle of laces;

Fig. 29 is a sectional view of a part of the

banding device taken along the line XXIX—XXIX in Fig. 28;

Fig. 30 illustrates an adhesive wrapper of the type used in the illustrated machine; and

Fig. 31 is a fragmentary perspective view of a folding jaw with parts broken away to show the heating unit therein.

The machine in which the invention is illustrated as embodied comprises a mechanism herein termed a bundling mechanism, the function of which is to wind laces into bundles of convolute loops; an apparatus herein termed a banding device for folding wrappers into bands about bundles formed by said bundling mechanism; and also a mechanism including a wrapper magazine operating in conjunction with the banding device for supplying wrappers thereto.

The bundling mechanism comprises a plurality of reels which are rotatable about their own axes to wind laces into bundles thereon and which are intermittently rotatable about a common axis in order successively to move the reels from that position in which the laces are fed thereto, to that in which the bundled laces are banded. The above-mentioned rotation of the reels about their own axes to wind laces into bundles thereon occurs during the bodily rotation of the reels about their common axis so that, simultaneously with the rotation of a reel of the bundling mechanism between the lace receiving and banding position, the laces on that reel are being wound into a bundle.

Laces brought to the machine to be bundled are deposited on a shelf 40 (Fig. 5) extending entirely across the front of the machine. The laces are laid lengthwise on the shelf 40 in a flattened heap with one end thereof overlying vertically disposed bristles of a brush 42 at the extreme left-hand end of the shelf 40. The laces on the shelf are held against the brush 42 by means of another brush 44 pivotally mounted in a bracket 46 which is fixed to the extreme left-hand end of the shelf 40. The brush 44 may be raised to permit the placing of a new group of laces on the shelf 40, by means of a handle 48 (Fig. 6) connected to the bracket 46 by a helical spring 50 which normally urges the brush 44 toward the brush 42, thereby pressing the ends of the laces on the shelf 40 against the bristles of the brush 42. The friction thus created by the cooperation of the brushes 42 and 44 prevents the removal of any laces other than those selected to be removed therefrom and to be fed to the reels.

Grasping the laces, usually in pairs, at both ends after removing them from the heap, the operator inserts the left-hand ends thereof in the left-hand bifurcated pin 52 (Figs. 13 and 14) of the reel in lace receiving position—that of the uppermost reel illustrated in Fig. 14, slides the end portions of the laces over the guide 54, between the jaws of a guiding and tensioning device 56 to be described later, into a slot between a fabric flap 58 and a cooperating abutment 60 at one side of a kerf in a vertically disposed shield 62 fastened to a table 64 fixed to the right-hand side of the machine at the same level as that of the shelf 40. Having done this, the operator with the right hand pulls the laces until the left-hand tips thereof, being stiff become wedged slightly in the V-shaped bifurcation in the pin 52 (Fig. 13) and then lets the right-hand ends of the laces drop loosely over the table 64, as indicated in Fig. 14. The feeding of a pair of laces to the reels is facilitated by a guide 66, the upper surface of the lower end of which is in alinement with the bifurcation in the left-hand pin 52 of the reel in lace receiving position. A guard 68, together with the guide 66, is operated by means to be described later so that its lower end overlies the ends of the right-hand pin 52 and one of two pins 70, the position of which determines the size of the bundle into which the laces are wound. The pins 70 are supported by a reel arm 72 (Figs. 11, 13 and 14) along which they may be adjusted simultaneously longitudinally thereof, in order to accommodate laces of various lengths, by means of a right and left-hand threaded rod 74 mounted for rotation in the arm 72. In order that the bifurcation in the left-hand pin 52 of the reel in lace receiving position may be readily alined with the guide 66, the pins are mounted at opposite ends of a support 76 which may be adjustably clamped against the arm 72 by means of screws 78 (Fig. 13) passing through arcuate slots in the support 76 which allow an angular adjustment of the support 76 with respect to the reel arm 72.

Having thus prepared the machine for operation by feeding laces to that reel in lace receiving position, the operator next depresses a treadle 80 (Fig. 10) which is pivotally supported on one side of the frame 82 on a stub shaft 84. Depression of the treadle actuates a mechanism next to be described for rotating the reel to which laces have been fed, about its own axis to wind said laces into a bundle thereon, and simultaneously about another axis to move the reel from its lace receiving position to the banding position—that of the left-hand reel illustrated in Fig. 10, and that in which a wrapper is folded into a band about the completely bundled laces.

Depression of the treadle 80 (Figs. 6 and 10) will result in the retraction of a rod 86 from a cam face 88 on one element 90 of a one-revolution clutch of the type described in my copending application referred to above, allowing said element urged by a spring 92 to slide to the left (Fig. 6) along a shaft 94 to which said clutch element 90 is splined and to engage a cooperating clutch element 96 which is rotatably mounted on the shaft 94, which shaft is journaled at both ends in

the frame 82. Power is supplied to the clutch element 96 through a speed reducing gear mechanism 98 driven from a shaft 100 journaled in the frame 82, which shaft by means of a clutch 102 controlled by a hand lever 104, may readily be connected with or disconnected from the source of power. A hand wheel 106 is fixed to one end of the shaft 100 to enable the operator to turn the machine over by hand if he so desires. Assuming then, that the clutch 102 is operated to provide a driving connection between the source of power and the shaft 100, for each depression of the treadle 80 the shaft 94 will revolve once, or, if the treadle is held down continuously, the shaft 94 will likewise rotate continuously.

The first result of depressing the treadle, as evidenced by motion of the bundling instrumentalities, is the lifting of the guide 66 and the guard 68 out of juxtaposition with the corresponding pins on the bundling reel. The guide 66 and guard 68 are mounted on arms 108 and 110 (Figs. 5, 7 and 10) respectively, which arms are fixed to a rock-shaft 112 rotatably supported by lugs 114 (Fig. 5), extending rearwardly from a casing 116 fixed to the rear of the frame 82. The arms 108 and 110 are oscillated to move the guide and guard into and out of juxtaposition with the pins as above noted by an arm 118 (Fig. 7) fixed at one end to the rock-shaft 112 and pivotally connected at its other end with a link 120 which may be adjustably pivoted to one arm of a bell-crank 122 by means of a bolt 124. The bell-crank 122 is pivoted on a rod 126 extending between the sides of the frame 82 and is arranged to be operated by a cam 128 which is fixed to a shaft 130 journaled at its opposite ends in the sides of the frame 82. A gear 132 (Fig. 3) is fixed to one end of the shaft 130 and is driven by another gear 134 of the same size which is fixed to a shaft 136 extending between and journaled in the sides of the frame. The gear 134 likewise meshes with another gear 138 which gear is fixed to the shaft 94 to which is imparted a full revolution each time the treadle is depressed, as above described.

It is apparent from Fig. 7 that upon a very slight rotation of the shaft 130 in the direction indicated from its illustrated position the cam 128 will allow a clockwise rotation of the bell-crank 122 caused by a spring 123 and through the link 120 and lever 118 will oscillate the guide 66 and guard 68 in a counter-clockwise direction, moving them out of juxtaposition with the pins 52 and 70. Upon further rotation of the shaft 130 the bodily rotation of the reels about their common axis begins, which movement is derived from the following mechanism: A connecting rod 140 (Fig. 3), which at its lower end is pivoted to a crank 142 fixed to the shaft 130, operates a bell-crank 144 pivoted at the side of the frame 82 on a stub shaft 146. A pawl 145 carried by one arm of the bell-crank 144 is resiliently held in engagement with a ratchet 148 fixed to a gear 150 both of which are arranged to rotate on the stub shaft 146. For each revolution of the crank 142 the ratchet 148 is rotated in a clockwise direction through an angle corresponding to that between successive teeth on it and hence in the illustrated machine the gear 150, which is attached to the ratchet 148, will rotate one-sixth of a revolution for each revolution of the crank 142. A pinion 152, having a diameter one-half that of the gear 150 and meshing with it, is keyed to the outer end of a shaft 154 (Figs. 3 and 4) rotatably mounted in a bearing 156 (Fig. 11) in the upper part of the frame 82. A spider 158 having three equally spaced and radially disposed arms 160 is fixed concentrically to the end of the shaft 154 opposite to that to which the pinion 152 is fixed. A shaft 162 is rotataby mounted in each of the arms 160 in suitable bearings 164 and each shaft 162 has fixed thereto at its outer end a reel arm 72. The spider 158 is rotatably supported at its right-hand end on a bearing 166 in alinement with the bearing 156 in the left-hand side of the frame 82. It is now apparent that for each one-sixth revolution of the gear 150, on account of the two to one ratio between the gears 150 and 152, the spider 158 will be rotated through one-third of a revolution or that angle between successive reels of the bundling mechanism. Simultaneously with the bodily rotation of the reels about the center of the shaft 158 as an axis, they are also rotated about their own axes, the centers of the shafts 162, to wind into bundles the laces previously fed thereto as described above. Mechanism for providing this rotation will now be described.

The power for rotating the reels about their own axes is taken from the shaft 136 (Fig. 1) by means of a gear 168 which is fixed to the shaft. An idler 170 rotatably mounted on the side of the frame 82 and meshing with the gear 168 drives a gear 172, of the same size as the gear 168, fixed to a crank shaft 174 also rotatably mounted in the frame 82. A link 176 pivotally connects a crank pin 178 on the shaft 174 with a link 180 pivoted to the frame on a screw 182. It is now apparent that rotation of the crank 174 will impart an oscillation to the link 180. This motion of the link 180 is in turn imparted to a bell-crank 184 by means of a link 186, the lower end of which may be adjustably secured in any of a plurality of holes 188 in the link 180 by means of a pin 190 thereby to vary the amplitude of oscillation of the bell-crank 184. The bell-crank 184 is rotatably supported on a rod 192 which is mounted at one end in a bracket 194 bolted to one side of the frame 82, the rod 192 be-

ing supported at its other end by the frame 82 itself. A pawl 196 (Fig. 2) slidably supported at the top of the upper arm of the bell-crank 184 is arranged to engage the teeth of a ratchet wheel 198 which is fixed concentrically to a gear 200 rotatably mounted on the shaft 192. The bundling reels are driven by the gear 200 through a pinion 202 (Fig. 11) which is pinned to a shaft 204, rotatably supported in suitable bearings 206, retained by the bearing 166. The shaft 204 carries at its other end a beveled gear 208 which drives the shafts 162 through beveled pinions 210 fixed to the inner ends thereof. In order that the bundling reels shall be rotated in only one direction about their own axes, mechanism is provided for rendering the bell-crank 184 effective to operate the gear 200 only when it rotates in a clockwise direction as seen in Fig. 1.

This mechanism comprises a cam 212 (Figs. 1 and 5) keyed to the shaft 130 which cam operates an arm 214, rotatably mounted in the bracket 194, on a rod to which is also fixed an arm 216 having a circular top concentric with the shaft 192. A spring 217 connecting the central portion of the arm 214 with the bracket 194 resiliently holds the cam roll on the end of the arm in contact with the operating fan of the cam. The top of the arm 216 is arranged to fit within a kerf 218 (Fig. 2) in the outer end of the pawl 196. It is now believed to be apparent that despite the oscillation of the bell-crank 184, the arm 216 when operated outwardly from the side of the frame by the mechanism just described will pull the pawl 196 out of engagement with the teeth of the wheel 198, thereby rendering the bell-crank 184 inoperative further to drive the gear 200 and hence to rotate the reels about their own axes. The cam 212 in the illustrated machine is so constructed that the pawl 196 is allowed to be in driving relation with the wheel 198 only after the rotation of the spider has commenced and until the rotation of the spider has stopped.

It is apparent from Fig. 14 that the bundling reels in lace receiving and banding position are substantially parallel. It follows then that the bundling reels as they pass from the lace receiving to the banding position must rotate about their own axes and integral number of half revolutions in order that the above condition may hold true. Some laces of various lengths may be wound in bundles of substantially the same length by controlling the winding thereof as to the number of loops. This result is obtained in the illustrated machine by varying the number of half-revolutions of the bundling reels about their own axes. As above described, this means comprises the link 186 and the oscillating link 180 which are adjustably pivoted together by means of the pin 190. As illustrated in Fig. 1, the pin may be inserted in either of two holes in the link 186 thereby enabling it to be engaged within any of the holes in either of the two rows of holes in the link 180. The amplitude of oscillation of the bell-crank 184, and hence the number of half revolutions of the bundling reels, may thus be varied by changing the position of the pin 190. The final adjustment of the bundling reels, for the purpose of so positioning the pins 70 thereof so that when the winding of a bundle is completed the outer ends of the laces therein lie as illustrated in Fig. 12, is accomplished by turning the right and left hand threaded rod 74 in order to vary the spacing of the pins 70.

The guiding and tensioning devices 56, one of which is associated with each of the bundling reels, are constructed and arranged to assist in the winding of laces into bundles on the reels, and insure that the bundles will be tightly wound in convolute loops. Each of the illustrated guiding and tensioning means is constituted by a clip comprising a jaw 220 (Figs 1, 11, 12 and 14) on which is pivoted a cooperating jaw 222 resiliently urged thereagainst by a spring 224 which surrounds a rod 226 fastened to the jaw 222. The jaws 220 are mounted for limited rotation on rods 228 (Fig. 11) slidably mounted in the arms 160 of the spider 158 parallel to the shafts 154 and 204. In order that the rotation of the bundling reels will not be interfered with by the clips of the guiding and tensioning means, the latter must remain outside of the path of rotation of the reels during the winding operation. This end is insured through the use of a plate 230 which is interposed between the spider 158 and the left-hand side of the frame to which the plate is fixed. As indicated in Figs. 11 and 14, the left-hand ends of the rods 228 are in abutting relation with the plate 230 during the lace winding operation, thereby prohibiting movement of the guiding and tensioning means to the left while the rods are thus in contact with the plate. However, as it is desirable to support the outer ends of the laces of the bundle, which are within the extremes thereof when its winding is completed, it is necessary to move the clips of the guiding and tensioning means within the path of rotation of the reel, which movement occurs during its last half-revolution as illustrated diagrammatically in Fig. 15. By the time that the bundling reels will have started their last half-revolution of the rotation required to wind laces into a bundle thereon, the spider will have been rotated about its major axis to bring a bundling reel substantially into banding position. A portion of the plate 230 opposite the rod 228 associated with the reel in banding position is notched, as at 232 (Fig. 14), to allow movement of the rod 228 to the left as shown in Fig. 12, or to the right as seen

moval of the endmost wrapper takes place. This means comprises the clutch 328 (Fig. 21) which is arranged to grip the cord 320 at the instant the magazine starts to drop away from the banding device. It will be apparent from an inspection of the above figure that upon a downward movement of the magazine, the clutch being fixed and having been operated to clamp the cord 320 by virture of the cord being led over the pulley 326 which is fixed to the magazine casing, for each unit of velocity with which the magazine drops, the support therein and hence the wrappers will drop with a velocity of two such units. Therefore, as soon as the magazine is moved away from the banding device the wrappers inside the magazine will quickly drop with respect to it, thereby relieving frictional resistance between the uppermost wrapper and the ears 336 when said wrapper is to be removed from the magazine. The clutch mechanism comprises a sleeve 386 (Fig. 19) which is slidably mounted on a stud 388 fixed to the bracket 304. As illustrated in Figs. 18, 19 and 21, the cord 320 is gripped as above described by being forced against a shoulder 390 on the sleeve 386 by means of a clutch element 392 rotatably and slidably mounted on the stud 388. A collar 394 having a cam finger 396 is fixed on the end of the stud 388 by means of a nut 398 holding the sleeve 386 and the clutch element 392 on the stud in assembled relation. The clutch finger 396 is engaged within a recess in the clutch element 392 having a cam face 400 which, when the clutch element 392 is rotated in the direction indicated in Fig. 19, rides up the incline of the cam finger 396, thereby moving the clutch element to the right against the pressure of a spring 402 and gripping the cord against the shoulder 390 on the sleeve 386 which is urged toward the clutch element 392 by means of a spring 404 of considerably greater strength than that of the spring 402. The mechanism for operating the clutch element 392 comprises a lever 406 (Fig. 18) fulcrumed at its central portion on the rod 126 and engaging at its bifurcated end a pin 408 (Figs. 16, 18 and 20) fixed in the end of an arm 410 extending from the clutch element 392. The other arm of the lever 406 carries a roll 412 arranged to engage a cam 414 fixed to the shaft 130. The cam roll is normally held in engagement with the cam 414 by means of a spring 416 connecting the lower end of the arm 406 with the frame. As above described, the clutch mechanism is arranged to grip the cord 320 just as the magazine is dropped with respect to the banding device to facilitate the removal of only the endmost wrapper in the magazine by the suction chuck, not only by suddenly retracting the labels from the chuck by virtue of their dropping with respect to the magazine, but also by eliminating the normal frictional resistance to the removal of the endmost wrapper owing to its engagement with the ears 336. Simultaneously with the dropping of the magazine, the nozzle directs the air blast as above described edgewise of the upper labels in the magazine so that the separation of the endmost wrapper from the rest will not be retarded by the time ordinarily required for air naturally to flow therebetween.

After the magazine 276 has begun to drop with respect to the banding device 272, the banding device is raised with respect to the arm 274 by means comprising a cam 418 (Fig. 10) which is fixed on a shaft 420 rotatably mounted in the central portion of the arm 274. The cam 418 is driven in the direction indicated in Fig. 10 from the shaft 136 by means of a gear train comprising a spur gear 422 fixed to the shaft 136, which gear drives an idler gear 424 rotatably mounted in the arm 274, which idler gear in turn drives a spur gear 426, which latter gear is fixed to the shaft 420 carrying the cam 418. The rotary motion of the cam 418 is delivered to the banding device as a reciprocating motion by means of a linkage comprising a lever 428 fulcrumed at 430 on the arm 274 and having on one end a cam roll 432 engaging a track 434 in the cam 418. The lever 428 is connected at its other end to one end of another lever 436 fulcrumed on the arm 274 on a pin 438 by means of an extensible link 440 having a right-hand thread cut on one end and a left-hand thread on the other which ends are screwed into yokes 442 and 446 pivoted, respectively, to one end of the levers 436 and 428. A bolt 448 connecting the yoke 446 with the lever 428 may be adjustably fixed in any desired position in the elongated slot 450 in the lever 428, thereby to vary the effective throw of the cam 418. The bifurcated end of the lever 436 extends through a hole 452 in the top end of the arm 274 and engages a pin 454 extending across a recess in a support 456 into which the bifurcated end of the lever 436 is received and which is mounted for reciprocation on a slide 458 at the upper extreme of the arm 274. In order to take up the backlash between the cam roll 432 and the track 434, a spring 460 is attached at one end to an extension 462 on the end of the lever 428 and is attached at the other end to the rear portion of the frame.

After the magazine, by dropping with respect to the banding device, has left a wrapper thereon and the banding device carrying the wrapper is raised on the end of the arm 274 by the mechanism above described to the position in which these parts are illustrated in Fig. 25, the arm 274 is oscillated to the right as seen in Fig. 10 until the banding device and a reel with bundled laces thereon

324 extending longitudinally of one side of the magazine casing 278. The cord 320 is led over a pulley 326 rotatably mounted at the upper part of the magazine and under a clutch 328 fixed to the lower portion of the bracket 304, the purpose of which will be described later, and thence over a pulley 330 rotatably mounted on the end of an arm 332 which is fixed to the rod 126. To the lower end of the cord 320 is attached a weight 334 which, being heavier than the combined weight of the wrapper support 318 and the greatest number of wrappers which can be put in the magazine at a time, will overcome the weight of the latter and hence hold the uppermost wrapper in the pile at the delivery end of the magazine. Extrusion of the wrappers from the magazine is prevented by means of lips 336 bent inwardly from opposite sides of the magazine casing 278. As indicated in Fig. 18, the lips 336 overlie the edges of the endmost wrapper in the magazine only enough to prevent the pile of wrappers from being forced out of the delivery end thereof.

By means of the above-described cam 310 and associated mechanism the magazine 276 is raised with respect to the banding device 272 in order that a wrapper shall be delivered thereto. The endmost wrapper in the magazine is thus brought momentarily into contact with the end of a vacuum chuck 338 (Fig. 24) slidably mounted in the banding device 272 and resiliently urged toward its lower position by means of a spring 340 bearing at one end against a shoulder 342 on the chuck which limits its downward movement and at the other end against the top of a recessed portion 344 in the banding device within which the shoulder 342 is free to slide. As illustrated in Fig. 29, the chuck 338 comprises a tube with a central opening 346 leading to a recess 348 formed between the flattened end of the tube and a plate 350 integral therewith. The plate 350 is provided with a plurality of perforations 352 connecting the chamber 348 with the outer air. Extensions 353 of the end of the chuck are arranged to engage the inner pins 52 of the winding reels in the event that no laces have been fed thereto in order to prevent the falling of the chuck into the path of the folding jaws 282 and 284.

As the magazine is moved to bring the endmost wrapper therein into contact with the plate 350 on the end of the chuck 338, a pressure less than that of the atmospheric pressure is created within the chamber 348, by an exhausting means now to be described, in order that the endmost wrapper may be held on the plate when the magazine is retracted therefrom. This means comprises a cylinder 354 (Fig. 1) containing a piston 356 fastened to a piston rod 358 which is pivotally connected to the end of a crank arm 360 fixed to the shaft 94. The cylinder 354 is mounted on a trunnion 362 fixed in a bracket 364 mounted on one side of the frame of the machine and is therefore free to oscillate to compensate for the throw of the crank 360. The upper end of the cylinder 354 is connected to the chuck 338 by means of a duct 366 attached to a T-fitting 368 (Fig. 24) which is fixed to the top of the chuck 338. A pet-cock 370 is screwed into an opening in the T-fitting opposite that to which the tube 338 is attached and may be opened to render the suction chuck inoperative at the operator's discretion.

As the chamber in the cylinder 354 above the piston 356 (Fig. 1) is being evacuated to enable the suction chuck to hold the wrapper at the end thereof, the air in the lower chamber in the cylinder below the piston is being compressed in order to provide an air blast for assisting in the separation of the uppermost label in the magazine from the rest of the pile, the operation of and means for providing which will now be described. The air blast is created as the magazine is retracted from the chuck 338 and is directed edgewise of the uppermost labels in the magazine by means of a nozzle 372 (Figs. 1, 6 and 16) fixed to an arm 374 adjustably supported on the frame by means of a bracket 376 which is fixed to the frame by means of a bolt 378 passing through a hole in the bracket 376, allowing the bracket 376 to be adjusted toward and from the magazine. The nozzle 372 is connected to the lower end of the cylinder 354 by means of a duct 380 (Fig. 1). Hence, by means of the apparatus above described, a blast of air is created edgewise of the uppermost labels in the magazine, to reduce the tendency of the labels to adhere on account of air pressure holding them together, simultaneously with an evacuation of the air within the suction chuck as the magazine is moved into and out of juxtaposition with the banding device. If, during this operation of transferring a wrapper from the magazine to the banding device, the magazine should tend to rise higher than is necessary to bring the uppermost label in the magazine into contact with the chuck and to such an extent that the lips 336 on the magazine should engage folding jaws 382 and 384 (Fig. 24), thereby arresting further upward movement of the magazine, the spring 290 will yield by an amount corresponding to the overtravel of the magazine operating mechanism and thus prevent breakage of the parts.

It is apparent that the force which must be applied to the support 318 in order to hold the wrappers at the upper part of the magazine will create a slight resistance at the lips 336 against the removal of the endmost wrapper. Further to facilitate the removal of only the endmost wrapper in the magazine at a time, means is provided for temporarily relieving this frictional resistance as the re-

through the chamfer 260 are thus guided so that they are wound in convolute loops on the pins of the associated bundling reel. The frictional resistance of the cooperating jaws offered to the laces as they pass therebetween also imparts a tension to the laces being wound on the reels, insuring a tightly wound bundle. As a bundling reel to which laces have been fed passes from the lace receiving position to the banding position, the loose ends of the laces, which, when fed to the reel in lace receiving position were allowed to hang freely over the table 64, are combed before passing through the guiding and tensioning means by the flap 58 (Fig. 14) cooperating with the abutment 60 at one side of the groove in the shield 62. As the flap 58 and cooperating abutment 60, as illustrated in Fig. 14, are adjacent to the path of the guiding and tensioning means between the lace receiving and the banding position of the associated bundling reel and substantially coextensive therewith, the loose ends of the laces will be combed by this means before they are passed to the guiding and tensioning means throughout the travel of the guiding and tensioning means between the lace receiving and banding position.

The mechanism having been described for winding laces into bundles and bringing them to the position in which wrappers are folded into bands thereabout, the mechanism for performing the last-mentioned operation will next be described.

This mechanism comprises a banding device 272 (Figs. 1, 3, 7 and 10) slidably mounted on the end of an oscillating arm 274 and a wrapper magazine 276 mounted for reciprocation on the frame and arranged to be brought intermittently into juxtaposition with the banding device which removes wrappers from the magazine one by one and applies them to bundles on the bundling reels as they are successively brought into banding position.

The magazine comprises a casing 278 (Figs. 3, 16, 17, 18, 20 and 21) substantially rectangular in cross-section, one side 280 (Fig. 17) of which is hinged to facilitate the placing of a fresh pile of wrappers within the magazine and which, by means of a latch 282 (Fig. 10), may be locked securely to hold the pile of wrappers within the magazine. A pair of guides 284 (Fig. 22) adjacent to opposite edges of one side of the casing 278 constitute a dovetailed groove within which one side of a dovetailed slide 286 is aranged to be engaged. As most clearly shown in Fig. 22, one of the guides 284 and one side of the dovetailed slides are notched, as indicated at 288, to facilitate the assembling of the slide and the magazine. To assemble the slide and magazine, the dovetailed shoulder opposite the notched portion of the slide is inserted in the corresponding groove formed by the right-hand guide 284. After the notches 288 in the slide and corresponding guide 284 have been alined, the slide may be swung relatively to the magazine into the position in which it is illustrated in Fig. 17 and a slight relative longitudinal movement will lock the side 286 to the magazine in the manner of the conventional dovetailed connection. The magazine, which is free to move longitudinally a limited amount with respect to the slide 286, is resiliently supported by a helical spring 290 (Fig. 20) encased in a closed tube 292 fixed to the magazine, the spring being in abutting relation with a pin 294 on the slide 286 arranged to slide within the tube and to abut a shoulder 296 (Fig. 22) at the upper end of the slide 286. Upward movement of the magazine to a point where its notches and those of the slide are alined is normally prevented by a latch 297 (Fig. 21) which engages a shoulder 299 on the slide 286. As will be more fully explained hereinafter, the movement of the magazine with respect to the slide is slight.

Wrappers are delivered to the banding device during the rotation of the bundling reels, and during this time the arm 274 is in its extreme rearward position, as illustrated in Figs. 1, 7 and 10, holding the banding device 272 in alinement with the magazine 276. In order to bring the banding device and the delivery end of the magazine into juxtaposition, the latter is arranged to be moved toward the former. The magazine disclosed herein derives its motion from the slide 286 which is arranged to be reciprocated with respect to a bearing block 298 (Fig. 18) adjustably secured to the frame 82 of the machine by means of a bolt 300 threaded into the bearing block 298 and extending through an elongated slot 302 in a bracket 304 which is bolted to the frame 82. The slide 286 and hence the magazine 276 are reciprocated bodily by means of a bell-crank 306 (Figs. 10 and 18) the bifurcated end of which engages a pin 308 in the lower end of the slide 286. The bell-crank 306, which is pivoted on the rod 126 extending between the sides of the frame, is operated by a cam 310 engaging a roll 312 on the lower end of the bell-crank, the cam being fixed to the shaft 130. The magazine is urged toward its lower position by a spring 314 which connects the lower end of the bell-crank 306 with the end of the frame and holds the cam roll 312 against the cam 310. Wrappers 316 are held at the delivery end of the magazine by means of a support 318 (Fig. 20) arranged to slide inside the magazine to hold the wrappers in the uppermost part thereof. The support is then suspended by means of a weighted cord 320 (Figs. 18 and 21) one end of which is attached to a pin 322 (Fig. 21) extending from the wrapper support 318 through a slot

in Fig. 14, to bring the clips of the guiding and tensioning means within the path of rotation of the associated reel. A shoulder 234 (Fig. 14) of the notch acts as a stop for the rod 228, thereby preventing further forward movement of the spider so long as the rod extends into the notch, that is, while a bundling reel is in banding position.

While the rod 228 associated with the bundling reel which is in banding position prevents further forward rotation of the spider as above described, the rod 228 associated with the bundling reel in lace receiving position, in cooperation with means to be described hereinafter, prevents the spider from rotating in a reverse direction. Thus, the means referred to temporarily locks the spider against rotation in either direction when a bundling reel is brought into banding position. The last-mentioned locking means comprises a latch 236 (Figs. 4 and 14) extending through the plate 230 and into the path of the ends of the rods 228. As the rods pass the latch it is moved inwardly within its holder 238 against the compression of the spring 240 until a bundling reel arrives at its banding position, at which time the rod 228 adjacent to the latch passes far enough beyond it to allow the latch to spring out of its holder into the position in which it is illustrated in Fig. 4, thereby locking the spider 158 against a reverse rotation.

The means for moving the clips of the guiding and tensioning means within the path of rotation of the bundling reels, as indicated by the series of views in Fig. 15, comprises a fin 242 (Figs. 10, 11 and 14) upon a collar 244 (Fig. 11) which is fixed to the shaft 228, which fin engages within a vertically disposed groove in a slide 246 (Figs. 10 and 11) arranged to be moved parallel to the rod 228 as the associated bundling reel approaches its banding position. The slide 246 is operated by a bell-crank, one arm 248 of which is bifurcated to receive a lug 250 on the slide. The other arm 252 of the bell-crank lever is bifurcated to receive the reduced end of a lever 254 (Figs. 1 and 11) fulcrumed to a side of the frame at 256 (Fig. 1). The lower end of the lever 254 carries a cam roll arranged to engage within a track in a cam 258 which is fixed to the crank shaft 174. The cam 258 is so constructed that during the last half-revolution of the bundling reel as it approaches its banding position, the mechanism above described is operated to move the clip of the guiding and tensioning means within the path of rotation of the reel, thereby to support the outer ends of the bundle wound thereon between its extremes, as illustrated in Fig. 12. It is understood that the pins 70 will have been adjusted longitudinally along the reel arms 72, so that upon completion of the winding of a bundle the outer ends of the laces therein will terminate short of the end of the bundle, as indicated in Fig. 12. It is now apparent that the laces are supported at all times during the bundling operation, which support is maintained until the bundles are removed from the reels. In order that the outer ends of the bundled laces may be held closely against the body of the bundle, the jaw 222 of the guiding and tensioning means is chamfered, as indicated at 260 (Fig. 1), through which chamfer the laces are pulled as they are wound on the reels. In the illustrated machine the thickness of the jaw 222 across the chamfer is very slight, so that the outer ends of the laces in the bundle in banding position may be held substantially against the body of the bundle. In order to insure the guiding and tensioning means being thus held against the body of the bundle when its winding is completed, the guiding and tensioning means is resiliently urged against the bundle in a counterclockwise direction as seen in Fig. 1 by means of a coiled spring 262 (Fig. 11) surrounding the rod 228 connecting the collar 244 with the guiding and tensioning means. Rotation of the guiding and tensioning means 56 on the rod 228 is limited by means of a lug 264 engaging within a recess (not shown) in the guiding and tensioning means. It is essential for the successful operation of the machine that the rotation of the bundling reels with respect to their own axes shall be stopped quite as definitely as their rotation about the centers of the shafts 204 and 154 as axes is stopped by means of the locking mechanism described hereinbefore. To this end each of the rods 228 is provided with an abutment 266 (Fig. 13) which is arranged to engage one of two extensions 268 of the reel arms 72. When the lace guiding and tensioning means 56 is moved within the path of rotation of the reel, rotation of the bundling reels in the forward direction is thus prevented by the abutment 266 engaging the extension 268 of the associated reel arm 72, and their rotation in the reverse direction is prevented by a Horton clutch 270 (Figs. 1 and 11) associated with the pinion 202 which is pinned to the shaft 204. As illustrated in Fig. 13, the bundling reels are thus stopped and held so that the pins 52 and 70 are substantially parallel to the rods 228.

The jaw 222 of the guiding and tensioning means associated with the bundling reel in lace receiving position is held away from the cooperating jaw 220 by means of the guard 68 while laces are being fed to the machine, as illustrated in Figs. 1 and 14. As soon as the guard is oscillated out of juxtaposition with the pins of that reel in lace receiving position, it also releases the jaw 222 which subsequently resiliently holds the laces within the chamfered portion thereof against the jaw 220. The laces being pulled

are in a relative position such as that in which they are illustrated in Fig. 25. This oscillating movement of the arm 274 is derived from the cam 418 in the outer side of which is cut a cam track 464 (Fig. 1) within which a cam roll 466 fixed to the frame is arranged to be engaged. During the oscillation of the arm 274 which brings the banding device into alinement with the bundle to be banded, a plunger 468 (Figs. 1 and 3) slidably mounted in a bearing 470 fixed to the arm 274 engages a roll on the end of an extension 472 on a rocker 474 pivoted to the frame on a rod 476 to move the rocker so that its upper end provides a support for the bundle in banding position. A spring 478 connecting the lower end of the rocker 474 with the frame normally urges the former in a clockwise direction as seen in Fig. 7. A set-screw 480 in the lower end of the rocker may be so adjusted that when it abuts a lug 482 extending downwardly from the frame lace supporting fingers 484 in the upper end of the rocker are directly under the bundle on the reel in banding position, as illustrated in Fig. 8. A spring 486 allows the plunger to slide with respect to the bearing 470 by an amount corresponding to its overtravel after the rocker 474 has moved to bring the set-screw 480 into abutting relation to the lug 482. If, for any reason, it is desirable not to move the rocker so as to support the bundle to be banded, the plunger 468 may be held in retracted position by means of a latch 488 (Fig. 3) which is arranged to engage a notch (not shown) in the plunger shaft. The lace supporting fingers 484 in the illustrated machine are of substantially the same length as the width of the bundle to be banded, are relatively thin as illustrated in Fig. 9, are separated just enough to allow the folding jaws 382 and 384 to pass therebetween, and are so shaped at their tips as to support the bundle in banding position across its entire width, as illustrated in Fig. 8. The fingers 484 (Fig. 9) are slidably received in holes in the upper end of the rocker and are resiliently held in their outer position by means of springs 490 the compression of which may be varied at will by means of thumb screws 492.

After the arm 274 has reached the extreme of its travel toward the bundling mechanism and the banding device is in alinement with the bundle in banding position and the lace support is moved into its operative position as above described, the cam 418 (Fig. 10) operates the mechanism associated with the cam track 434 to lower the banding device with respect to the end of the arm 274, as illustrated in Fig. 26, partially to enclose the bundle in banding position with the wrapper previously removed from the magazine. During this operation, indicated by a comparison of Figs. 25 and 26, the chuck 338 drops with the banding device until the former engages the bundle to be banded. Upon further movement of the banding device toward the bundle the chuck 338 remains stationary with respect to the bundle while the body of the banding device continues to move to fold the wrapper about the sides of the bundle. This folding means comprises shoulders 494 (Fig. 27) one at either side of the suction chuck 338. The banding device 272 is held thus in its lower position while the folding jaws 382 and 384 are oscillated alternately in order to fold the loose ends of the wrapper about the bundle and one over the other, as illustrated respectively in Figs. 27 and 28, mechanism for doing which will now be described.

The jaw operating mechanism comprises a cam 496 (Figs. 3 and 6) fixed to one end of the shaft 420 which is driven by the gear 426 mentioned hereinbefore. A lever 498 carrying at one end a cam roll 500 arranged to engage within a cam track 502 in the cam 496 is fixed at its other end to a shaft 504 which is journaled in a bearing 506 (Fig. 6) at the mid-portion of the arm 274. An arm 508 (Figs. 1 and 6) is fixed to the other end of the shaft 504 and carries at its upper extremity a pin 510 (Figs. 1, 5 and 6) which may be adjustably clamped in any desired position within an elongated slot 512. The inner end of the pin 510 is arranged to engage either of the upper ends 514 and 516 (Fig. 26) of the jaws 282 and 284, respectively, which are pivoted by means of pins 518 to the body of the banding device. The banding device and bundle to be banded being assumed now to be in the position in which they are illustrated in Fig. 26, the first operation in folding the ends of the wrapper about the bundle consists in moving the jaw 282 under the bundle by means of the mechanism above described until the jaw reaches the position in which it is illustrated in Fig. 27. To complete this first operation, the arm 508, as seen in Fig. 1, will have rotated through a small angle in a counterclockwise direction and accordingly the pin 510, as shown in Fig. 26, will have been moved to the right, thereby rotating the jaw 282 about its pivot 518 in a clockwise direction. A plunger 520 received in the lower part of the banding device body is urged outwardly thereof by means of a spring 522 and into engagement with the inner folding face of the jaw 282 in order to hold the jaw in any position in which it is left by the jaw operating means. The pin 510 is held in its extreme left-hand position as seen in Fig. 1 for a relatively short period, holding the jaw 282 underneath the bundle thereby to impart a "set" to that end 526 of the wrapper which is folded about the bundle. Thereafter the arm 508 actuated by the cam 496 is moved in the opposite direction, the pin 510 engaging the arm 516 of

the jaw 284 to rotate it in a counterclockwise direction under the bundle, as illustrated by a comparison of Figs. 27 and 28, thereby to fold the depending end 528 of the wrapper over the other and against the bottom of the bundle. As indicated in Fig. 30, the wrappers 316 at the end 528 are coated with adhesive material 530 which preferably is rendered tacky by the application of heat but not affected by moisture. Wrappers are so arranged, in the illustrated machine, that when they are folded about bundles as above described the end of the wrapper 316 on which the adhesive is coated, is pressed against the opposite end of the wrapper 526 after the latter end has been folded underneath the bundle. The folding jaw 284 is normally maintained at a constant and relatively high temperature, in order quickly to fuse the adhesive 530 on the wrapper, by means of a heating unit 532 (Fig. 31) which is removably held in a recess in the jaw 284 by a screw 534. As illustrated, the heating unit comprises a pair of contact points 536 which engage corresponding spring conductors 538 which are attached to the jaw 284 by binding posts 540 and are insulated from the jaw 284 by a plate 542. Leads 544 extend from the binding post 540 to a rheostat 546 (Fig. 3) which in turn is connected in any suitable manner to a source of electric power and by the use of which the temperature of the jaw 284 may be controlled at will. It will now be apparent that a replacement of the heating unit entails no great difficulty since the removal of a worn-out unit recessitates only the removal of the screw 534 and, similarly, to replace a new unit it is necessary only to insert it in the recess in the jaw 284 so that its contacts 536 are alined with the corresponding conductors 538, and then to secure it in its operative position by making up the screw 534.

While the bundle has been banded as just described, it has been supported on the pins of a bundling reel at its extremes, at its central portion adjacent to the banding device by the fingers 484, and at the loose ends thereof by means of the clip of the guiding and tensioning means 56 above described. The pins 52 and 70 of the reel supporting the bundle in banding position, being disposed substantially in alinement with the direction of the oscillating motion of the banding device, will cause no difficulty in the stripping of the banded bundle therefrom by the banding device. However, the guiding and tensioning means, which, as stated above, firmly grips the loose ends of the laces in the bundle throughout the banding operation, must be released before the bundle is free to be stripped from the reel holding it. The mechanism for performing this operation comprises a lever 548 (Fig. 10) which is pivoted to the frame at 550 and carries at its lower end a roll 552 arranged to engage the face of a cam 554 fixed to the shaft 130. The cam 554 operates the lever 548 so that a finger 556, adjustably mounted at the upper end of the lever 548 by means of a bolt 558, may be moved in a clockwise direction (with reference to Fig. 10) into engagement with the pivoted jaw 220 of the guiding and tensioning means 56 associated with the winding reel in banding position, thereby releasing the grip of the jaws 220 and 222 upon the outer ends of the bundled laces. As soon as the laces are thus released, the banding device rises with respect to the arm 274 a slight amount, in the illustrated machine about a quarter of an inch, somewhat to relieve the downward pressure of the spring 340 holding the chuck against the bundle and then the arm 274 is oscillated to the left and in a counterclockwise direction as seen in Fig. 10, stripping the banded bundle from the reel which wound it and carried it into the banding position. When the arm 274 has thus been oscillated through substantially one half the distance between its position when the banding device is in banding position and one of alinement with the magazine, the jaw 284 is released by the pin 510, allowing the spring 560 which connects the jaw 284 with a pin 562 extending from the lower portion of the body of the banding device to pull the jaw 284 in a clockwise direction from beneath the bundle thereby releasing it. The chuck 338 operated by the spring 340 then discharges the banded bundle from the banding device. This operation is so timed that the banded bundle will fall from the moving banding device into a bundle collecting means, which will now be described.

The collecting means above referred to comprises a trough 564 (Fig. 11) extending transversely of the path of movement of the banding device and fixed to the frame of the machine. One side of the trough 564 is recessed as at 566, thereby to allow the banding device to pass by without interference. A conveyor chain 568 is carried by two sprockets 570 and 572 which are rotatably mounted in brackets 376 (Figs. 16 and 11) and 574, respectively, the latter of which brackets is fixed, as indicated in Figs. 3 and 5, to the frame 82. The sprockets 570 and 572 are so disposed with respect to the trough that the upper run of the chain is suspended directly beneath its vertex. As illustrated in Fig. 11, the trough 564 is provided with a longitudinal slot 576 through which extend cleats 578 fixed to the chain 568 and which engage the ends of the bundles dropped in the trough and push them to the left as seen in Fig. 11 to the head of a collecting table 580. The mechanism for rotating the sprockets thereby to move the chain 568 to carry a bundle to the collecting table com-

prises a bell-crank 582 (Fig. 6) pivotally mounted on the bracket 574 and carrying a pawl 584 resiliently held in engagement with a ratchet wheel 586 which is fixed to the sprocket 572. The bell-crank is intermittently oscillated by a link 588 to which it is pivotally connected at one end, the other end of the link being attached through a knuckle joint 590 (Fig. 3) to the gear 134 by means of a stud 592 fixed in said gear and serving as a crank pin. The stud 592 is so placed on the gear 134 that the conveyor chain is first operated to carry the banded bundle last dropped thereon to the head of the collecting table 580 substantially at the same time when the bundling mechanism is first operated to wind laces into a bundle, which operation also occurs while a wrapper is being delivered to the banding device. When the motion of the conveyor chain 568 ceases and a banded bundle is brought to the collecting table, it remains temporarily directly in the path of a push rod 594 (Fig. 11) mounted in a bearing fixed to the table 580 and arranged to be pushed across the conveyor chain when stationary to remove a bundle therefrom, against the compression of a spring 596 (Fig. 3) which tends to hold the push rod in the position in which it is illustrated in Fig. 11 and out of the path of the cleats 578 on the conveyor chain 568. The push rod is thus operated while the conveyor chain is stationary by the arm 274 to which is fixed a strap 598 (Fig. 3) through a hole in the outer end of which the push rod 594 is inserted. The movement of the push rod is relatively slight, being only enough to remove a banded bundle from the conveyor chain and starts when the strap 598 abuts a shoulder 600 on the push rod. The position of the push rod in its bearing when the arm 274 is in its extreme rearward position may be governed by adjusting check nuts 602 on the extreme left-hand end of the push rod (Fig. 3). It will now be apparent that each banded bundle is transferred from the banding device to the head of the collecting table during the oscillation of the arm 274 which brings the banding device from the banding position to that in which a wrapper is delivered thereto and that the same bundle is pushed from the conveyor chain at the head of the table upon the return oscillation of the arm 274 which carries the banding device again to the banding position.

In summarizing the sequence of motions of the various instrumentalities of the illustrated machine, let us begin at that point in the cycle at which the machine is stopped by the one-revolution clutch referred to hereinbefore. Assuming that the control lever 104 has been moved to connect the machine with the source of power and laces have been inserted in the winding reel in lace receiving position, the operator then depresses the treadle 80, releasing the movable element 90 of the one-revolution clutch, thereby initiating the operation of the machine through one cycle. Immediately after the treadle is depressed, the guide 66 and the guard 58 are oscillated out of juxtaposition with the reel in lace receiving position and the winding reels are rotated bodily about their common axis and about their own axes in order that the reel to which laces have been fed may wind them into a bundle thereon. Loose laces are thus wound into a bundle while being carried from the lace receiving position of the winding reels to their banding position. The guiding and tensioning means 56 associated with that winding reel in lace receiving position is moved within the path of rotation of that same reel during its last half revolution, which occurs as the reel approaches the banding position. By this means the outer ends of the laces in the bundle are supported between the extremes thereof, it being understood that the pins 52 and 70 on the winding reels have been so adjusted that upon the completion of the winding of the bundle the tips of the outer ends of the laces lie within the adjacent extreme of the bundle for the sake of its appearance and ease of packing the bundles in boxes after they have been banded. Before the winding reels are again rotated to wind into a bundle the laces next presented thereto, the guiding and tensioning means associated with the winding reel last in banding position is moved outside of the path of rotation of the corresponding reel so as not to interfere with the next operation of the winding mechanism.

While laces are being wound into a bundle by the winding mechanism, a wrapper is being delivered from the magazine 276 to the banding device 272 which is in alinement therewith. This function is performed mainly by the magazine which is moved into juxtaposition with the suction chuck 338 of the banding device, thereby to bring the uppermost wrapper in the magazine into contact with the chuck. Their contact is only momentary and is followed by a sudden dropping of the magazine 276, simultaneously with which, by virtue of the pulley mechanism described hereinbefore, the wrappers are dropped with respect to the magazine in order that the friction between the uppermost wrapper in the magazine and the lips 336 thereof may be relieved, thereby to facilitate the removal of the wrapper by the chuck. While the above operations of the magazine are being performed, the air blast directed edgewise of the uppermost labels in the magazine by the nozzle 372 further facilitates the removal of only the endmost wrapper in the magazine by reducing its tendency to remain with the pile owing to air pressure holding it thereagainst. The above operations of the magazine and associated mech-

anism occur during the winding of laces into a bundle by a winding device. By the time that the rotation of the winding device is stopped, the magazine 276 will have dropped away from the chuck 338, leaving a wrapper thereon.

As the wrapper magazine drops farther the banding device 272 is raised with respect to the arm 274 in order that it may be oscillated without interference with the bundle to a position above the bundle on the winding means in banding position. When the banding device 272 has thus substantially reached the end of its upward movement with respect to the arm 274, the arm is oscillated toward the winding reel to bring the banding device into alinement with the bundle in banding position. Having reached this position, the banding device is dropped with respect to the arm 274 enclosing a bundle between the shoulders 494 and partially folding the wrapper held by the chuck about the bundle. The jaws 282 and 284 are next operated successively to fold the loose ends of the wrapper about the unenclosed side of the bundle and the heated jaw 284, fusing the adhesive material on the end of the wrapper in contact therewith, causes its ends to adhere. The jaw 284 is held temporarily underneath the bundle to insure a perfect connection between the ends of the wrapper and the banding device is raised a little with respect to the arm 274 to facilitate the removal of the banded bundle from the pins which support it by relieving the previous downward pressure of the banding device which was necessary to insure a compactly banded bundle. Substantially simultaneously with the preliminary raising of the banding device above referred to, the grip of the guiding and tensioning means on the tips of the banded bundle is released by the finger 556 and then the arm 274 is oscillated away from the winding mechanism, thereby stripping the banded bundle from the pins on the winding reel which bundled it. As the banding device 272 passes over the trough 564, the jaw 284 is swung from beneath the bundle, allowing the spring-operated chuck 338 to force the banded bundle out of the banding device into the trough 564. While the next wrapper is being fed to the banding device, which again will have been brought into alinement with the magazine, the conveyor chain 568 is operated to carry the banded bundle last dropped in the trough to the head of the collecting table 580 and, when the arm 274 is next oscillated to carry the banding device to its banding position, the push rod 594 is operated by the strap 598 to remove the banded bundle from the conveyor chain and carry it to the collecting table from which the banded bundles may be removed by the operator at any convenient time.

Having thus explained an embodiment of my invention, what I claim as new and desire to protect by Letters Patent of the United States is:

1. In a bundling and banding machine, means for bundling laces comprising a rotatable reel, means for rotating said reel to wind the laces into a bundle thereon, means for guiding and tensioning said laces as they are wound on the reel and means for causing said guiding and tensioning means to hold the outer ends of the laces against the bundle when its winding is completed.

2. In a bundling and banding machine, means for bundling laces comprising a rotatable reel, means for rotating said reel to wind laces into a bundle thereon, a clip for guiding and tensioning said laces as they are wound on the reel and means for urging said clip toward said bundle thereby to hold the outer ends of the laces against the bundle when its winding is completed.

3. In a bundling and banding machine, means for bundling laces comprising a rotatable reel, means for rotating said reel to wind the laces into a bundle thereon, means for both guiding and tensioning said laces as they are wound on the reel, and means for resiliently urging the guiding and tensioning means against the bundle thereby to hold the outer ends of the laces in said bundle against the body thereof when the winding of the bundle has been completed.

4. In a bundling and banding machine, a rotatable reel for bundling laces, means for rotating said reel to wind the laces thereon, a clip for both guiding and tensioning said laces as they are wound on said reel, and means for causing said clip to urge the outer ends of the laces in said bundle against the body thereof when the winding of the bundle has been completed.

5. In a bundling and banding machine, means for bundling laces comprising a rotatable reel, means for rotating said reel to wind the laces into a bundle thereon, means for adjusting said reel whereby the outer ends of said laces lie between the extremes of the bundle when the rotation of said reel is completed, means normally outside of the path of rotation of said reel for guiding and tensioning laces as they are wound thereon, and mechanism for moving said guiding and tensioning means into the path of revolution of said reel during its last half revolution thereby to support the outer ends of said bundled laces when their winding is completed.

6. In a bundling and banding machine, a rotatable reel for winding laces into a bundle, means for rotating said reel, means for adjusting said reel whereby the outer ends of said laces lie between the extremes of the bundle when the rotation of the reel is completed, a clip normally outside of the path of rotation of the reel for guiding and tensioning laces as they are wound thereon, and

mechanism for moving said clip into the path of rotation of said reel during its last half revolution comprising a cam and connections between it and said clip.

7. In a bundling and banding machine, means for bundling laces comprising a rotatable reel, means for rotating said reel to wind laces thereon, means for adjusting said reel whereby the outer ends of said laces lie between the extremes of the bundle when the rotation of the reel is completed, means for both guiding and tensioning said laces as they are wound on said reel, said means normally being outside of the path of revolution of said reel, and mechanism for moving said guiding and tensioning means into the path of revolution of said reel during its last half revolution, said guiding and tensioning means also being constructed and arranged to hold the outer ends of the laces in said bundle against the body thereof when the winding of the bundle has been completed.

8. In a bundling and banding machine, means for bundling laces comprising a rotatable reel, means for rotating said reel to wind laces into a bundle thereon, means for guiding and tensioning laces as they are wound on said reel, means for limiting the rotation of said reel constructed and arranged to support said guiding and tensioning means, and means connecting said guiding and tensioning means and said rotation limiting means for causing the guiding and tensioning means to hold the outer ends of the laces against the bundle as the rotation of the reel is completed.

9. In a bundling and banding machine, a rotatable reel, means for turning said reel to wind laces thereon, and means cooperating with said reel for positively stopping its rotation in a predetermined position.

10. In a bundling and banding machine, a rotatable reel, means for rotating said reel to wind laces thereon, means normally outside of the path of rotation of said reel for stopping its rotation when the winding of said laces is completed, and mechanism for moving said means into the path of rotation of said reel during its last half revolution to stop it in a predetermined position.

11. In a bundling and banding machine, means for winding laces into bundles comprising a rotating reel, means for rotating said reel to wind laces into bundles thereon, means for guiding and tensioning said laces as they are wound on said reel, mechanism for moving said guiding and tensioning means within the path of revolution of said reel during its last half revolution thereby to support the loose ends of the bundled laces between the extremes thereof, and means associated with said guiding and tensioning means for stopping the rotation of said reel in a predetermined position.

12. In a bundling and banding machine, a spider, a reel rotatably mounted in said spider, means for rotating said reel to wind laces into a bundle thereon, a rod slidably mounted in said spider adjacent to said reel, means for guiding and tensioning said laces as they are wound on said reel rotatably supported by said rod at one end thereof, mechanism for moving said rod to bring the guiding and tensioning means within the path of rotation of said reel during its last half revolution, and resilient means for urging said guiding and tensioning means against the bundled laces to hold the outer ends thereof against the bundle when its winding is completed.

13. In a bundling and banding machine, a spider, a reel rotatable upon said spider, power-operated gearing interposed between said spider and said reel for rotating it to wind laces in a bundle thereon, a rod slidably mounted in said spider adjacent to said reel a clip for guiding and tensioning said laces as they are wound on said reel rotatably supported by said rod at one end thereof, mechanism for moving said rod to bring said clip into the path of rotation of the reel during its last half revolution, and a spring connecting said clip and rod arranged to urge said clip toward the bundled laces to hold the outer ends thereof against the bundle when its winding is completed.

14. In a bundling and banding machine, a spider, a reel rotatably mounted in said spider, means for rotating said reel to wind laces into a bundle thereon, a rod having an abutment thereon and being slidably mounted in said spider adjacent to said reel, and mechanism for moving said rod during the last half revolution of said reel to bring the abutment on the rod within the path of rotation of the reel thereby to stop its rotation in a predetermined position.

15. In a bundling and banding machine, means for winding laces into bundles comprising a plurality of reels, means for rotating said reels about their own axes to wind laces into bundles thereon, means associated with each of said reels for guiding and tensioning said laces as they are wound on said reels, means for rotating said reels about a common axis to bring them successively into banding position, and supports for said guiding and tensioning means constructed and arranged to prevent the rotation of the reels about their common axis in either direction when one of them is in banding position.

16. In a bundling and banding machine, a spider having a plurality of arms, a reel rotatably mounted in each of said arms, means for intermittently rotating said spider through the angle between successive arms thereof, means for rotating said reels about their own axes to wind laces into a bundle thereon, a rod on each of the arms of said spider for stopping the rotation of the reels in a predetermined position, means for fold-

ing a wrapper into a band about a bundle on one of said reels while said spider is stationary, a plate fixed in juxtaposition to said spider, and a latch on said plate cooperating with one of said rods to prevent a reverse rotation of said spider when a bundle is being banded.

17. In a bundling and banding machine, a spider having a plurality of arms, a reel rotatably mounted in each of said arms, gearing for rotating said spider through the angle between successive arms thereof, means for intermittently operating said gearing comprising a pawl and ratchet, means for rotating said reels about their own axes to wind laces into a bundle thereon operable during the rotation of said spider, a rod on each of the arms of said spider for stopping the rotation of the reels in a predetermined position, means for folding a wrapper into a band about a bundle on one of said reels while said spider is stationary, a plate fixed in juxtaposition to said spider, and a latch on said plate cooperating with one of said rods to prevent a reverse rotation of said spider when a bundle is being banded.

18. In a bundling and banding machine, a spider having a plurality of arms, a reel rotatably mounted on each of said arms, means for intermittently rotating said spider through that angle separating successive arms thereof, means for rotating said reels about their own axes to wind laces into a bundle thereon during the rotation of said spider, a rod slidably mounted in each of said arms adjacent to said reels having a reel-engaging abutment, means for folding a wrapper into a band about a bundle on one of said reels while said spider is stationary, a notched plate in juxtaposition to said spider abutting the ends of said rods, a latch on said plate cooperating with one of said rods to prevent a reverse rotation of said spider, and mechanism for moving another of said rods to bring its reel-engaging abutment within the path of rotation of the corresponding reel thereby to stop its rotation in a predetermined position, said last mentioned rod also being constructed and arranged to enter a notch in said plate to prevent a forward rotation of said spider while a bundle upon a reel is being banded.

19. In a bundling and banding machine, a spider having a plurality of arms, a reel rotatably mounted in each of said arms, means for intermittently rotating said spider through that angle separating successive arms thereof, means for rotating said reels about their own axes to wind laces into a bundle thereon during the rotation of said spider, means for guiding and tensioning the laces as they are wound on said reels, rods for supporting said guiding and tensioning means mounted in the arms of said spider, a plate in juxtaposition to said spider, means for folding a wrapper into a band about a bunble on one of said reels while it is stationary, and a latch on said plate cooperating with one of said rods for preventing a reverse rotation of said spider during the banding operation.

20. In a bundling and banding machine, a spider having a plurality of arms, a reel rotatably mounted in each of said arms, means for rotating said spider to move said reels successively from a position in which laces are fed thereto into a banding position, means for rotating said reels to wind laces into bundles thereon during the rotation of said spider, means for adjusting said reels whereby the outer ends of said laces in said bundles lie within the extremes thereof when their winding is completed, a slidably mounted rod adjacent to each of said reels and having a reel-engaging abutment, means for guiding and tensioning said laces as they are wound on said reels supported by said rods, mechanism for moving said rods to bring said guiding and tensioning means within the extremes of the bundles in order to support the ends of the laces therein during the last half revolution of its winding and to bring said abutments into cooperative relation with said reels thereby to stop their rotation in a predetermined position, means for folding a wrapper into a band about the bundle formed on that reel in banding position, and means cooperating with said rods to prevent the rotation of said spider in either direction during the banding operation.

21. In a bundling and banding machine, a spider having a plurality of arms, a reel rotatably mounted in each of said arms, means for intermittently rotating said spider through that angle between successive arms thereof, means for rotating said reels about their own axes to wind laces into bundles thereon, means normally outside of the path of rotation of said reels for guiding and tensioning the said laces as they are wound, a support comprising a rod for each of said guiding and tensioning means slidably mounted in said arms, a notched plate in juxtaposition to said spider and normally in abutting relation to said rods, mechanism for moving said rods to bring said guiding and tensioning means between the extremes of a bundle on a reel during the last half revolution of its winding, means for folding a wrapper into a band about the bundle on the reel when said spider is stationary, said rods being constructed and arranged to enter a notch in said plate as the guiding and tensioning means is moved to its inner position thereby to prevent forward rotation of the spider during the banding operation, and a latch on said plate cooperating with another of said rods for preventing a reverse rotation of said spider during the banding operation.

22. In a bundling and banding machine, means for winding laces into bundles comprising a plurality of reels rotatable about a common axis, means for intermittently rotating said reels about said axis through an angle equal to that between adjacent reels successively to bring said reels into banding position, banding means for folding wrappers into bands about bundles on said reels in banding position, mechanism for moving said banding means in a direction substantially parallel to that of the rotation of said bundles at the banding position partially to encircle a bundle with a wrapper, and means for supporting the bundles on said reels during the banding operation.

23. In a bundling and banding machine, means for winding laces into bundles comprising a plurality of reels rotatable about a common axis, power-operated gearing for intermittently rotating said reels about said axis through an angle equal to that between adjacent reels successively to bring them into banding position, banding means for folding wrappers into bands about bundles on said reels in banding position, mechanism comprising a cam and a linkage connecting said cam with said banding means for moving it in a direction substantially parallel to that of the rotation of said bundles at the banding position partially to encircle a bundle with a wrapper, and means for supporting the bundles on said reels during the banding operation.

24. In a bundling and banding machine, a reel, means for rotating said reel to wind laces into a bundle thereon, a wrapper magazine in proximity thereto, banding means for folding a wrapper into a band about a bundle on said reel, an oscillating arm supporting said banding means, means for operating said arm to move said banding means between said magazine and a bundle on said reel, means for supporting a bundle thereon during the banding operation, and means on said arm for moving said supporting means into contact with the bundle as said banding means is moved from said magazine toward said bundle.

25. In a bundling and banding machine, a reel, means for rotating said reel to wind laces into a bundle, means for folding a wrapper into a band about a bundle on said reel, a wrapper magazine in proximity thereto, an oscillating arm supporting said banding means, means for operating said arm to move said banding means between said magazine and a position of alinement with said reel, a fork for supporting the bundle on the reel during the banding operation, and means on said arm for moving said fork into contact with the bundle as said banding means is moved from the magazine toward the bundle.

26. In a bundling and banding machine, bundling means for winding laces into bundles comprising rotatable reels having spaced lace holding arms, banding means for folding an adhesive wrapper into a band about the mid portion of a bundle wound on one of said reels, the ends of said wrapper overlapping each other, said means being constructed and arranged to press said wrapper against the bundle thereby to insure a firm bundle, and means for supporting the bundle at its lower side against the pressure of said wrapping means.

27. In a bundling and banding machine, bundling means for winding laces into bundles comprising rotatable reels having spaced lace holding arms, banding means for folding an adhesive wrapper into a band about the mid portion of a bundle wound on one of said reels, the ends of said wrapper overlapping each other, said means being constructed and arranged to press said wrapper against the bundle thereby to insure a firm bundle, and means for yieldingly supporting said bundle adjacent to the portion surrounded by the band at both sides thereof against the pressure of said wrapping means.

28. In a bundling and banding machine, bundling means for winding laces into bundles comprising rotatable reels having spaced lace holding arms, banding means for folding an adhesive wrapper into a band about the mid portion of a bundle wound on one of said reels with the ends of said wrapper overlapping each other, said means being constructed and arranged to compress the bundle thereby securely to connect the ends of the wrapper, and a fork having yielding bundle engaging elements for supporting said bundle adjacent to the portions surrounded by the band at each side thereof against the pressure of said wrapping means.

29. In a bundling and banding machine, means comprising a yielding plate for presenting a wrapper to a bundle to be banded therewith, said plate being constructed and arranged to retain the wrapper thereon, a magazine arranged to hold a plurality of wrappers in a pile, means for holding the endmost wrapper of the pile at the delivery end of the magazine, means for bringing the delivery end of the magazine and said plate into and out of juxtaposition thereby to bring said plate and the endmost wrapper in the magazine into contact, and means for dropping said wrappers with respect to said magazine as it is brought out of juxtaposition with said plate thereby to facilitate the removal by said plate of only the endmost wrapper in the magazine.

30. In a bundling and banding machine, means comprising a yielding plate for presenting a wrapper to a bundle to be banded therewith, said plate being constructed and arranged to retain a wrapper thereon, a

magazine arranged to hold a plurality of wrappers in a pile, means for holding the endmost wrapper of the pile at the delivery end of the magazine, means for bringing the delivery end of the magazine and said plate into and out of juxtaposition thereby to bring said plate and the endmost wrapper in the magazine into contact, and a pulley mechanism for dropping said wrappers with respect to said magazine as it is brought out of juxtaposition with said plate to facilitate the removal by said plate of only the endmost wrapper in the magazine.

31. In a bundling and banding machine, means comprising a yielding plate for presenting a wrapper to a bundle to be banded therewith, said plate being constructed and arranged to retain the wrapper thereon by a differential air pressure, a magazine arranged to hold a plurality of wrappers in a pile, means for holding the endmost wrapper of the pile at the delivery end of the magazine, means for bringing the delivery end of the magazine and said plate into and out of juxtaposition thereby to bring said plate and the endmost wrapper in said magazine into contact, a nozzle directed edgewise of the wrappers at the delivery end of said magazine, and means simultaneously for producing a less than atmospheric pressure at said plate to enable it to hold a wrapper and a greater than atmospheric pressure at said nozzle creating an air blast to assist in separating said wrapper from the pile thereby to facilitate the withdrawal by said plate of only the endmost wrapper in the magazine.

32. In a bundling and banding machine, means comprising a yielding plate for presenting a wrapper to a bundle to be banded therewith, said plate being constructed and arranged to retain the wrapper thereon by a differential air pressure, a magazine arranged to hold a plurality of wrappers in a pile, means for holding the endmost wrapper of the pile at the delivery end of the magazine, means for bringing the delivery end of the magazine and said plate into and out of juxtaposition thereby to bring said plate and the endmost wrapper in said magazine into contact, a cylinder having a piston therein arranged to be moved in synchronism with the magazine, a duct connecting said plate with that end of said cylinder from which said piston is moving when said magazine is moved into juxtaposition with said plate, a nozzle arranged to direct a stream of air edgewise of the wrappers at the delivery end of the magazine, and a duct connecting said nozzle with that end of the cylinder being approached by said piston as the magazine is retracted from said plate.

33. In a bundling and banding machine, means for winding pairs of laces into bundles comprising a plurality of reels rotatable about a common axis, means for intermittently rotating said reels about said axis through an angle equal to that between adjacent reels successively to bring said reels into banding position, banding means for folding wrappers into bands about bundles on said reels in banding position, and mechanism for moving said banding means in a direction substantially parallel to that of the rotation of said bundles at the banding position to encircle a bundle with a wrapper.

34. In a bundling and banding machine, means for winding laces into bundles comprising a plurality of reels rotatable about a common axis, means for intermittently rotating said reels about said axis through an angle equal to that between adjacent reels successively to bring said reels into banding position, banding means for folding wrappers into bands about bundles on said reels in banding position, mechanism for moving said banding means toward and against the bundle at the banding position in order to encircle it with a wrapper, and means for supporting said bundle at its lower side against the pressure of said banding means during the banding operation.

35. In a bundling and banding machine, means for winding laces into bundles comprising a plurality of reels rotatable about a common axis, means for intermittently rotating said reels about their common axis to bring them successively into banding position, means for rotating said reels about their own axes during their rotation about their common axis thereby to wind laces into bundles thereon, a wrapper magazine, a banding device constructed and arranged to retain a wrapper thereon, means for oscillating said banding device between said magazine and the bundle on said reel in banding position, means for bringing said banding device and magazine into juxtaposition at one extreme of said oscillatory movement to supply said banding device with a wrapper from said magazine, said means also being adapted to bring said banding device and bundle into cooperative relation at the other extreme of said oscillatory movement of the banding device, and means associated with said banding device for folding a wrapper about the bundle.

36. In a bundling and banding machine, means for winding laces into bundles comprising a plurality of reels rotatable about a common axis, means for intermittently rotating said reels about their common axis to bring them successively into banding position, means for rotating said reels about their own axes during their rotation about their common axis thereby to wind laces into bundles thereon, a wrapper magazine, a banding device constructed and arranged to retain a wrapper thereon, means for oscillating said

banding device between said magazine and the bundle on said reel in banding position, and means for moving said banding device into and out of juxtaposition to said magazine, thereby to remove a wrapper therefrom when said banding device and magazine are in alinement, said means also being constructed to move the banding device into cooperative relation with the bundle when in alinement with said bundle thereby to encircle it with a wrapper, said banding device being arranged to move in a direction substantially perpendicular to that of its oscillatory movement.

37. In a bundling and banding machine, means for winding laces into bundles comprising a reel, means for rotating said reel to wind a pair of laces into a bundle thereon, means for guiding and tensioning said laces as they are wound on said reel, and means for combing said laces as they pass to the guiding and tensioning means.

38. In a bundling and binding machine, means for winding laces into bundles comprising a reel, means for rotating said reel comprising power-operated gearing, a clip for guiding and tensioning said laces as they are wound on said reel, and means for combing said laces as they pass through the guiding and tensioning clip.

39. In a bundling and binding machine, means for winding laces into bundles comprising a plurality of reels, means for intermittently moving said reels successively into banding position from a position in which laces are supplied thereto, means for rotating said reels to wind laces into bundles thereon during said movement, means for guiding and tensioning said laces as they are wound on said reels, and means for combing said laces as they pass to said guiding and tensioning means disposed in proximity to the path of said guiding and tensioning means between the supply and banding positions of said reels.

40. In a bundling and banding machine, a plurality of reels for winding laces into bundles, an intermittently operated pawl-and-ratchet mechanism for moving said reels successively into banding position from a position in which laces are supplied thereto, gearing for rotating said reels to wind laces into bundles thereon during said first-mentioned movement, a clip for guiding and resiliently tensioning said laces as they are wound on said reels, and means for combing said laces as they pass to said clip, said combing means being disposed in proximity to the path of said clip between the supply and banding position of said reels.

41. In a bundling and banding machine, means for winding laces into bundles comprising a plurality of reels, means for intermittently moving said reels successively into banding position from a position in which laces are supplied thereto, means for rotating said reels to wind laces into bundles thereon during said movement, means associated with said reels for guiding and tensioning said laces as they are wound thereon, and relatively fixed means for combing said laces as they pass to said guiding and tensioning means disposed in proximity to the path of said reels between the supply and banding positions thereof.

42. In a bundling and binding machine, means for winding laces into a bundle comprising a reel, means for rotating said reel to wind laces into a bundle thereon, means for guiding and tensioning said laces as they are wound on said reel, and means for combing said laces as they pass to said guiding and tensioning means comprising a fixed abutment and a cooperating yieldable flap constructed and arranged to remove twists from said laces before they pass to said guiding and tensioning means.

43. In a bundling and banding machine, means for winding laces into a bundle comprising a reel, means for rotating said reel to wind laces into a bundle thereon, means for moving said reel into banding position from a position in which laces are supplied thereto, means associated with said reel for guiding and tensioning said laces as they are wound on said reel, and means for combing twists from said laces as they pass to said guiding and tensioning means disposed adjacent to the path of said guiding and tensioning means throughout its length between said supply and banding positions.

44. In a bundling and banding machine, means for winding laces into a bundle, means for supporting laces to be bundled in a group in proximity to said bundling means, and means on said support for resisting removal of laces therefrom thereby to allow removal of only those laces selected by the operator to be fed to said bundling means.

45. In a bundling and banding machine, means for winding laces into bundles, means for supporting a plurality of laces to be bundled in a group in proximity to said bundling means, and means on said support for frictionally resisting removal of laces therefrom thereby to allow removal of only those laces selected by the operator to be fed to said bundling means.

46. In a bundling and banding machine, means for winding laces into bundles, means for supporting a plurality of laces to be bundled in a group in proximity to said bundling means, and means on said support for frictionally resisting removal of laces therefrom thereby to allow removal of only those laces selected by the operator to be fed to said bundling means, said friction means comprising a brush the bristles of which are disposed substantially perpendicularly to the lace engaging surface of said support.

47. In a bundling and banding machine, means for winding laces into bundles, means for supporting a plurality of laces to be bundled in a group in proximity to said bundling means, and means on said support for frictionally resisting removal of laces therefrom thereby to allow removal of only those laces selected by the operator to be fed to said bundling means, said friction means comprising a brush the bristles of which are disposed substantially perpendicularly to the lace engaging surface of said support with the ends thereof extending beyond said surface.

48. In a bundling and banding machine, means for winding laces into bundles, means for supporting a plurality of laces in a group to be bundled in proximity to said bundling means, means on said support for frictionally resisting removal of laces therefrom thereby to prevent removal of only those laces selected by the operator to be fed to said bundling means, said friction means comprising a brush the bristles of which are disposed substantially perpendicularly to the lace engaging surface of said support with the ends thereof extending beyond said surface, and means cooperating with said brush for holding the laces on the support against the brush.

49. In a bundling and banding machine, a bundling device for winding laces into bundles, a banding device constructed and arranged to fold a wrapper into a band about a bundle on said bundling means, means for moving said banding device away from said bundling means to strip a banded bundle therefrom, a trough disposed transversely of the path of movement of said banding device, means for discharging the banded bundle from the banding device into said trough, a collecting table adjacent to one end of said trough, and a conveyor for carrying the banded bundles discharged in the trough to the collecting table.

50. In a bundling and banding machine, a bundling device for winding laces into bundles, a banding device constructed and arranged to fold a wrapper into a band about a bundle on said bundling means, means for moving said banding device away from said bundling means to strip a banded bundle therefrom, a trough disposed transversely of the path of movement of said banding device, means for discharging the banded bundle from the banding device into the trough as it passes thereover, a collecting table adjacent to one end of the trough, a conveyor chain at the vertex of said trough operable to carry bundles discharged therein to the end adjacent to the collecting table, and means for transferring bundles from the trough to the collecting table.

51. In a bundling and banding machine, a bundling device for winding laces into bundles, a banding device constructed and arranged to fold a wrapper into a band about a bundle on said bundling means, means for moving said banding device away from said bundling means to strip a banded bundle therefrom, a trough disposed transversely of the path of movement of said banding device, means for discharging the banded bundle from the banding device into the trough as it passes thereover, a collecting table adjacent to one end of the trough, a conveyor chain at the vertex of said trough intermittently operable to carry bundles discharged therein to the end thereof adjacent to the collecting table, and means for transferring bundles from the trough to the collecting table intermittently operated in alternation with the movement of said conveyor chain.

52. In a bundling and banding machine, a bundling device for winding laces into bundles, a banding device constructed and arranged to fold a wrapper into a band about a bundle on said bundling means, means for moving said banding device away from said bundling means to strip a banded bundle therefrom, a trough disposed transversely of the path of movement of said banding device, means for discharging the banded bundle from the banding device into the trough as it passes thereover, a collecting table adjacent to one end of the trough, a conveyor chain at the vertex of said trough operable to carry bundles discharged therein to the end thereof adjacent to the collecting table, and means for transferring bundles from the trough to the collecting table comprising a push rod mounted to slide transversely of said conveyor chain and means for operating said push rod successively to force bundles from the trough onto the collecting table.

53. In a bundling and banding machine, a bundling device for winding laces into bundles, a banding device constructed and arranged to fold a wrapper into a band about a bundle on said bundling means, means for moving said banding device away from said bundling means to strip a banded bundle from said bundling means, a trough disposed transversely of the path of movement of said banding device, means for discharging the banded bundle from the banding device into the trough as it passes thereover, a collecting table adjacent to one end of the trough, a conveyor chain at the vertex of said trough intermittently operable to carry bundles discharged therein to the end thereof adjacent to the collecting table, a push rod mounted to slide transversely of said conveyor chain, and means for intermittently operating said push rod in alternation with the movement of said conveyor chain to transfer bundles successively from the trough to the collecting table.

54. In a bundling and banding machine,

means for bundling laces comprising a rotatable reel, means for rotating said reel to wind laces into a bundle thereon, means for guiding and tensioning laces as they are wound on said reel, a support for said guiding and tensioning means movable into and out of the path of said reel, means for moving said support and said guiding and tensioning means within the path of said reel as the winding of the laces thereon is completed thereby to limit the rotation of the reel, and connections between said guiding and tensioning means and said support arranged to yield and to urge the outer ends of the laces in the guiding and tensioning means against the bundle in opposition to the rotation of said reel.

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

CARL A. MATSON.