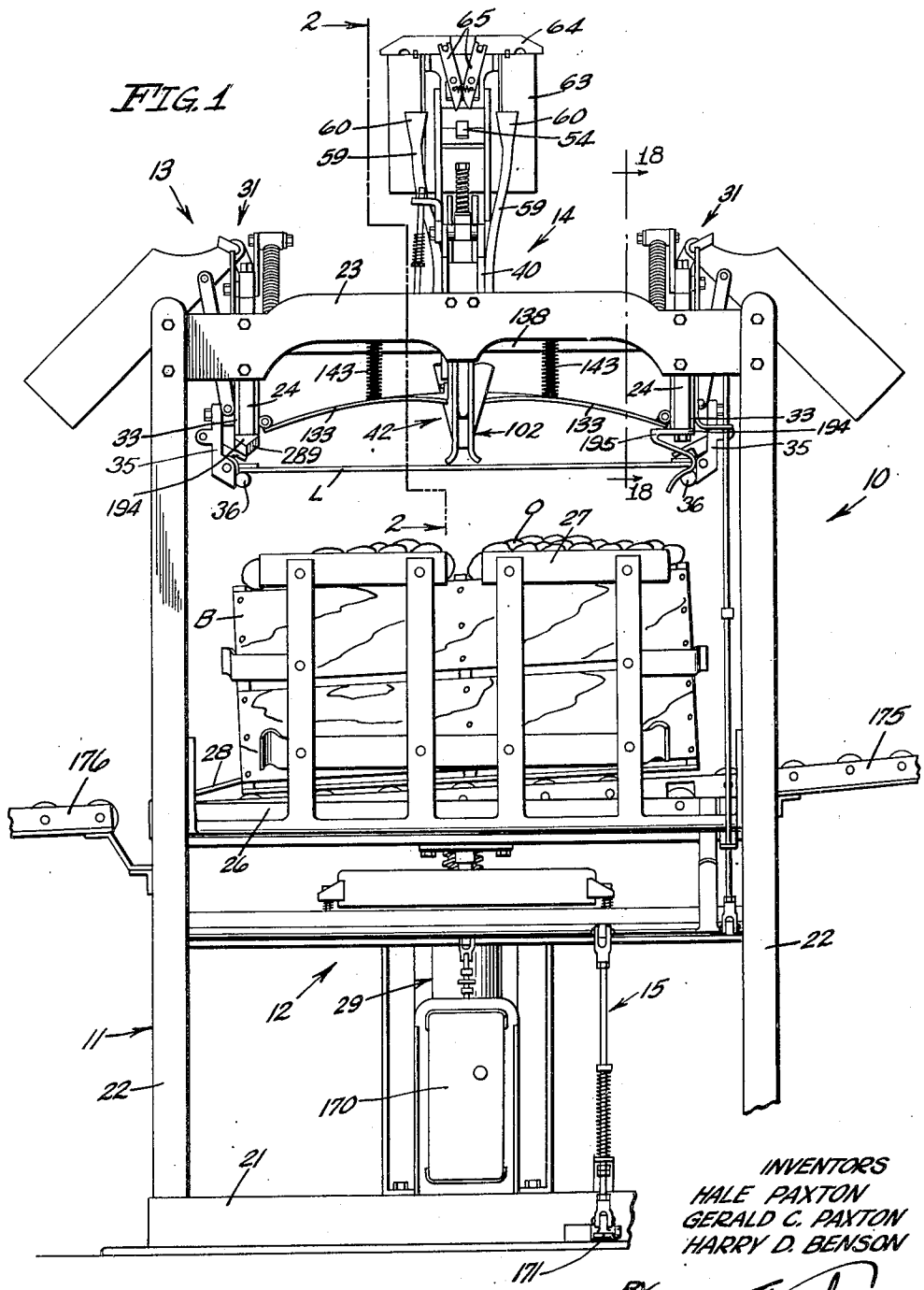
Sept. 21, 1937. H. PAXTON ET AL 2,093,733

METHOD OF AND APPARATUS FOR APPLYING STRAPS TO BOXES

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FIG. 1



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FIG. 2

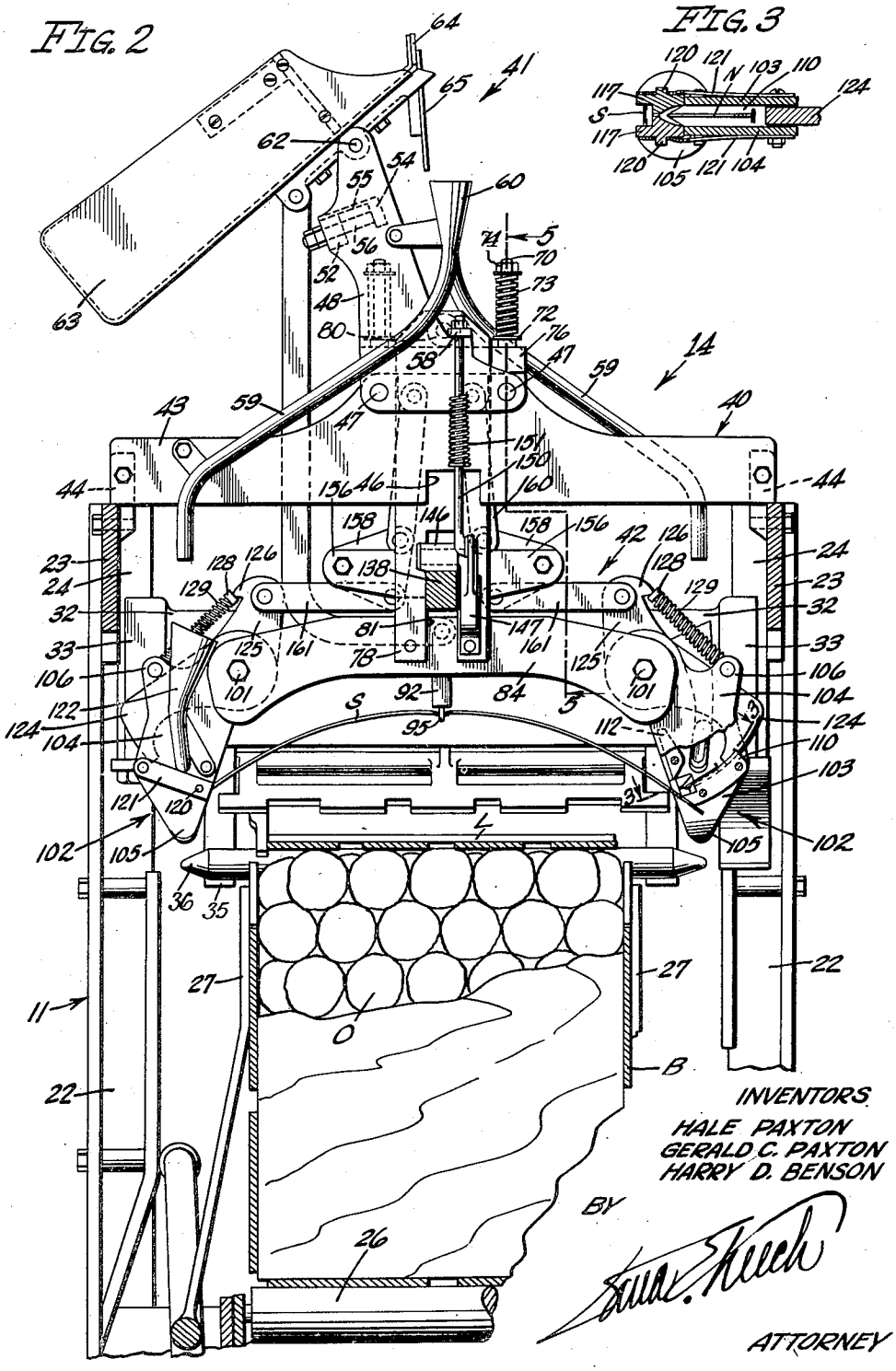


FIG. 3

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FIG. 4

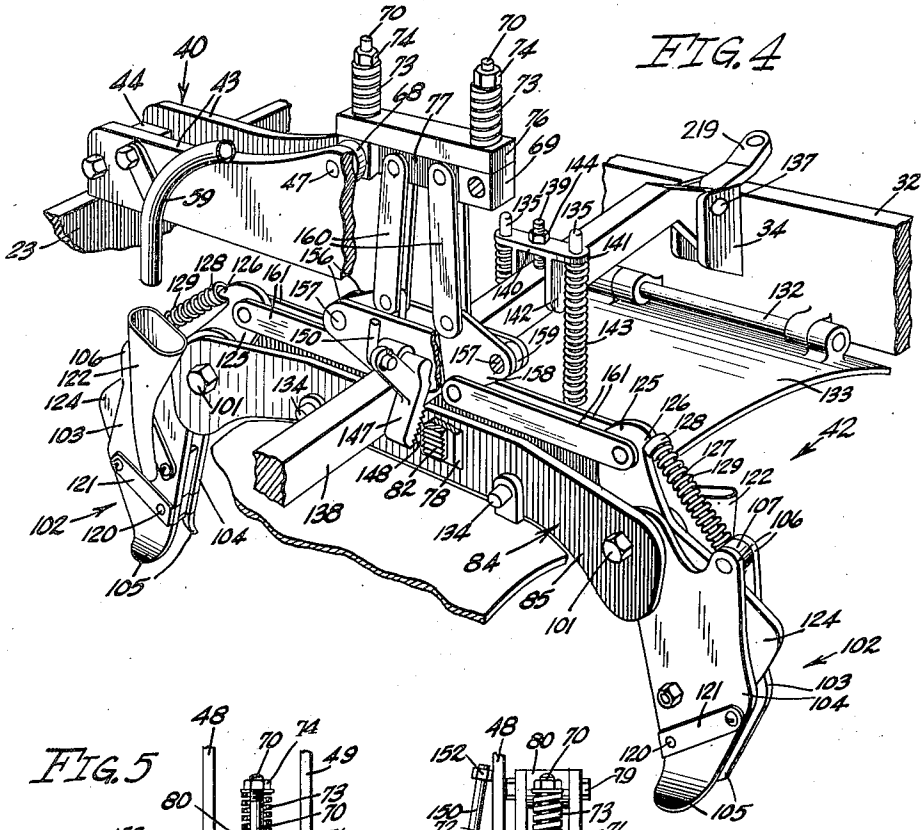


FIG. 5

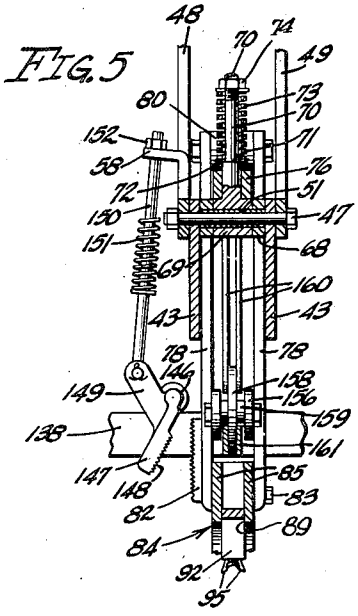
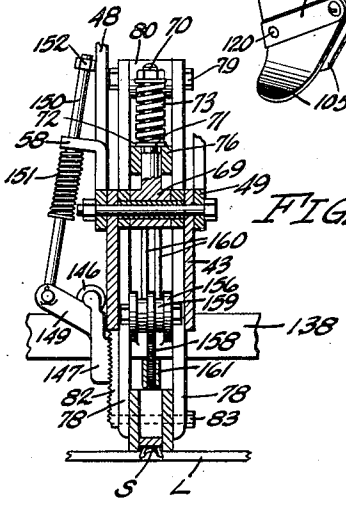


FIG. 6



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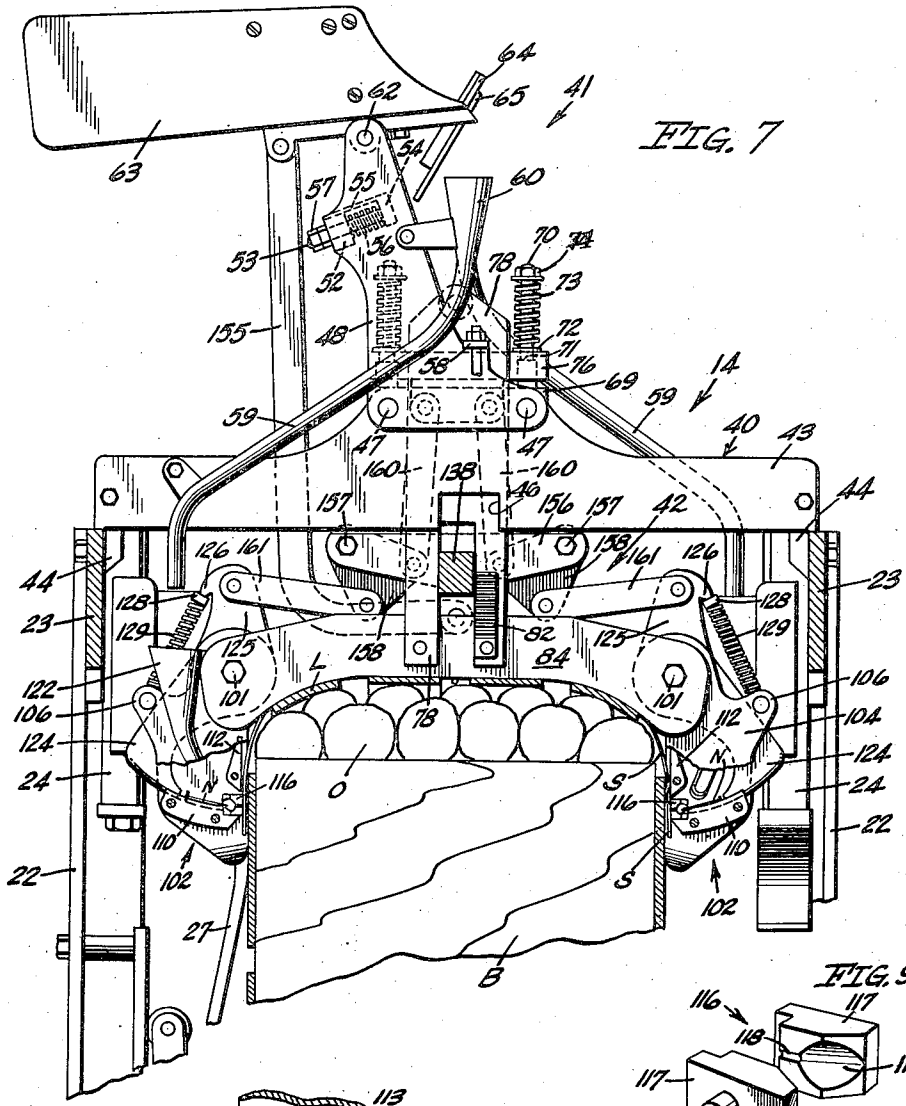


FIG. 7

FIG. 9

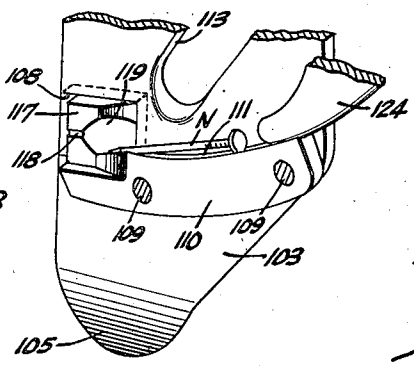


FIG. 8

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FIG. 11

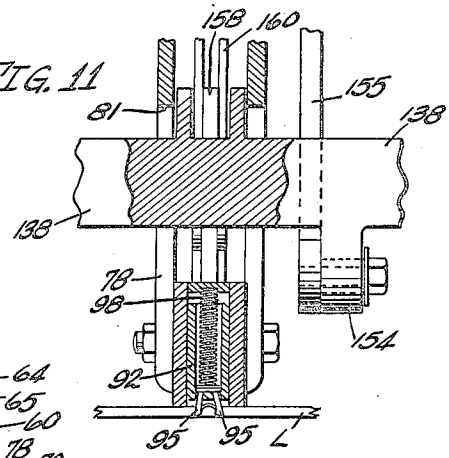


FIG. 10

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FIG. 12

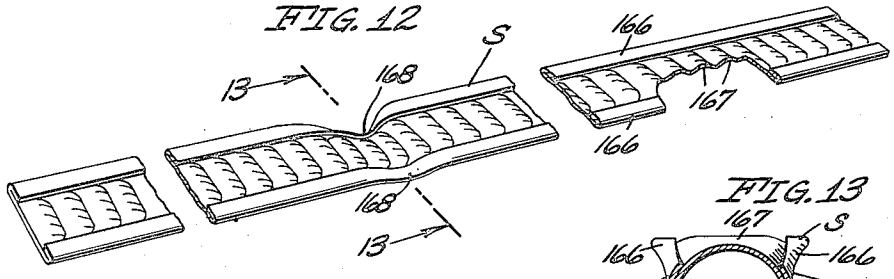


FIG. 13

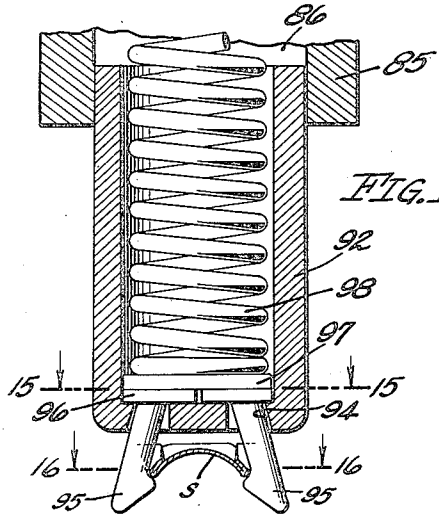
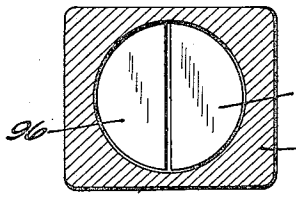


FIG. 14

FIG. 15



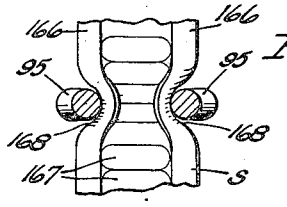
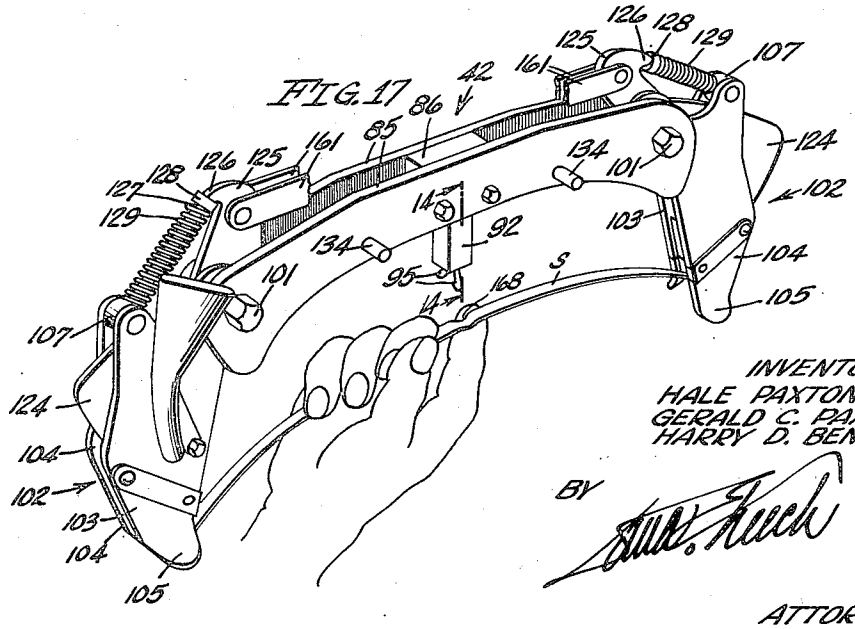


FIG. 16

FIG. 17



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FIG. 18

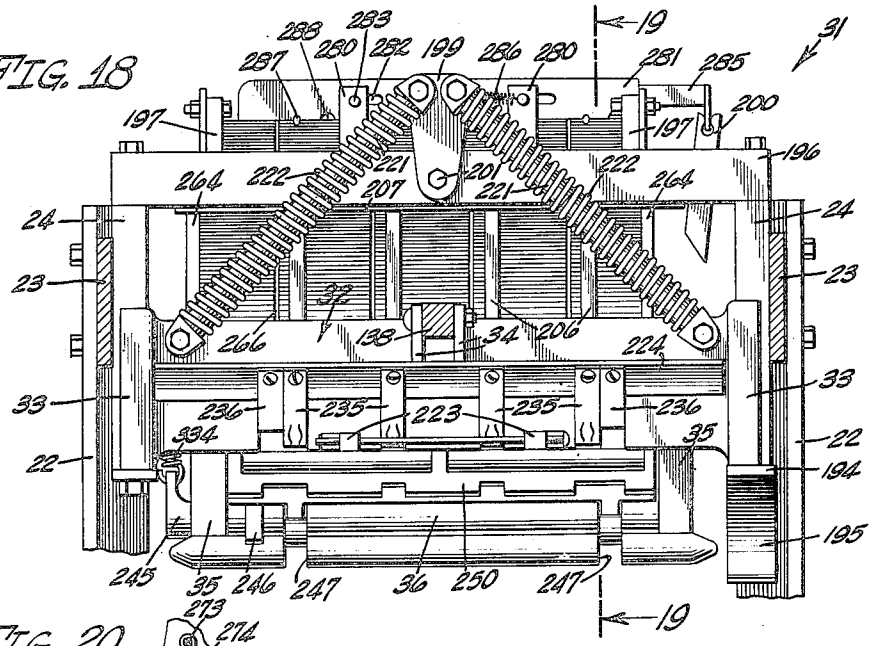


FIG. 20

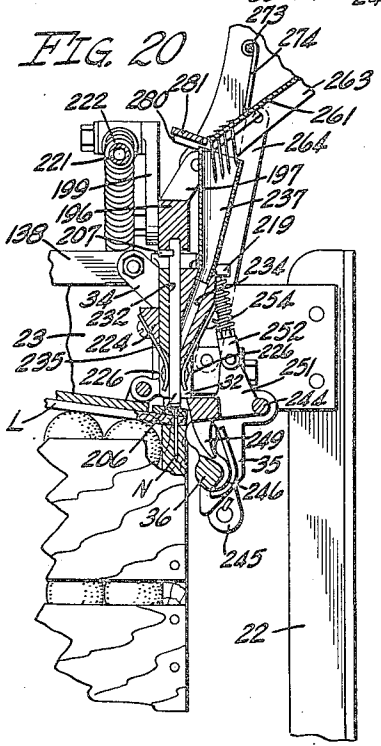
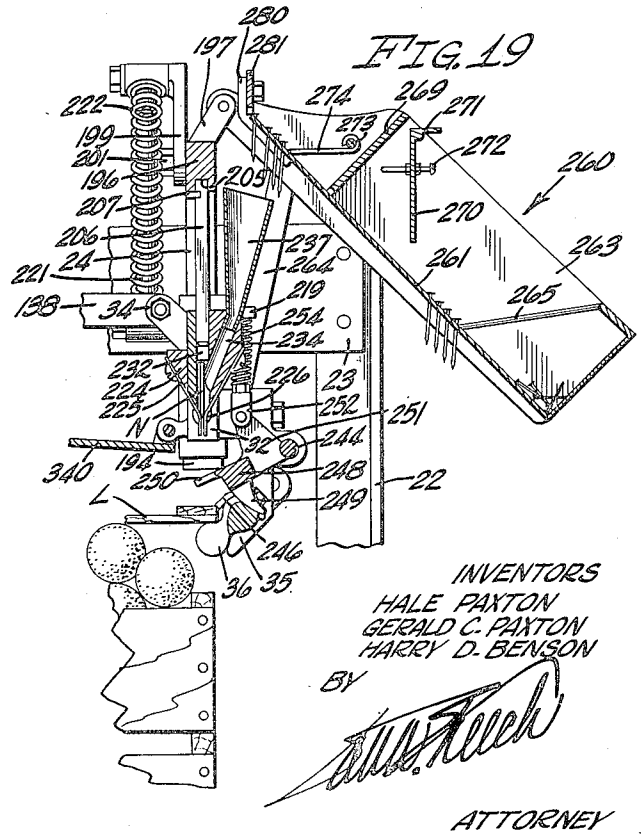


FIG. 19



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FIG. 22

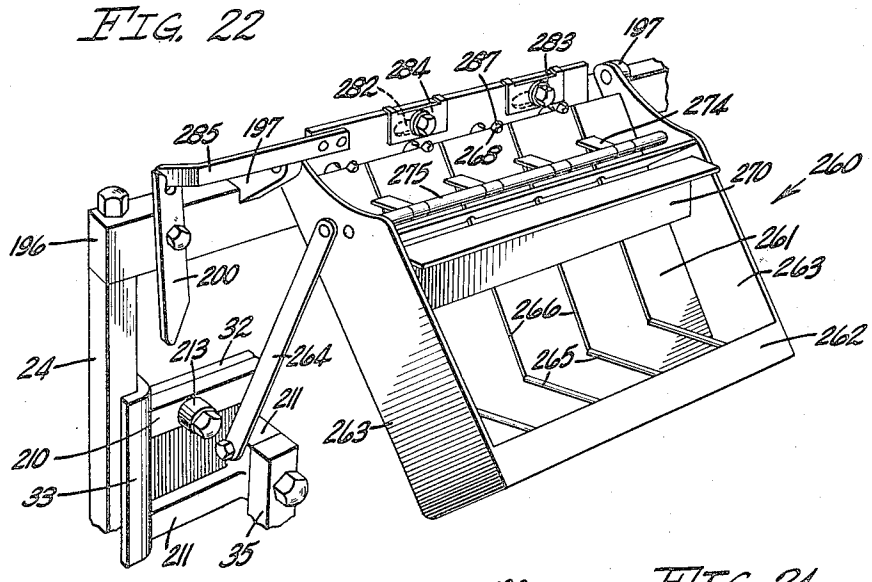
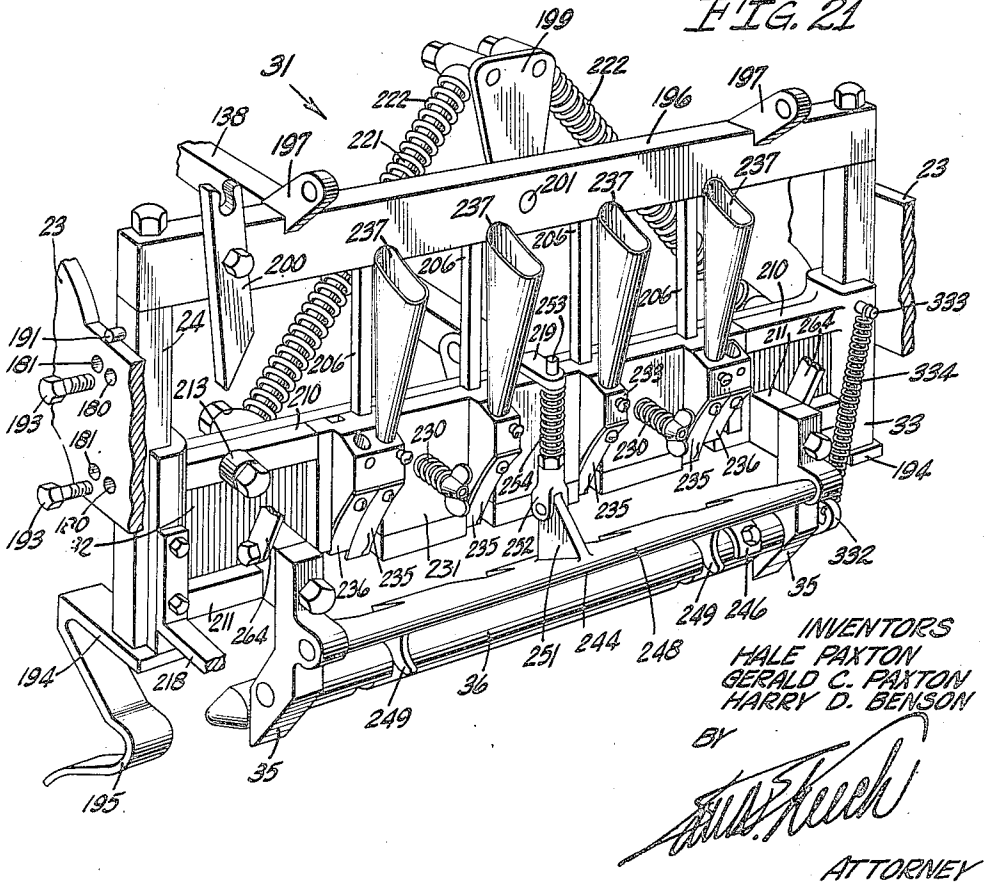


FIG. 21



Patented Sept. 21, 1937 2,093,733

UNITED STATES PATENT OFFICE

2,093,733

METHOD OF AND APPARATUS FOR APPLYING STRAPS TO BOXES

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Application January 31, 1934, Serial No. 709,176

20 Claims. (Cl. 1—10)

Our invention relates to the box cover pressing, nailing, and strapping art and has particular utility in securing covers on boxes overfilled with fresh farm products.

This invention is an improvement on our copending application for U. S. Letters Patent Serial No. 688,104, filed September 5, 1933, and relates particularly to straps and methods of and apparatus for applying the same.

While our invention has wide utility, it is particularly useful in pressing, nailing, and strapping lids on citrus boxes, and an embodiment of the invention particularly adapted for this purpose will be disclosed in this application.

Among other objects, this invention is directed towards producing an improved strap which can be manufactured at a less cost than those hitherto applied by machinery; and suitable methods of and apparatus for applying this strap.

For various reasons, the flat strap secured by nails to the sides of a box is considered in the citrus industry by many packers to be superior to round wire strap having driving ends formed thereon, the latter being driven into the sides of the box to secure the strap in place. It is accordingly a further object of our invention to provide a novel flat strap and methods of and apparatus for applying this across the covers of boxes and nailing the ends of the strap to the sides of the box.

The manner of accomplishing the foregoing objects, as well as further objects and advantages, will be made manifest in the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is a front elevational view of a preferred embodiment of our invention.

Fig. 2 is an enlarged sectional view taken on line 2—2 of Fig. 1.

Fig. 3 is an enlarged sectional view taken on line 3—3 of Fig. 2.

Fig. 4 is a fragmentary perspective view of a portion of the machine as shown in Fig. 2.

Fig. 5 is a fragmentary vertical sectional view taken on line 5—5 of Fig. 2.

Fig. 6 is a view similar to Fig. 5 showing the operative position of certain parts disclosed therein.

Fig. 7 is a view similar to Fig. 2 illustrating the operation of certain parts therein.

Fig. 8 is an enlarged fragmentary perspective view of a portion of the machine as shown in Fig. 7.

Fig. 9 is a detail perspective view of certain parts included in the machine of our invention.

Fig. 10 is a view similar to Figs. 2 and 7 showing the parts in positions following the positions in which they are shown in Fig. 7.

Fig. 11 is an enlarged fragmentary vertical sectional view taken on the line 11—11 of Fig. 10.

Fig. 12 is a fragmentary perspective view of a box strap included in our invention.

Fig. 13 is a sectional view taken on line 13—13 of Fig. 12.

Fig. 14 is an enlarged vertical sectional view taken on line 14—14 of Fig. 17.

Figs. 15 and 16 are horizontal sectional views taken on lines 15—15 and 16—16 respectively of Fig. 14.

Fig. 17 is a perspective view of a portion of the machine of our invention showing the manner in which the box strap is positioned.

Fig. 18 is a transverse sectional view taken on the line 18—18 of Fig. 1.

Fig. 19 is a longitudinal sectional view taken on the line 19—19 of Fig. 18.

Fig. 20 is a view similar to Fig. 19 illustrating the culmination of the nail driving operation of the nailing mechanism in nailing the lid to the box.

Fig. 21 is a perspective view of one of the nailing units of the nailing mechanism.

Fig. 22 is a perspective view of the nail hopper which is provided upon each of the nailing units of our invention.

Referring specifically to the drawings, a box lidding machine 10, comprising a preferred embodiment of our invention, is shown in Fig. 1. This machine includes a frame 11, an elevator 12, a nailing mechanism 13, a strapper 14 and a control mechanism 15.

With the exception of the strapper 14, the box lidding machine 10 disclosed herein is substantially identical with the machine disclosed in our copending application Serial No. 688,104, filed September 5, 1933. The frame 11, elevator 12, nailing mechanism 13, and control mechanism 15 of the machine 10 will be but briefly described herein, a more complete description of these units being found in the application above referred to.

The frame 11 includes a rectangular base 21, from which extend four vertical angle iron posts 22. Fixed to the upper ends of the posts 22 are front and rear plates 23 as shown in Fig. 2. Fixed on opposite ends of each of the plates 23 is a vertical slide bar 24.

The elevator 12 includes a box supporting table 26 slidable vertically in the frame 11. Rockably mounted on the front and rear sides of the table 26 are side flushers 27 as shown in Figs. 1 and 2.

Provided at one end of the table 26 is a box stop 28. Mounted on the frame 11 below the table 26 is an electrically driven power unit 29 for raising and lowering the table 26.

The nailing mechanism 13 includes a pair of units 31 as shown in Fig. 1. Each of the units 31 includes a chuck beam 32, opposite ends of the latter having guide shoes 33 for slidable engagement with the aforementioned slide bars 24 of the frame 11. Fixed at the center of each of the beams 32 on the inside faces thereof are bifurcated lugs 34, one of the latter being clearly shown in Fig. 4. Mounted on the chuck beams 32 are brackets 35 in which end tuckers 36 are pivotally mounted.

The strapper 14

The strapper 14 includes a horizontal transverse beam 40, a nailing feeding mechanism 41, and a strap applying and nailing mechanism 42.

The beam 40 includes a pair of plates 43, opposite ends of which are fixed to the plates 23 of the frame 11 by means of blocks 44 as shown in Figs. 1 and 2. Formed on the lower edges of the plates 43 are notches 46, (see Fig. 7) the purpose of which will become apparent hereinafter.

Fixed to the upper edges of the plates 43 of the beam 40 by suitable bolts 47 is a pair of upstanding plates 48 and 49, spacers 51 being provided on the bolts 47 between the plates 43 to maintain the latter in a definite spaced relation. The plates 48 and 49 are joined and held in spaced relation by an apertured block 52 which is welded to the plates 48 and 49. Slidably mounted in the apertured block 52 is a threaded stud 53 having a head 54 at one end thereof as shown in Fig. 2. Welded to the upper side of the head 54 in parallel relation with the stud 53 is a plate 55 positioned so as to slide along the upper side of the apertured block 52. On the stud 53 between the block 52 and head 54 is a compression spring 56. Movement of the stud 53 relative to the block 52 is limited by nuts 57. Outstruck on the plate 48 is an apertured lug 58 shown in Figs. 2 and 5.

Mounted on the plates 48 and 49 are nail feed tubes 59 having funnels 60 on the upper ends thereof. The lower end of each of the tubes 59 terminates at one of the opposite ends of the beam 40 and is attached thereto as shown in Fig. 2.

Rockably mounted on a suitable pin 62 at the upper end of the plates 48 is a nail hopper 63. Slidably mounted at the mouth of the hopper 63 is a pair of nail picking bars 64, the latter being actuated by levers 65 as shown in Figs. 1 and 2. The hopper 63 is similar in construction to the hoppers described fully in the above referred to copending application.

Rotatably mounted on each of the spacers 51 of the bolts 47 are pairs of rollers 68 as shown in Figs. 4 and 5. Also positioned on the spacers 51 between the pairs of rollers 68 are blocks 69. Formed integral with the blocks 69 and extending upward therefrom are studs 70, the latter having shoulders 71 thereon.

Resting on the shoulders 71 of the studs 70 are washers 72 and springs 73, the latter being compressed against the washers 72 by means of nuts 74 threaded on the upper ends of the studs 70.

Slidable vertically on the studs 70 between the blocks 69 and washers 72 is a horizontal bar 76 formed to provide a central downwardly extending flange 77, the latter being slidable between the blocks 69 of the studs 70. It will be noted in Fig. 5 that the space between the block 69 and the washer 72 of each stud 70 is greater than the thickness of the bar 76 so as to allow a slight degree of free vertical movement of the bar 76 on the studs 70.

Slidable vertically between the plates 43 of the beam 40 is a pair of plates 78, the latter being spaced by the bar 76 and guided by the rollers 68 as shown in Figs. 2 and 5. Secured between the upper ends of the plates 78 by a bolt 79 (see Fig. 6) is a spacer 80, the latter serving to limit the downward movement of the plates 78 by contact with the bar 76 as shown in Figs. 2 and 5. The lower ends of the plates 78 are bifurcated as indicated by the numeral 81 in Fig. 2. Fixed to the lower end of one of the plates 78, as shown in Figs. 2 and 4, is a serrated bar 82, the purpose of which will be made manifest hereinafter.

Fixed between the lower extremities of the plates 78 as by bolts 83 is a saddle bar 84 comprising a pair of identical plates 85 which are separated by a spacing member 86 as shown in Figs. 10 and 17. The spacing member 86 is formed to provide a central opening 87 and a pair of lateral wings 88, the latter being formed to coincide with the contour of the lower edges of the plates 85 of the saddle bar 84. As noted in Figs. 10 and 11, the lower edges of the spacer 86 and wings 88 thereof are positioned above the lower edges of the plates 85 to provide a channel 89 (see Figs. 5 and 10). The spacing member 86 is formed to provide a pair of shoulders 90 at the lower end of the opening 87 as shown in Fig. 10.

Slidable vertically between the plates 85 and within the opening 87 of the spacer 86 is a hollow plunger 92 having a pair of outward extending lugs 93 on the upper end thereof as shown in Fig. 10. Extending downward through suitable openings 94 in the lower end of the plunger 92 is a pair of fingers 95 having semicircular heads 96 formed thereon as shown in Figs. 14 and 15. Resting on top of the heads 96 within the plunger 92 is a circular disc 97. The plunger 92 is urged to its downwardmost position by a compression spring 98, the movement of the plunger 92 being limited by contact of the lugs 93 thereof with the shoulders 90 of the spacing member 86. It will be noted that the pressure of the spring 98 against the disc 97 and heads 96 causes the fingers 95 to be yieldably held in the position in which they are shown in Fig. 14.

Pivotally hung from opposite ends of the saddle bar 84 on pivot bolts 101 are strap nailing jaws 102 as shown in Fig. 4. Each of the jaws 102 includes outer plates 103 and 104, these being flared at their lower extremities to provide wings 105. Formed on the outside edges of the plates 103 and 104 are apertured ears 106, the latter receiving the trunnions of an apertured collar 107.

On the inner edges of the plates 103 and 104 notches 108 are formed, one of the latter being shown in Fig. 8. Secured between the plates 103 and 104 of each jaw 102 by screws 109 is an arcuate block 110 formed in concentric relation with the pivot bolt 101. The upper edges of the blocks 110 are channeled to provide a nail receiving trough 111. Also secured between the plates 103 and 104 are strap positioning blocks 112 as shown in Fig. 7. The plate 103 of each of the jaws 102 is formed to provide an elongated opening 113. Received by the notches 108 of the plates 103 and 104 are nail chucks 116 comprised of identical halves 117. The confronting faces of the halves 117 have semi-circular nail receiv-

ing grooves 118 and dished nail guiding portions 119 as shown in Figs. 8 and 9. Formed on the outside faces of the halves 117 of the nail chucks 116 are studs 120. The chuck halves 117 are held in position and yieldably urged together by flat springs 121, the latter having apertures at their free ends for receiving the studs 120 as shown in Figs. 2 and 3.

Fixed to the outside surfaces of the plates 103 of the jaws 102 are nail receiving funnels 122, the lower ends of which extend into the elongated openings 113 of the plates 103.

Pivoted on the pivot bolts 101 between the plates 103 and 104 of the jaws 102 are nail drivers 124, the lower ends of the latter being formed and positioned in the nail troughs 111 of the arcuate blocks 110 as shown in Fig. 8. The upper ends of the drivers 124 extend above the saddle bar 84 to provide apertured lever arms 125 as shown in Fig. 2.

Formed on the upper end of each of the lever arms 125 of the drivers 124 are hooks 126. Slidable within the apertured collars 107 are pins 127 having heads 128 on the upper ends thereof, the top sides of the heads 128 being concave to receive the hooks 126 of the driver lever arms 125. Provided on the pins 127 between the heads 128 and collars 107 are compression springs 129 which tend to urge the jaws 102 downward so that the collars 107 thereof contact the back edge of the nail drivers 124.

Hinged at their outermost ends to the lower edge of the chuck beams 32 by pins 132 are crown sheets 133, the innermost ends of the sheets 133 being supported by the saddle bar 84 by means of suitable pins 134 provided on the plates 85 as shown in Fig. 4. Extending upward from the center of each of the crown sheets 133 is a pair of pins 135.

Fixed at its opposite ends by pins 137 to the aforementioned lugs 34 of the chuck beams 32 is a horizontal strapper actuating bar 138, the latter passing through the bifurcations 81 of the plates 78 and above the saddle bar 84 as shown in Figs. 2 and 4.

Threaded into the upper side of the bar 138 in transverse alignment with the pairs of pins 135 of the crown sheets 133 are studs 139. Positioned on each of the studs 139 and pairs of pins 135 is a yoke 140 having horizontal apertured ears 141 and downward extending guide lugs 142. Provided on the pins 135 between the crown sheets 133 and the ears 141 of the yokes 140 are compression springs 143. Threaded onto the studs 139 are nuts 144 by means of which the yokes 140 are held down against the springs 143.

Fixed to the upper side of the bar 138 adjacent one of the plates 78 is a sleeve 146 in which a pawl 147 is pivotally mounted. The pawl 147 has a serrated face 148 for engagement with the serrated bar 82 on the plate 78 in a manner to be described hereinafter. Fixed to the pawl 147 is an arm 149, a rod 150 extending from the arm 149 upward through the apertured lug 58 of the plate 48 as shown in Fig. 5. Provided on the rod 150 is a compression spring 151 and a stop nut 152.

Mounted on the under side of the bar 138 adjacent the saddle bar 84 is an apertured lug 154 as shown in Fig. 11. Pinned at its lower end to the lug 154 and pivoted at its upper end to the nail hopper 63 is a link 155 which rocks the hopper 63 in response to vertical movement of the bar 138 in a manner to be described hereinafter.

Secured to the top and side surfaces of the strapper actuating bar 138 is a pair of vertical plates 156, the latter being positioned in vertical alignment with the plates 85 of the saddle bar 84 as shown in Fig. 5. The extremities of the plates 156 are apertured to receive bolts 157 upon which bell cranks 158 are pivotally mounted, the latter being positioned centrally between the plates 156 by spacers 159 as shown in Fig. 4. Connecting the upper side of the bell cranks 158 with the aforementioned flange 77 of the bar 76 are pairs of vertical links 160, the lower side of the bell cranks being connected to the apertured lever arms 125 of the drivers 124 by pairs of horizontal links 161 as shown in Fig. 4.

A box strap S adapted to be applied to a box by the machine 10 of our invention is shown in Fig. 12. The strap S is formed of a single piece of sheet metal by folding the longitudinal edges to provide beads 166 and crimping the central portion between the beads 166 to form transverse corrugations 167. The center of the strap S is pinched to reduce the width thereof and provide indentations 168 as shown in Fig. 16.

The indentations 168 are formed to provide lips 169 which extend downwardly from the upper face of the strap S. In handling the strap the operator can always be certain by feeling the lips 169 with the palm of his hand and fingers that the strap is right side up. Also no attention of the operator is required as to which end of the strap goes into the machine first in view of the fact that the indentations 168 are formed exactly at the center of the strap.

The control mechanism 15 of the machine 10 as shown in Fig. 1 includes an electrical switch 170 for starting, stopping, and reversing an electric motor (not shown) to cause the power unit 29 of the elevator 12 to raise or lower the table 26. The switch 170 is manually operated by means of a foot pedal 171. A more complete description of the control mechanism 15 of the machine 10 may be had by referring to our above mentioned copending application.

The nailing mechanism

As the nailing units 31 are substantially identical, a description of one of these will suffice for both. Referring specifically to Figs. 18 to 21 inclusive, each unit 31 has pins 191 provided in the side slide bars 24 (see Fig. 21) by which the unit may be supported upon the side plates 23 of the frame, these units normally being mounted on the side plates 23 by cap screws 193 extending either through pairs of holes 180 or through pairs of holes 181 in the side plates 23 and being threadedly received in suitable holes provided in the side slide bars 24. Secured to lower ends of the side slide bars 24 are chuck beam stops 194, the front stop 194 having a lid guiding member 195 secured thereon. Extending between and preferably rigidly connected at its opposite ends to the upper ends of the side slide bars 24 is a cross bar 196, this bar having stripper supporting ears 197, an upwardly extending spring hanger 199, and a picker operating cam lever 200 pivotally mounted thereon. The spring hanger 199 is connected to the cross bar 196 by a single cap screw 201. Formed in the lower face of the cross bar 196 is a groove 205 and square nail drivers 206 have their upper ends held in place in the grooves 205 by a key 207 which extends into suitable notches provided in the drivers 206, the key 207 being secured in

any suitable manner to the lower face of the cross bar 196.

The chuck beam 32 is disposed between the side slide bars 24 with the guide shoes 33 at the opposite ends of the chuck beam sliding on the side slide bars 24. The chuck beam 32 is reenforced by welding blocks 210 along its upper edge and blocks 211 along its lower edge adjacent the guide shoes 33 and then by blocks 212 welded in spaced relation along the lower edge of the chuck beam. One of the blocks 210 at the front of the machine provides a mounting for a picker cam actuating roller 213. Secured to the guide shoe 33 at the front of the machine (see Fig. 21) on the right hand unit 31 only is a control rod guide and release finger 218. Provided on the upper edge of the chuck beam 32 at the middle of the beam is a lid centralizer spring lug 219 (see Figs. 20 and 21). Pivotally mounted at their opposite ends on the spring hanger 199 and on opposite ends of the chuck beam 32 are telescopic spring spindles 221 on which heavy compression springs 222 are mounted under constant tension. Provided on the lower edge of the chuck beam 208 and extending inwardly is a pair of crown sheet attaching eyes 233, to which the crown sheet halves 133 are connected.

Formed on the chuck beam 32 and extending inwardly across its entire length is a chuck spring supporting boss 224, chuck springs 225 being secured by screws to an inclined lower face of this boss and extending through suitable notches in the lower edge of the chuck beam 32 and downwardly on the opposite side of the chuck beam. The lower ends of the chuck springs 225 are bent to extend vertically downward and pockets 226 are formed in these springs preferably by expressing the material thereof outwardly.

Resting on top of the lower reenforcing blocks 212, disposed between the upper reenforcing blocks 210, and yieldably held against the chuck beam 208 by springs 230 is a compound spring chuck block 231 which is clearly shown in Fig. 21. This block 231 has a plurality of driver guideways 232 (Figs. 19, 20, and 21) provided therein and a rearwardly extending boss 233 opposite each of these guideways, this boss providing a nail feeding duct 234 leading into the channel 232 and inwardly inclined faces against which chuck springs 235 are secured by screws. These springs are substantially identical with springs 225 (Fig. 19) and extend inwardly and downwardly to cooperate with the springs 225 in a manner which will be made manifest hereinafter.

In the preferred embodiment of our invention there are six guideways 232 shown in the compound chuck block 231, the endmost pairs of these guideways being closer together than the inner pairs so that the outer pair of bosses 233 are formed as a single unit. As shown in Fig. 21, only one of each of the endmost pairs of the guideways 232 is used, the purpose of these two guideways being close together being to permit operation upon boxes differing considerably in width. When any of the guideways 232 are not used, it has been found preferable to cover up their lower ends as by dummy chuck springs 236 secured both to the boss 233 and to the boss 224 opposite this guideway.

Removably supported in each of the ducts 234 and connecting therewith is a nail funnel 237.

The brackets 35 are mounted on the chuck beam reenforcing block 211 as clearly shown in Fig. 21, these brackets pivotally carrying the opposite ends of the end tucker 36 for this nailing unit, and a lid depresser and centralizer 244. The end tucker 36 comprises two substantially cylindrical bodies, one of which is disposed on the axis of rotation of the tucker and the other of which is disposed parallel with the first body and radially therefrom, the two being connected by a substantially continuous web of metal. The tucker 36 normally extends downwardly at an angle as clearly shown in Fig. 19, so that it is adapted to support the end of a box lid as shown in this figure. Secured on the tucker 36 to provide a stop for the rear edge of such a lid is a cam member 246. Also formed in the tucker 36 as clearly shown in Figs. 18, 19, 20 and 21, is a pair of slots 247.

The lid depresser and centralizer 244 has a cross section as shown in Figs. 19 and 20 which includes a body 248 having arcuate guides 249 extending downwardly into the grooves 247 in the tucker 36, and a lip 250 which extends inwardly from the body 248 at the upper edge thereof and is provided with suitable notches 250a at the opposite edge of the nail driver guideways 232. The lid depresser and centralizer 244 has an upwardly extending hump 251 to which is pivotally secured a clevis 252 carrying a rod 253 which extends through a suitable aperture in the lug 219, a compression spring 254 being coiled about the rod 253, said spring constantly urging said lid depresser and centralizer 244 to rotate downwardly into the position in which it is shown in Figs. 19, 20 and 21.

Referring now particularly to Figs. 19, 20 and 22, it will be seen that each nailing unit 31 includes a nail hopper 260 having a floor 261, a rear wall 262 and side walls 263, the inner ends of the latter being pivotally connected to the hopper mounting lugs 197. The hopper side walls are also connected by links 264 to the reenforcing block 211 of the chuck beam 208. Extending from the upper edge of the rear wall 262 to spaced points in the floor 261 are nail agitating rods 265, there being nail advancing slots 266 extending forwardly from these rods to a front edge 267 of the floor 261. Formed in the edge 267 adjacent each of the slots 266 is a relatively small notch 268. The stripper 260 has a fixed baffle wall 269 extending between the walls 263 and rigidly secured thereto, there being clearance between the lower edge of the wall 269 and the floor 261 adjacent the slots 266 to permit nail heads to pass underneath the baffle wall 269 as the stems of the nails extend through the slots 266. Pivotally mounted between the walls 263 is a pivoted baffle 270, this baffle having a flange 271 at its upper end and a set screw 272 for limiting its downward swinging movement when the hopper 260 is extended upwardly. Also extending between the walls 263 is a rod 273 on which are pivotally mounted a series of traps 274, these being held in spaced relation by spacers 275. Each of the traps 274 is disposed over one of the slots 266.

As shown in Figs. 18, 19 and 20, two brackets 280 are connected to the lower surface of the stripper floor 261 and extend forwardly beyond the front edge 267 of said floor. Slidably mounted on these brackets is a picker bar 281 having a pair of slots 282 through which cap screws 283 extend, these screws then screwing into suitable apertures in the brackets 280. Disposed between the heads of the cap screws 283 and the picker bar 281 so as to cover the slots 282 are guard washers 284. Fixed on the picker bar 281 is an actuating arm 285, the extremity of

which is bent as shown in Fig. 22 to extend into the upper bifurcated end of the cam lever 200 by which the picker bar 281 is adapted to be actuated. As shown in Fig. 18, a coil spring 286 attaches to one of the brackets 280 and to the picker bar 281 so as to constantly urge this picker bar into the position in which it is shown in Figs. 18 and 22.

The picker bar 281 has its lower edge both parallel and close to the front edge 267 of the stripper floor 261, and this edge of the picker bar is provided with a series of pairs of notches, one pair for each of the slots 266 of the stripper floor. Each of these pairs of notches comprises a small notch 287 and a large notch 288, the notch 287 of each of these pairs being opposite one of the notches 263 when the picker bar is positioned as shown in Fig. 22, while the large notch 288 of that pair is on the opposite side of that notch 263 from the slot 266 adjacent that notch 263. The notches 287 and 288 are spaced apart the same distance from their centers as is each of the slots 266 and adjacent notch 263.

Each end tucker 36 has an arm 332 which is connected to a lug 333 on the chuck beam 32 by a contractile spring 334.

We have now completed a description of the right hand nailing unit 31 as shown in Fig. 1. The left hand nailing unit 31 is an exact duplicate of the one hereinabove described, except that instead of a hook 195 being formed on the forward chuck beam stop 194, the corresponding chuck beam stop on the left hand nailing unit 31 merely has a shallow V-shaped lid and guide 289 as shown in Fig. 1.

Operation

Prior to lidding a box in the machine 10 the strap S is first positioned in the strap applying and nailing mechanism 42 of the strapper 14 in the manner shown in Fig. 17. To accomplish this the strap S is seized in the hand as shown and raised so that the ends of the strap are guided into the jaws 102 by the wings 105 of the plates 103 and 104. The center of the strap S is then snapped into engagement with the fingers 95 of the plunger 92 as shown in Figs. 14 and 16 by inserting the neck 168 of the strap between the fingers 95.

After the strap S is positioned, a box lid is inserted in the machine from the front thereof with the ends of the lid resting on the end tuckers 36 as shown in Fig. 1. A box B containing an overfull pack O is then delivered onto the table 26 of the elevator 12 by a delivery conveyor 175, the box B being stopped by the stop 28.

The operator of the machine 10 then drops a nail N into each of the funnels 122 of the strap nailing jaws 102, the nails N gravitating into the troughs 111 of the arcuate blocks 110 as shown in Fig. 8. After the first lidding operation of the machine 10 the nails N are automatically fed to the jaws 102 by the nail feeding mechanism 41 in a manner to be presently described.

After the nails N are supplied to the jaws 102 and the strap S, lid L, and box B are positioned as aforesaid, the operator depresses the foot pedal 171 causing the power unit 29 to elevate the table 26. The side flushers 27 then swing inward against opposite sides of the box B as shown in Fig. 2. The flushers 27 center the box transversely and longitudinally relative to the table 26 and press the overfull portion of the contents O inward from over the upper edges of the box sides as described in our aforementioned copending application. The inward movement of the side flushers 27 also automatically lowers the box stop 28 and allows the latter to move inward under the end of the box B to permit removal of the box from the table 26 after the lidding operation.

As the table 26 continues to rise, the fruit in the box comes in contact with the lid L as shown in Fig. 19. This lifts the lid L against the lid centralizer lips 250, and swings the centralizers 246 upwardly until the lips 250 rest against the lower faces of the chuck beams 32. While this is happening, however, the ends of the box rise into engagement with the end tuckers 36 and rock the latter inwardly to tuck any fruit overhanging the edges of the box inwardly so that when this engages the cover, it is pressed down inside the box. The upward movement of the box then rocks the end tuckers outwardly from between the ends of the box and the ends of the lid, this occurring just as the lid end presses the lid centralizer lips 250 up against the chuck beams 32. The ends of the lid are now pressed against the ends of the box and the middle portion of the lid is in conformation with the crown sheets 133 as shown in Fig. 20, but the crown sheets and chuck beams 32 and parts associated therewith are still in their lowermost positions as shown in Fig. 19.

When the lid ends have thus been completely pressed against the ends of the box, the continued upward movement of the box B lifts the chuck beams 32, further compressing the springs 222 and causing the drivers 206 to drive nails in the recesses 232 downwardly from between the chuck springs 225 and 235 through the lid ends, and into the ends of the box, as clearly shown in Fig. 20. In the embodiment of the invention disclosed, the nails N and drivers 206 do not move downwardly, but remain stationary while the box and the lid are pushed upward onto the nails.

It is to be noted that the strapper actuating bar 136 is mounted on the chuck beams 32 and rises with these during the nailing of the ends of the lid to the ends of the box as shown in Figs. 19 and 20. The operation of the strapping mechanism 14 takes place during the lifting of this bar.

The pressure of the compression springs 143 as shown in Figs. 1 and 4 is adjusted so as to permit the upward pressure of the overflow pack against the lid L to be sufficient to support the middle ends of the crown sheets 133 and the strapper 14 during the upward travel of the chuck beams 32.

When the chuck beams 32 start moving upward, of course, the bar 136 also moves upward and of course carries with it the plates 156 secured thereto and the pins 157 mounted in these plates. As the block 76 has only a very slight degree of freedom to move vertically on the studs 70, and as these studs are fixed upon the crossbeam 40 which is a part of the frame of the machine, the upward movement of the pivot pins 157 with the bar 136 results in the links 160, the bell cranks 156, and the links 161 swinging the nail drivers 124 and the strap positioning jaws 102 downwardly and inwardly around their pivot pins 101. The first part of this swinging movement of the nail drivers 124 brings the strap positioning jaws 102 against the sides of the box B as shown in Fig. 7. This movement of the jaws 102 completes the wrapping of the strap S loosely across the middle of the lid L with end portions of the strap extending down fairly close to the sides of the box.

The positioning of the jaws 102 as shown in Fig. 7 is accomplished when the chuck beams 32 and the strapper 14 have been lifted approximately one-half of the vertical movement necessary in nailing the ends of the lid to the ends of the box. Accordingly, as the box and the machine parts being lifted thereby continue upwardly the swinging movement of the nail drivers 124 about their pins 101 also continues. This causes the compression of springs 129 and the engagement of the nails N by the driving portions of the drivers 124 so as to drive these nails through the nail chucks 116 and the end portions of the strap S and into the sides and center partition of the box B, as clearly shown in Fig. 10. The nail engaging portions of the drivers 124 pass between the individual halves 117 of the nail chucks 116, these nail chuck halves being sprung outwardly against the yielding pressure of the springs 121 which are clearly shown in Figs. 3 and 4.

The springs 73 are provided as a safety measure, these springs yielding in case the nail drivers 124 should ever become jammed in the jaws 102.

As seen in Fig. 7, the links 161 do not lie horizontally when the nail driving operation commences. Slight upward forces are thus transmitted to the drivers 124 by this driving operation. To prevent this upward force causing the jaws 102 to shift upwardly during the nailing of the strap to the box, we have provided the serrated jaws 82 and 147 and the mechanism for actuating these, as shown in Figs. 5 and 6, to lock the saddle bar 84 against vertical movement relative to the chuck beam cross-bar 138 after the crown sheets 133 and saddle bar 84 have adjusted themselves to the crown of the lid L, and the upward movement of the chuck beams 32 and other parts lifted by the box has started. This insures that the jaws 102 will not move vertically relative to the box B during the nailing of the strap ends to the box. In many cases we have found that this precaution is unnecessary and may be dispensed with. However, where the packs are very high so that the upward inclination of the links 161 during the strap nailing operation is considerable we find it advisable to provide the locking mechanism comprising the serrated jaws 82 and 147 and means for bringing these into engagement.

During the driving of the nails N the upward movement of the strapper actuating bar 138 raises the aforementioned link 155 and lifts the nail hopper 63 to the position shown in Fig. 10. As the hopper 63 rocks on the pin 62, the lower ends of the levers 65 are spread by contact with the head 54 of the stud 53 causing the nail picking bars 64 to be moved toward each other to allow a nail to be dropped from the hopper 63 into each of the funnels 60. The nails gravitate through the tubes 59, into the funnels 133 of the jaws 124, through the openings 113 of the plates 103 and into contact with the nail drivers 124, the latter being, at this time, in the driving position shown in Fig. 10. As soon as the drivers 124 swing from the driving position back to their normal position, the openings 113 in the plates 103 are uncovered allowing the nails to fall into position in the troughs 111 of the blocks 110 in readiness for the next strap nailing operation.

After the lid L is nailed and strapped to the box B the operator releases the pedal 171 allowing the power unit to lower the table 26. The side flushers 27 automatically swing outward to their normal position and the lidded and strapped box B is discharged from the machine onto a suitable discharge conveyor 176.

It is to be noted that as the strap is being shaped over the cover and alongside the sides of the box the plunger 92 is lifted upwardly against the pressure of the spring 98 so that when the strap is so positioned just prior to the nailing of the end portions to the sides of the box, as shown in Fig. 7, the plunger 92 is disposed upwardly practically flush with the lower cover shaping face of the saddle bar 84. Owing to the fact that multi-slat covers are in general use in which a free space between adjacent slats extends down the center of the cover, the fingers 95 do not interfere with the cover in any way during the lidding and strapping operation but extend into this central space as shown in Fig. 7.

Advantages

There are numerous advantages which the strap and the method of and machine for applying the same hereinbefore described possess over previous straps, methods, and machines provided for strapping covers to overfilled boxes. In the first place, most of the machines previously provided for this purpose have applied a round wire strap, the ends of which were bent inwardly and driven into the box sides to hold the strap in place. This type of strap is inferior to the flat strap in which the end portions of the strap are nailed to the sides of the box as it is much more difficult to pull out the nailed ends of the flat strap than the bent driving ends formed integrally with the ends of the wire strap. Furthermore, there is a considerable saving as the flat strap can be produced and sold much cheaper than the wire strap. Another advantage is the handling of the flat strap which we have made in straight sections without any bent ends formed thereon and considerable time is thus saved in handling the flat strap over the time required for handling the wire strap having driving ends bent from the ends thereof. A further advantage is the ease with which the flat strap bends over the side edges of the lid. The wire strap is relatively stiff and therefore does not bend easily at the side edges of the lid as is highly desirable in strapping boxes of citrus fruit and this is the most extensive use made of strap on overfilled packs.

It is also to be noted that our new method of indexing a strap in the machine is much easier than the former method of inserting the strap and positively prevents the faulty indexing of the strap. It is further to be noted that the strap itself has been provided with an indexing neck in a manner which has not reduced the cross-section of the strap nor materially decreased the resistance of the strap to stretching forces.

Although we have shown and described but one specific embodiment of our invention, it is to be understood that various changes and modifications might be made without departing from the spirit and scope of the following claims.

We claim as our invention:

1. A method of binding the cover of an overfilled box thereto under a transverse compression which consists in providing a relatively straight flat strap of suitable length, indexing said strap transversely above the middle of said cover so the ends of said strap extend equal distances beyond the edges of said cover, applying said cover to said box with the cover ends against the box ends and the middle of the cover disposed upwardly, compressing said middle bulge in said cover to shape this transversely beneath said strap, shap-

ing said strap in its indexed position to substantially conform to said transverse contour of the middle of said cover and with the ends of said strap extending downwardly close to the sides of said box equal distances, driving nails through said strap end portions to nail these to opposite sides of said box, and releasing the transverse pressure on said cover.

2. A method of binding the cover of an overfilled box thereto under a transverse compression which consists in providing a relatively straight flat strap of suitable length, indexing said strap transversely above the middle of said cover with the ends of said strap extending equal distances beyond the edges of said cover, applying said cover to said box with the cover ends against the box ends and the middle of the cover disposed upwardly, compressing said middle bulge in said cover to shape this transversely beneath said strap, shaping said strap in its indexed position to substantially conform to said transverse contour of the middle of said cover and with the ends of said strap extending downwardly close to the sides of said box equal distances, simultaneously driving nails through said strap end portions to nail these to opposite sides of said box, and releasing the transverse pressure on said cover.

3. A method of binding the cover of an overfilled box thereto under a transverse compression which consists in providing a relatively straight flat strap of suitable length, indexing said strap transversely above the middle of said cover to the ends of said strap extending equal distances beyond the edges of said cover, applying said cover to said box with the cover ends against the box ends and the middle of the cover disposed upwardly, compressing said middle bulge in said cover transversely beneath said strap, shaping said strap in its indexed position to substantially conform to said transverse contour of the middle of said cover and with the ends of said strap extending downwardly close to the sides of said box equal distances, simultaneously nailing said strap end portions to opposite sides of said box, and releasing the transverse pressure on said cover, said strap being indexed at a middle point therein, the balance of said strap loosely conforming to said cover and said box prior to the nailing of the strap ends to the sides of the box.

4. In a machine for strapping the middle portion of the cover of an overfilled box to said box, the combination of: means to shape said middle portion of said cover transversely and apply a piece of flat strap previously cut to length in substantial conformation with the contour thus given said middle portion of said cover and with end portions of said strap on opposite sides of said box; and means for driving nails through said opposite end portions of said strap to nail said portions to the sides of said box.

5. In a machine for strapping the middle portion of the cover of an overfilled box to said box, the combination of: means to shape said middle portion of said cover transversely and apply a piece of flat strap previously cut to length in substantial conformation with the contour thus given said middle portion of said cover and with end portions of said strap on opposite sides of said box; and means for simultaneously driving nails through said opposite end portions of said strap to nail said portions to the sides of said box.

6. In a machine for strapping the middle portion of the cover of an overfilled box to said box, the combination of: a strapper unit including a cover shaping bar and nailing means provided on opposite ends thereof; indexing means on said unit adapted to engage a flat length of strap and properly index this strap beneath said cover shaping bar; a table for supporting a box beneath said strapping unit with the cover disposed over said box; and means for causing relative vertical movement between said unit and said table to shape said cover transversely and to position said strap over the shaped portion of said cover with its ends at opposite sides of said box and then drive nails through said end portions of said strap to nail said portions to sides of said box.

7. A combination as set forth in claim 6 in which said indexing means is provided on said cover shaping bar and engages complementary indexing means on said strap at the middle thereof.

8. A combination as in claim 6 in which said indexing means on said unit yields to receive said strap, said strap being locked against longitudinal displacement when it has been received by said indexing means.

9. In a machine for strapping the middle portion of the cover of an overfilled box to said box, the combination of: a strapper unit including a cover shaping bar and nailing means provided on opposite ends thereof; indexing means provided on said cover shaping bar, said indexing means being adapted to engage complementary indexing means at the middle of a flat length of strap and properly index this strap beneath the cover shaping bar; a table for supporting a box beneath said strapping unit with the cover disposed over said box; and means for causing relative vertical movement between said unit and said table to shape said cover transversely, to position said strap over the shaped portion of said cover with its ends at opposite sides of said box and to nail said end portions of said strap to sides of said box.

10. In a machine for strapping the middle portion of the cover of an overfilled box to said box, the combination of: a strapper unit including a cover shaping bar and nailing means provided on opposite ends thereof; indexing means on said unit, said indexing means yielding to receive a flat length of strap and properly index this strap beneath said cover shaping bar, said strap being locked against longitudinal displacement when it has been received by said indexing means; a table for supporting a box beneath said strapping unit with the cover disposed over said box; and means for causing relative vertical movement between said unit and said table to shape said cover transversely, to position said strap over the shaped portion of said cover with its ends at opposite sides of said box and to nail said end portions of said strap to sides of said box.

11. In a machine for strapping the middle portion of the cover of an overfilled box to said box, the combination of: a nailing table for supporting said box; a superstructure on said machine extending above said table; a strap applying and nailing mechanism mounted on said superstructure and including a transverse cover shaping bar and strap end nailing means on the ends of said bar, said mechanism being adapted to support a strap thereon; means causing relative vertical movement between said table and said superstructure to cause said strapper to engage said cover and shape said middle portion thereof transversely and position said strap to conform to said shaped portion of said cover, engagement of

said cover with said mechanism then causing relative movement between said mechanism and said superstructure; and operating means connected to said mechanism and to said superstructure to cause said strap end nailing means to nail said strap ends to the sides of said box said operating means being actuated by relative vertical movement between said mechanism and said superstructure.

12. In a machine for strapping the middle portion of the cover of an overfilled box to said box, the combination of: a nailing table for supporting said box; a superstructure on said machine extending above said table; a strap applying and securing mechanism mounted on said superstructure and including a unit comprising a transverse cover shaping bar and strap end securing means on the ends of said bar, said unit being adapted to support a strap thereon; means causing relative vertical movement between said table and said superstructure to cause said mechanism to engage said cover and shape said middle portion thereof transversely and position said strap to conform to said shaped portion of said cover, engagement of said cover with said mechanism then causing relative movement between said unit and said superstructure; and operating means connected to said mechanism and to said superstructure to cause said strap end securing means to secure said strap ends to the sides of said box as a result of relative vertical movement between said mechanism and said superstructure, said operating means being disposed so that said cover shaping bar is substantially free from vertical pressure incidental to the actuation of said strap end securing means.

13. In a cover pressing and strapping machine the combination of: a frame; a nailing table for receiving a packed box with a lid disposed thereover; a superstructure on said frame extending above said table; a cover end presser head mounted on said superstructure and capable of vertical movement relative to the latter; means for causing relative vertical movement between said table and said superstructure to bring said cover presser head into contact with the ends of said cover; means for yieldably biasing said presser head in a given direction to cause said relative vertical movement between said table and said superstructure to press the ends of said cover against the ends of said box, said yieldable means then yielding to permit relative vertical movement between said presser head and said superstructure; a strap applying and securing means mounted on said superstructure and capable of vertical movement relative thereto, said strapper means being disposed transversely of said cover and means actuated by the aforesaid relative vertical movement between said superstructure and said presser head to operate said strap applying and securing means to secure said strap to opposite sides of said box.

14. A combination as in claim 13 in which nailing mechanism is provided on and operated by relative movement between said superstructure and said presser head to nail ends of the cover to ends of the box.

15. In a cover pressing and strapping machine the combination of: a frame; a nailing table for receiving a packed box with a lid disposed thereover; a superstructure on said frame extending above said table; a cover end presser head mounted on said superstructure and capable of vertical movement relative to the latter; means for causing relative vertical movement between said table and said superstructure to bring said cover presser head into contact with the ends of said cover; means for yieldably biasing said presser head in a given direction to cause said relative vertical movement between said table and said superstructure to press the ends of said cover against the ends of said box, said yieldable means then yielding to permit relative vertical movement between said presser head and said superstructure; a strap applying and nailing means mounted on said superstructure and capable of vertical movement relative thereto, said strapper means being disposed transversely on said cover; and means actuated by the aforesaid relative vertical movement between said superstructure and said presser head to operate said strap applying and nailing means to nail said strap to opposite sides of said box.

16. In a strapping machine the combination of: a table for receiving a packed box with a lid disposed thereover; a strapper unit including means for positioning a strap across said lid with its ends adjacent opposite sides of said box and means for nailing said strap ends to said box sides; a frame for supporting said table and said unit in spaced relation; and mechanism on said frame for causing relative movement between said table and said unit to bring said box with its lid into pressural contact with said unit, continued operation of said mechanism after said contact actuating said strapper unit to nail said strap ends to opposite sides of said box.

17. In a strapping machine the combination of: a frame; strapper means including means for positioning a strap across a face of an object with the ends of said strap opposite other faces of said object, adjacent said first mentioned face and strap end nailing means; yieldable means connecting said strapper means to said frame for operating said strapper means; and means causing relative movement between said object and said frame to press said object against said strapper means to shift the latter towards said frame, said shifting actuating said operating means and causing said strapper means to position the ends of said strap and nail said strap ends to the aforesaid other faces.

18. In a machine for nailing ends of a lid to the ends of an overfilled box and nailing ends of a strap to sides of said box to hold down a bulged middle portion of said lid, the combination of: a box supporting table; a frame structure extending above said table; lid pressing and nailing means on said structure; means causing relative vertical movement between said box table and said lid pressing and nailing means to successively press the ends of said lid onto ends of said box and nail said lid ends to said box ends; strap holding means supported on said structure so as to position the strap transversely across a middle portion of said lid; and other nailing means actuated in timed relation with said relative movement to nail end portions of said strap to opposite sides of said box while said strap is so positioned across said lid.

19. In a machine for nailing ends of a lid to the ends of an overfilled box and nailing ends of a strap to sides of said box to hold down a bulged middle portion of said lid, the combination of: a box supporting table; a frame structure extending above said table; a lid pressing and nailing means on said structure; means causing relative vertical movement between said box table and said lid pressing and nailing means to successively press the ends of said lid on to

ends of said box and nail said lid ends to said box ends; strap holding means supported on said structure so as to position the strap transversely across a middle portion of said lid; and other nailing means actuated by said relative movement producing means during the final portion of said relative movement to nail end portions of said strap to opposite sides of said box while said strap is so positioned across said lid.

20. A combination as in claim 12 in which automatic locking means is provided to lock said cover shaping bar against vertical movement relative to said box during the strap securing operation.

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