Aug. 6, 1957 G. A. CROSBY ET AL 2,801,558

JOINT FORMING MECHANISM

Filed April 22, 1954 7 Sheets-Sheet 1

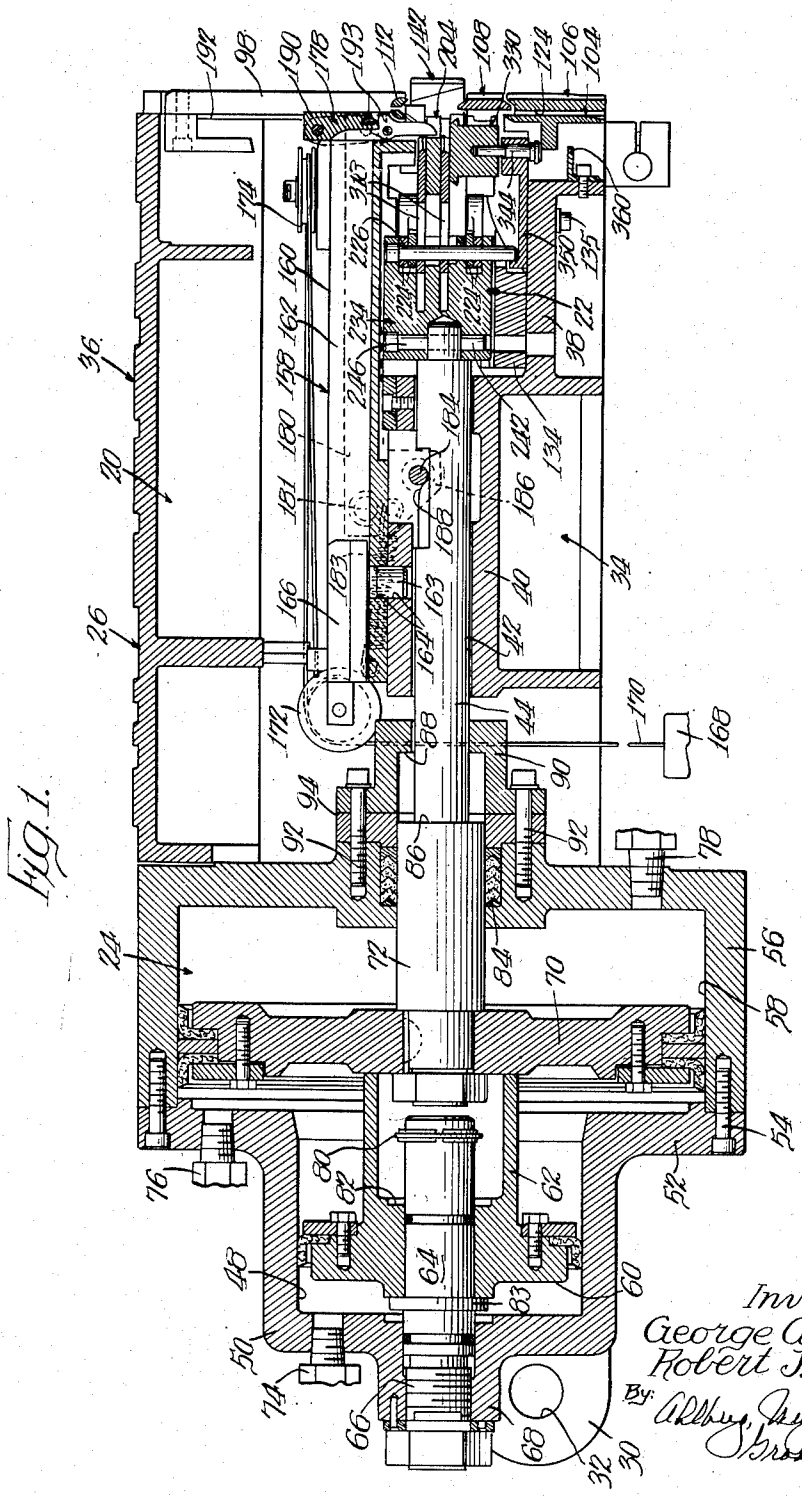


FIG. 1.

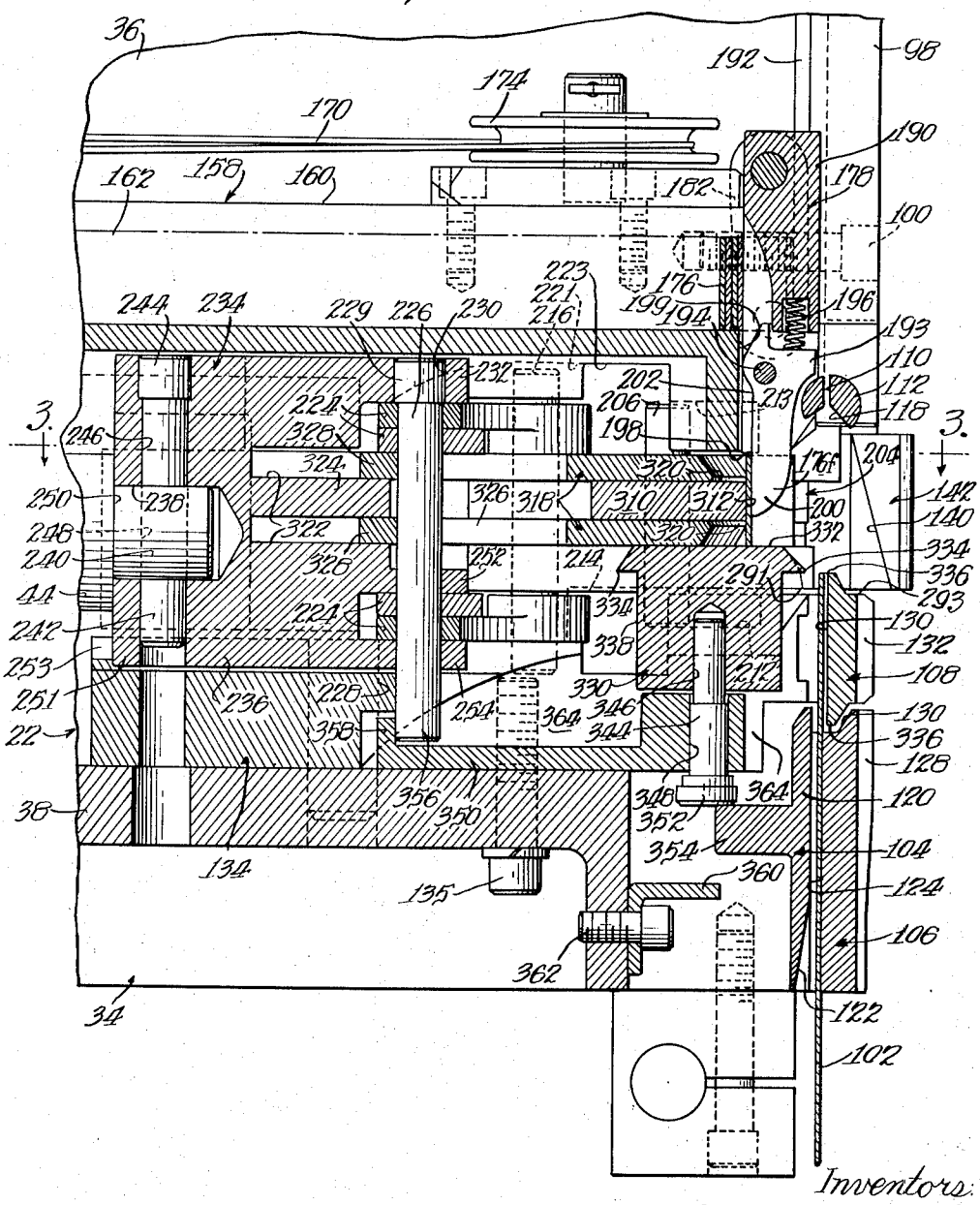
Inventors:
George A. Crosby
Robert J. Frey
By: Albright, Jaffin & Albright
Attys.

Aug. 6, 1957 G. A. CROSBY ET AL 2,801,558

JOINT FORMING MECHANISM

Filed April 22, 1954 7 Sheets-Sheet 2

Fig. 2.



Inventors:
George A. Crosby
Robert J. Frey
By:
Albers, Ruffner & Grabolfe
Attys.

Aug. 6, 1957 G. A. CROSBY ET AL 2,801,558

JOINT FORMING MECHANISM

Filed April 22, 1954 7 Sheets-Sheet 3

Fig. 3.

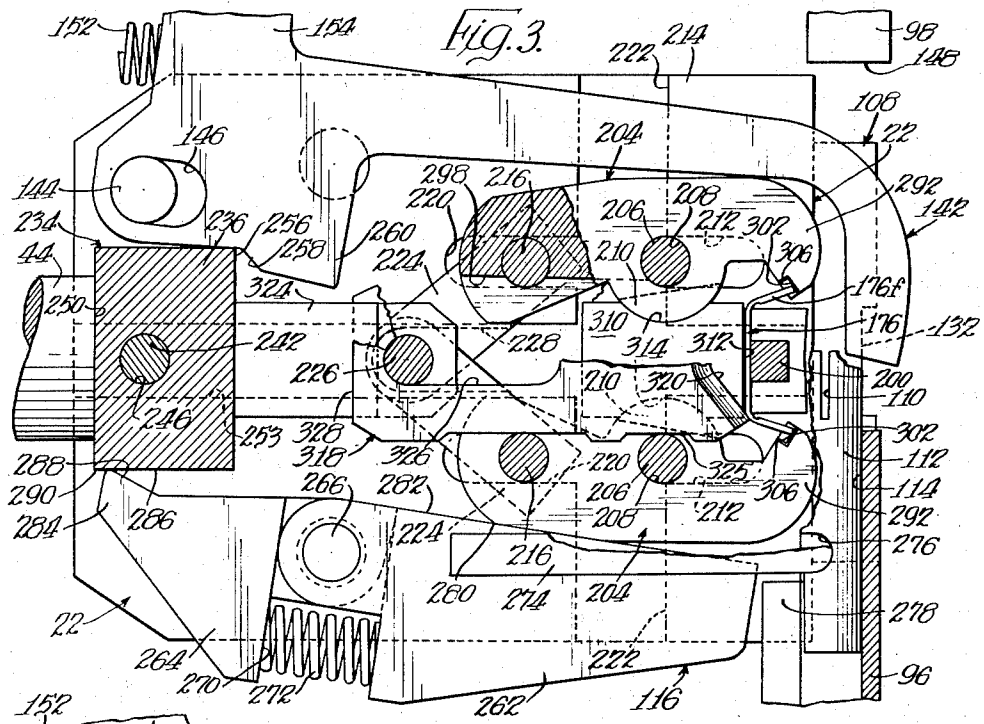
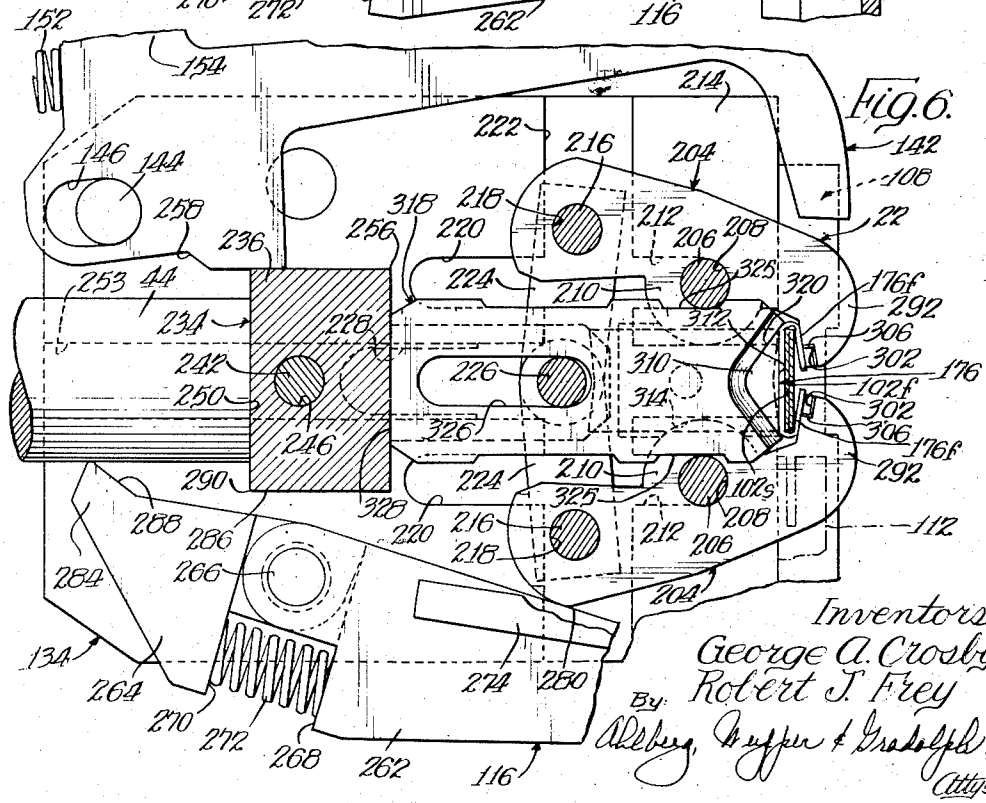


Fig. 6.



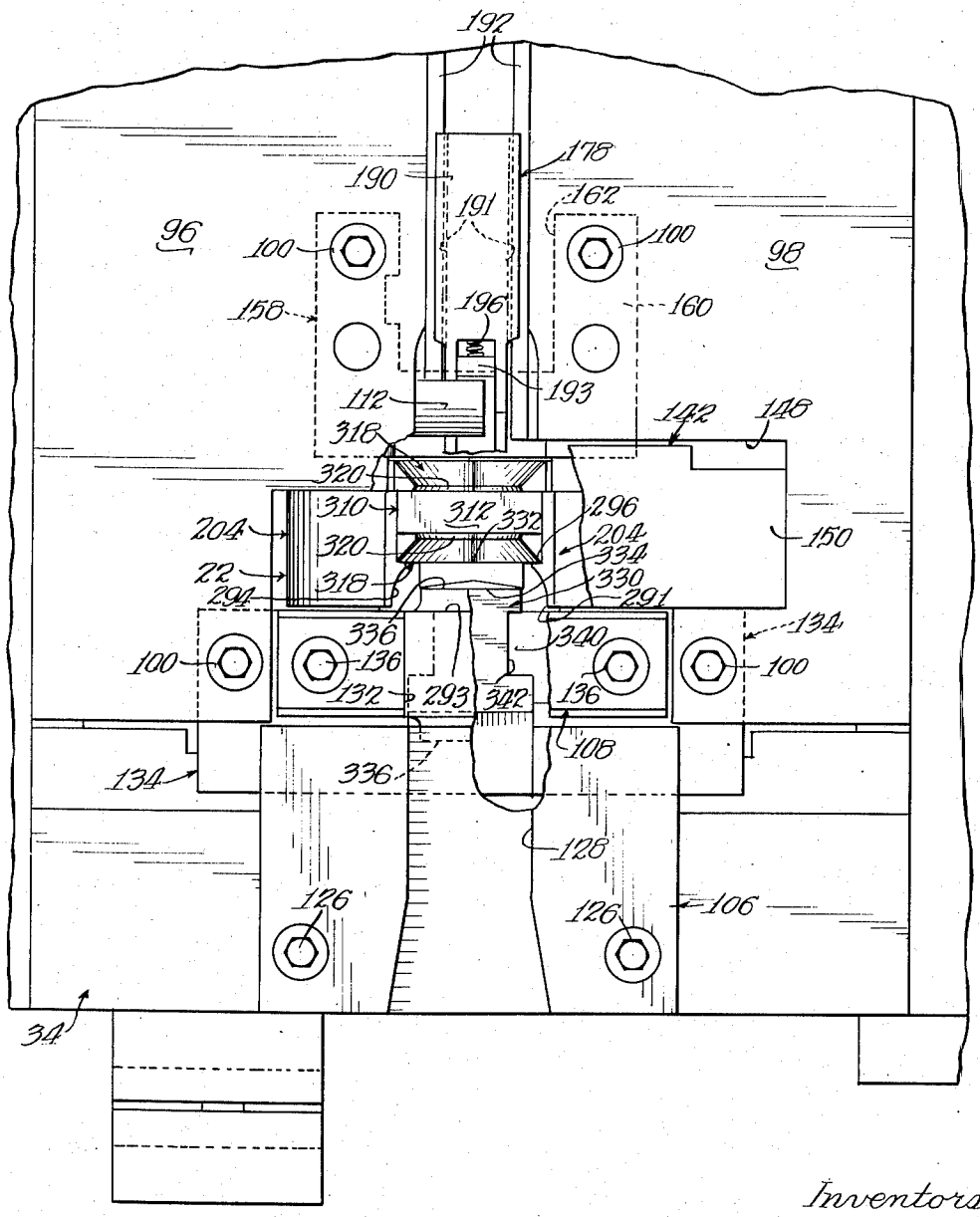
Inventors:
George A. Crosby
Robert J. Frey
By
Allsberg, Hoffer & Gradolph
Attys.

Aug. 6, 1957 G. A. CROSBY ET AL 2,801,558

JOINT FORMING MECHANISM

Filed April 22, 1954 7 Sheets-Sheet 4

Fig. 4.



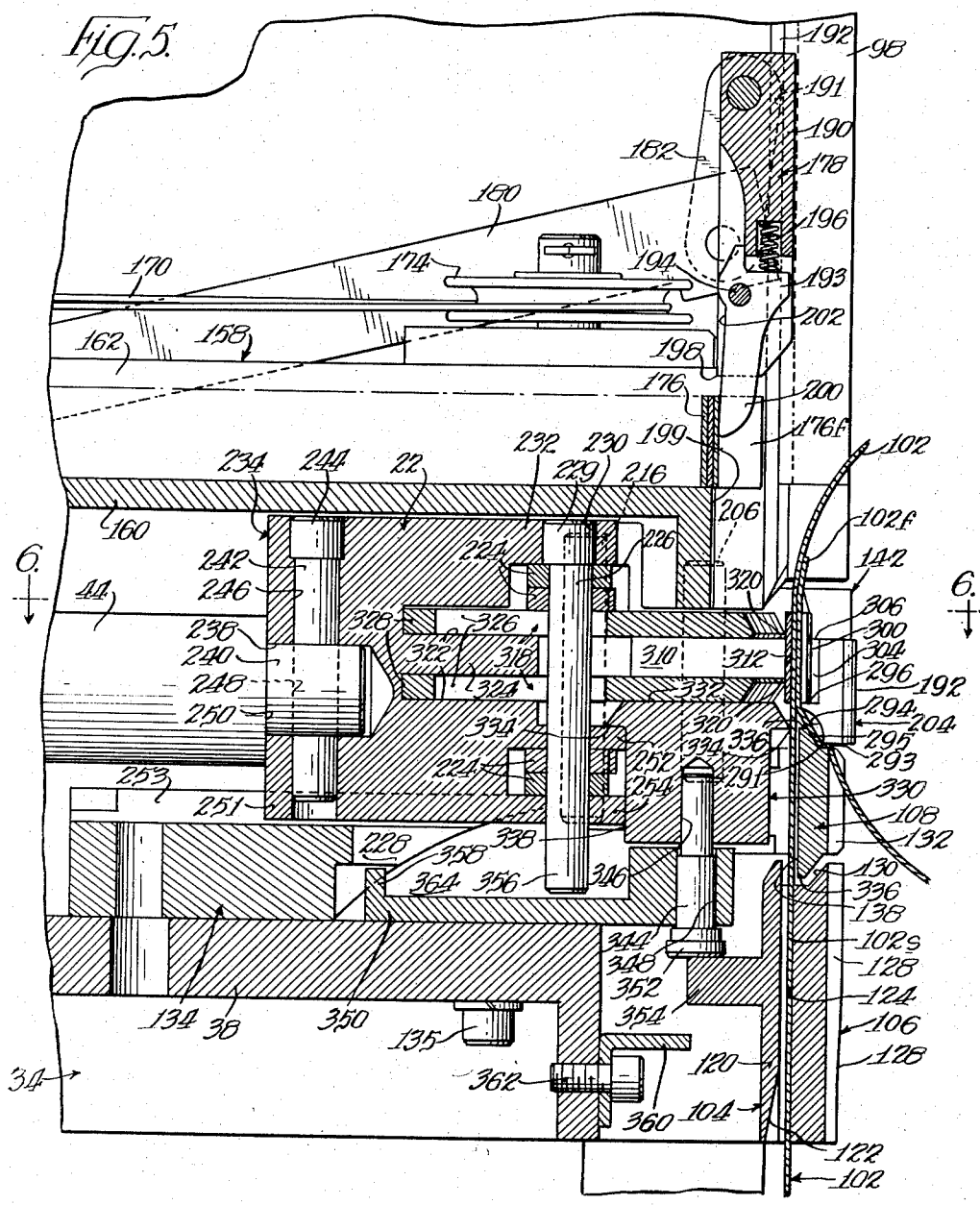
Inventors:
George A. Crosby
Robert J. Frey
By:
Oldberg, Kuyper & Rudolph
Attys.

Aug. 6, 1957 G. A. CROSBY ET AL 2,801,558

JOINT FORMING MECHANISM

Filed April 22, 1954 7 Sheets-Sheet 5

Fig. 5.



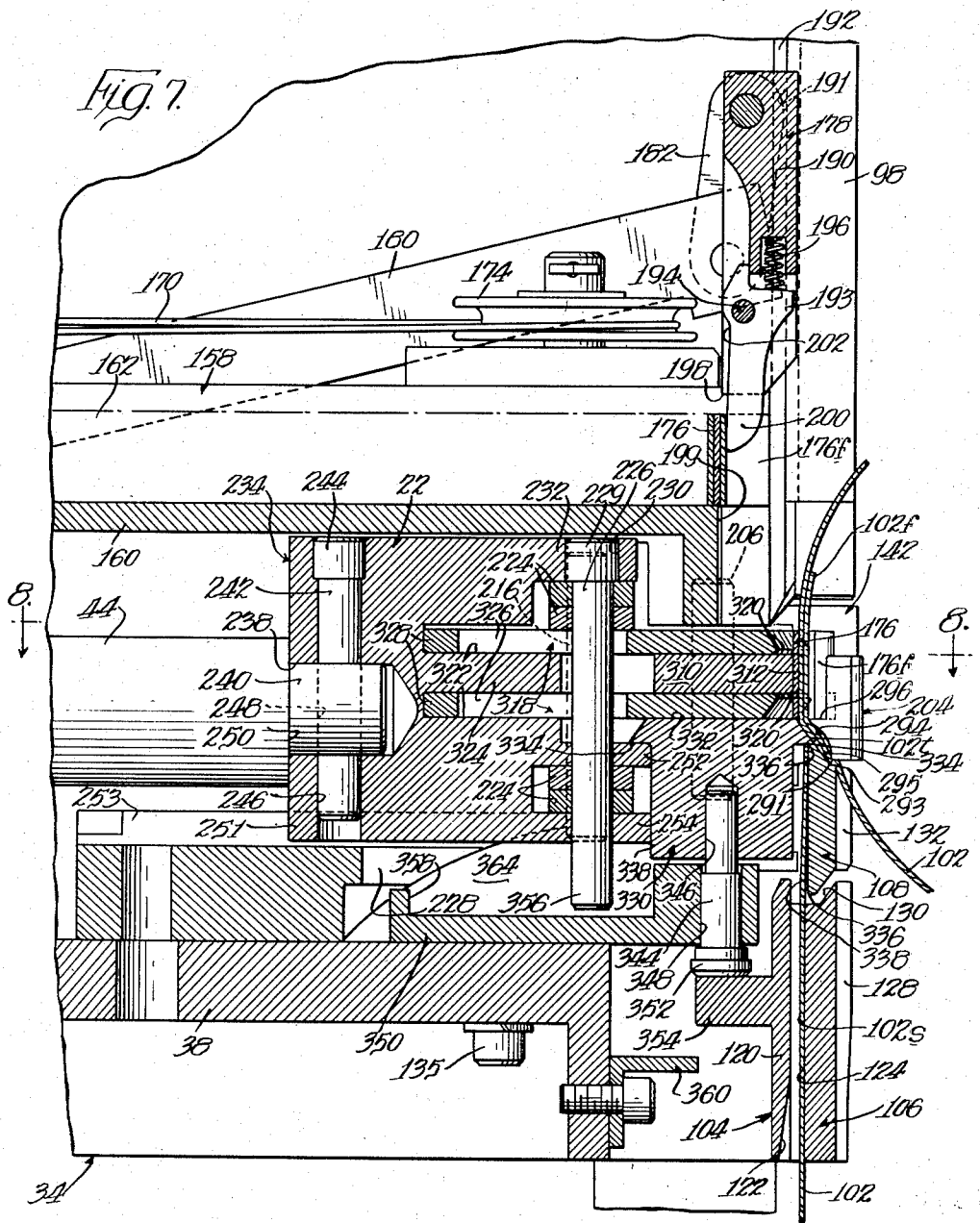
Inventors:
George A. Crosby
Robert J. Frey
By Albeg, Cuffee & Gradolph
Attys.

Aug. 6, 1957 G. A. CROSBY ET AL 2,801,558

JOINT FORMING MECHANISM

Filed April 22, 1954 7 Sheets-Sheet 6

Fig. 7.



Inventors:
George A. Crosby
Robert J. Frey
By
Oldberg, Griffin & Rudolph
Attys.

Aug. 6, 1957 G. A. CROSBY ET AL 2,801,558

JOINT FORMING MECHANISM

Filed April 22, 1954 7 Sheets-Sheet 7

Fig. 8.

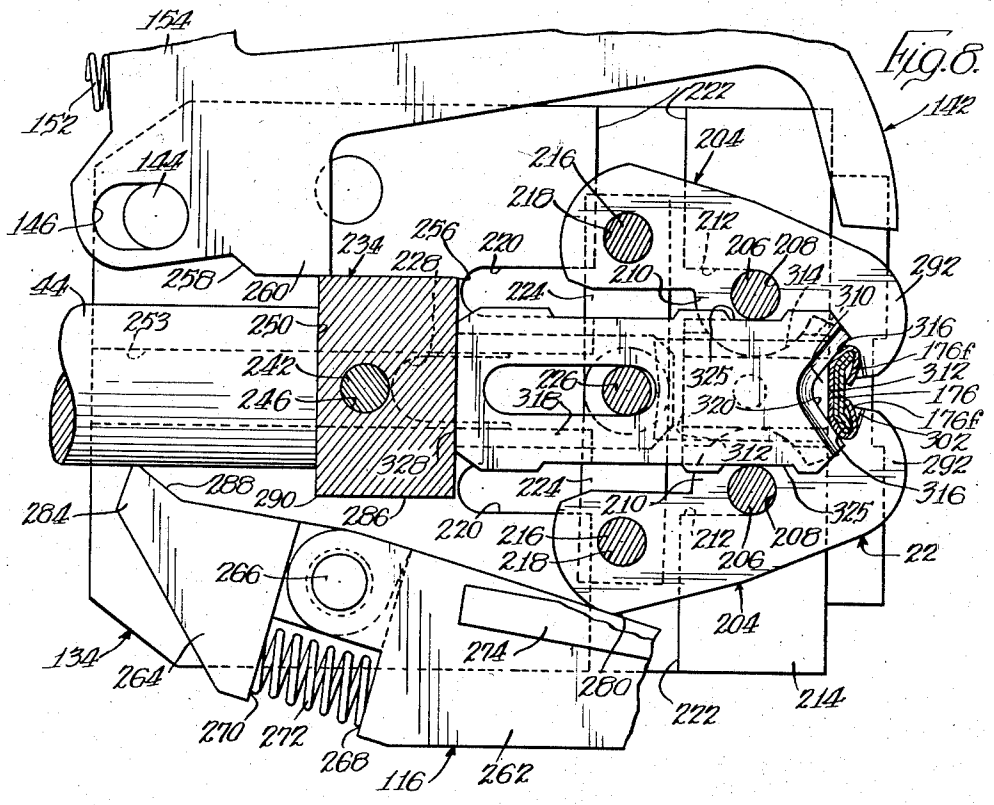


Fig. 9.

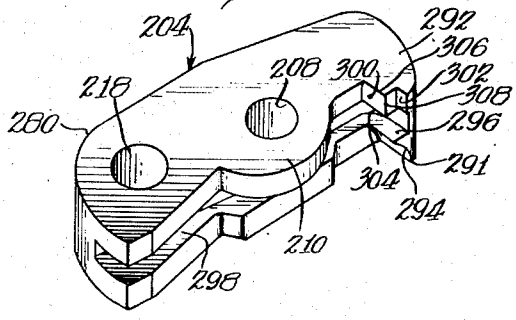
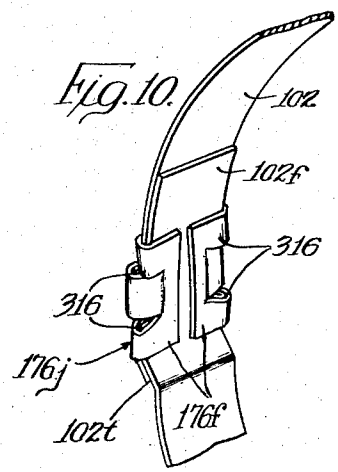


Fig. 10.



Inventors:
George A. Crosby
Robert J. Frey

By:
Albright, Kauffman & Rudolph
Attys.

United States Patent Office 2,801,558
Patented Aug. 6, 1957

2,801,558

JOINT FORMING MECHANISM

George A. Crosby, Park Ridge, and Robert J. Frey, Chicago, Ill., assignors to Signode Steel Strapping Company, Chicago, Ill., a corporation of Delaware

Application April 22, 1954, Serial No. 424,832

14 Claims. (Cl. 81—9.1)

The present invention relates to a new and improved mechanism for forming joints in the overlapping portions of package or bundle binding metallic strapping and an embracing metallic seal.

The joint forming mechanism of this invention is capable of incorporation into automatic bundle binding machines of the type described, illustrated and claimed in the copending applications of John H. Leslie, II, and George A. Crosby, Serial Nos. 48,448 and134,526, filed September 9, 1948 and December 22, 1949, respectively, and issued on May 3, 1955, as Patents Nos. 2,707,429 and 2,707,430, respectively, and the mechanism of this specification is described with reference to those applications and patents. It is to be understood, however, that this mechanism may be, and is, intended to be used in strapping machines of other designs, whether they be fully automatic or semi-automatic.

In the fully automatic machines of the aforementioned patent applications the strap is fed from a power driven coil through a bundle encircling track around the package so that the leading or free end of the strap has its travel arrested in front of the joint forming mechanism. At the end of strap feed a portion of the mechanism clamps the free end of the strap against longitudinal movement, and the supply coil is rotated in the opposite direction to shrink the strap closely about the bundle and to apply tension thereto. Simultaneously with the clamping of the free end of the strap, the joint forming mechanism folds the wings of flanges of a seal blank about the overlapping strapping portions, but not tightly, so that that end of the strapping which is connected directly to the coil may be slid through the embracing seal and moved relative to the fixed end to effect tensioning of the strap. When the strapping has been properly tensioned, the machine operates the joint forming mechanism to form a tension resisting joint in the overlapping strapping portions and embracing seal. Simultaneously with the formation of the joint, the strapping about the bundle and incorporated into the joint is severed from the source of strap supply.

One of the problems encountered in such automatic strapping machines is that of adapting them to bind bundles of many sizes and shapes, and particularly bundles of small height where it is desired or most convenient that the joint be formed at the face of smallest dimension, usually a vertical dimension. It has been found to be extremely difficult properly to apply a tensioned strap about such bundles if the height or thickness thereof is much smaller than about three times the length of a seal blank or the joint. Where the strapping, for example, is three-quarters inch wide and the seal is one inch long, the bundle height cannot be smaller than approximately three inches.

Another problem is encountered in the binding of bundles where the face against which the joint is formed is not flat, such, for example, as a coil of wire or tubing or a bundle of bars, pipes or the like. In such operations the short piece of strap adjacent the completed joint which

was severed from the source of strap supply projects outwardly from the joint and the strap which tightly embraces the bundle, due to the generally circular configuration of the embracing tensioned strap. This projecting piece serves as a potential cause of personal injury to a person handling the bundle and is likely to damage or snag other bundles, unless hammered inwardly toward the bundle.

It is, therefore, a principal object of the present invention to provide a new and improved joint forming mechanism which solves the aforementioned problems.

Another object is to provide a new and improved joint forming mechanism which may be used in automatic and semiautomatic bundle binding machines of designs which are currently available.

Another object is to provide a new and improved joint forming mechanism for automatic bundle binding machines which will form a joint in the overlapping strapping portions and embracing seal within a dimension measured longitudinally of the strap which is substantially shorter than is possible with mechanisms now available.

Another object is to provide a new and improved joint forming mechanism which forms a joint and severs the joined strap from the source of strap supply wherein the tab end of the strap projecting from the completed joint is substantially shorter than in joints formed with previously available mechanisms.

Another object is to provide a new and improved joint forming mechanism for automatic bundle binding machines which bends the short end of strap inwardly against the strap embracing the bundle at a point immediately adjacent the joint simultaneously with the severing of the strap embracing the bundle from the source of strap supply.

Another object is to provide a new and improved joint forming mechanism which is extremely rugged in its construction but has substantially fewer parts than mechanisms heretofore available.

Another object is to provide a new and improved joint forming mechanism wherein a single pair of jaws is used to fold the wings or flanges of the seal blank about the overlapping strapping portions and to clamp one end of the strap against movement relative to the bundle and the joint forming mechanism.

Other objects and advantages will become apparent from the following description taken in conjunction with the accompanying drawings wherein:

Fig. 1 is a longitudinal sectional view through the housing or head of an automatic strapping machine of the type disclosed in the aforementioned patent applications and patents, illustrating the joint forming mechanism of the present invention in retracted position;

Fig. 2 is a greatly enlarged vertical medial sectional view through the jaw assembly of the joint forming mechanism of the present invention in retracted positoin showing a seal blank loaded into the jaws and ready to be advanced to joint forming position and the strapping in position before being pushed about the bundle or package to be bound;

Fig. 3 is a horizontal sectional view taken substantially on the line 3—3 of Fig. 2 looking in the direction of the arrows, but showing some elements below the section line broken away for illustrative purposes;

Fig. 4 is a fragmentary front elevational view of the joint forming mechanism showing some parts broken away and omitting the strap and seal blank shown in Fig. 2;

Fig. 5 is a vertical medial sectional view similar to Fig. 2 but showing the jaw assembly components clamping the free end of the strap against movement and folding the wings or flanges of the seal about the overlapping strapping portions;

Fig. 6 is a horizontal sectional view taken substantially

on the line 6—6 of Fig. 5 looking in the direction of the arrows;

Fig. 7 is a vertical medial sectional view similar to Figs. 2 and 5 but showing the jaw assembly components in the position they occupy at the conclusion of the joint forming operation and the severing of the completed joint and tension strapping from the source of strap supply;

Fig. 8 is a horizontal sectional view taken substantially along the irregular line 8—8 of Fig. 7 looking in the direction of the arrows;

Fig. 9 is a perspective view of one of the jaws taken from a position to the rear and inner side thereof; and

Fig. 10 is a perspective view, taken from the bundle side, of a joint made by the joint forming mechanism of the present invention.

Referring to Fig. 1, the reference character 20 indicates the joint forming mechanism in its entirety, and it comprises a jaw assembly 22 connected to an operating mechanism 24, with the jaw assembly 22 and mechanism 24 enclosed within a housing 26 which is adapted pivotally to be mounted to the frame or carriage of a machine by a pair of lugs 30 provided with apertures 32 to receive the pintle of the hinged connection.

The housing 26 includes a base casting 34 and a lid or cover 36 hinged thereto to permit access to the interior of the housing to load the seal magazine with seals and to service and lubricate the jaw assembly. The housing casting 34 includes a forward shelf forming portion 38 on which the jaw assembly 22 of the joint forming mechanism 20 is mounted. The shelf 38 is integral with an intermediate guiding portion 40 formed with a longitudinally extending aperture 42 through which a push rod 44 slidably extends, the forward end of the push rod being connected to the jaw assembly 22 and the rear portion of the push rod being connected to the operating mechanism 24.

The operating mechanism 24 comprises a first cylinder 48 formed in a cup 50 having its marginal flange 52 secured by bolts 54 to a second cup 56 which forms a second and larger diameter cylinder 58. A piston 60 is slidable in the first cylinder 48 and is formed with a tubular forward extension 62, the piston 60 being guided upon a fixed guide rod 64 having its rear end anchored at 66 in a tapped boss 68 of the cylinder cup 50. The forward end of the tubular extension 62 abuts against a piston 70 which is slidable in the cylinder 58. The push rod 44 is integral with an enlarged piston rod 72 which is fixed to the piston 70. As shown in Fig. 1, the cylinders 58 and 48 are in free communication with each other between the pistons 60 and 70, and fluid is admitted to and vented from the separate spaces in the cylinders through suitable fittings 74, 76 and 78 which are connected to the pneumatic or hydraulic operating system of the machine.

The forward movement of the piston 60 in the cylinder 48 is limited by a stop ring 80 mounted on the guide rod 64 abutting against an inner face or shoulder 82 of the tubular extension 62, and the rearward movement is limited by the annular flange, shoulder or ring 83 on the guide rod 64. The cylinder 48 and piston 60 operate the jaw assembly 22 sufficiently to anchor the free or leading end of the strap against movement at the beginning of the joint forming operation and to fold a seal about the overlapping strap portions. In its advance, the piston 60, with the extension 62 abutting against the piston 70, moves the latter forward in the cylinder 58. When fluid under pressure is admitted between the two pistons 60 and 70, the piston 70 moves forwardly in the cylinder 58, pushing the piston rod 72 through stuffing box 84 under shoulder 86 between the piston rod 72 and push rod 44 abuts against the stop face 88 of a cup 90 which is secured to the closed end of the cylinder 56 by bolts 92. The position of the stop face 88 relative to the shoulder 86 determines the extent of forward movement of the push rod 44, piston rod 72 and piston 70 and, therefore, the maximum movement of the jaw assembly 22 during the formation of the joint in the overlapping strapping portions and the severance of the bundle encircling strap from the source of strap supply. The disposition of the stop face 88 may be finely adjusted by shims 94 between the cup 90 and the closed end of the cylinder forming cup 56.

The forward end of the housing 26 is closed by a pair of face plates 96 and 98 which are secured by bolts 100 to a seal magazine 158 and a jaw assembly guide block 134 which are in turn suitably secured to the frame 34. These face plates, in addition to closing the forward end of the housing, serve as the abutment against which the bundle or package being bound is held during the bundle binding operation.

Strapping 102 is fed from the coil of strapping, as described in the previously mentioned patent applications, through a chute and between a lower back strap guide 104 and a lower strap guide block 106, past a stationary cutter and clamping block 108, the front end of the jaw assembly 22, and through a slot 110 in a movement limiting barrier 112 which is slidably mounted in a bore 114 (Fig. 3) in the face plate 96 for reciprocation between the positions shown in Figs. 3 and 6 by an elbow linkage 116 which will be described presently. The strap is then guided around the bundle by a closed guiding track (not shown) so that its free end 102*f* is directed by sloping face 140 of guide finger or jaw 142 to abut against sloping face 118 of the barrier 112 and to wedge against the standing strap portion at the slot 110, whereby the travel of the strap is terminated.

The lower back strap guide 104 comprises a plate 120 having a plane face and adjacent its lower end formed with a tapering slot 122 to guide the strap 102 as it is received from the storage coil. The lower strap guide block 106 is formed on its rear face with a slot 124 having a flaring lower end and throughout the remainder of its length is just slightly wider than the width of the strapping 102 which is used in the machine. The guide block 106 and back strap guide plate 104 are mounted in face-to-face contact so that the slot 124 in the block 106 with the forward face of the plate 120 forms the guideway for the strapping 102. The block 106 and guide 104 are secured to the front face of the main frame 34 by bolts 126 passing through coinciding holes in the block 106 and guide 104 and screwed into suitable tapped openings in the frame. A vertically extending slot 128 is milled in the front face of the guide block 106 to receive the forward or free end 102*f* of the strap as it emerges from the closed strap track and begins its travel across the front of the jaw assembly 22 for the second time to overlap the standing portion 102*s* of the strapping.

The stationary cutter and clamping block 108 is mounted immediately above the guide block 106 and the latter has a recessed upper edge 130 at its rear face to accommodate the central part of the lower edge of the cutter and clamping block 108, and the cutter and clamping block 108 is formed with a vertically extending slot 132 on its forward face which is aligned with the guide block slot 128 to receive and guide the strapping 102. The block 108 is bolted to the forward face of jaw assembly guide block 134 by bolts 136. On its rear face the stationary cutter and clamping block 108 has a slot 138 which is aligned with the slot 124 in the lower guide block 106.

The strap guiding jaw or finger 142 is pivotally mounted on a stud 144 anchored near the inner end of the guide block 134 and projecting through a slot 146 in the finger to permit the finger to have both a pivotal and a longitudinal movement so that it may be pivoted away from the strap path and, if contacted by the bundle, pushed into the housing. The face plate 98 is cut away at 148 to accommodate the projecting end of the guiding finger 142, and a spring 152 acting between an abutment 154 on

the finger and a fixed wall of the frame 34 biases the finger 142 to the position shown in Fig. 3.

As seen in Fig. 2, the jaw assembly 22 is mounted on the shelf 38 at the forward end of the frame 34 and below a seal storage magazine 158 in which is stored a quantity of nested seals 176 for use in forming the joints. The magazine 158 comprises an elongated block 160 of U-shaped cross section having a storage slot 162 in its upper face and is mounted to the intermediate portion 40 of the frame by a stud 163 (Fig. 1) projecting through the aligned apertures 164 in the magazine block 160 and frame portion 40. As previously noted, the magazine is also secured to the face plates 96 and 98. A seal advancing follower block 166 is slidably mounted in the slot 162 and is urged toward the outlet end of the magazine 158 by means of a weight 168 connected to a cord or cable 170 passing over a pair of pulleys 172 and 174 and connected to the follower 166.

Seals 176 are withdrawn one at a time from the magazine by a seal ejector assembly 178 movable between the positions shown in Figs. 2 and 5 by a pair of arms 180 pivotally mounted at 181 to the sides of the magazine 158 and connected to the ejector assembly by short links 182. Springs 183 (Fig. 1) snap the ejector assembly 178 from the position shown in Fig. 5 to that shown in Fig. 2, and a transverse pin 184, mounted in projections 186 on the ejector arms 180 so as to be in engagement with a cam 188 on the push rod 44, pivots the ejector arms upwardly as the push rod 44 is advanced to raise the ejector assembly 178 out of the jaw assembly during the joint forming operation and to load it with another seal.

The ejector assembly 178 comprises an ejector 190 formed with vertical edge slots 191 to be guided on a pair of ways 192 formed in the adjacent edges of the face plates 96 and 98. The lower end of the ejector 190 is bifurcated to receive the upper end of an ejector finger 193 which is pivotally mounted thereon by a pin 194 and biased for pivotal movement in the clockwise direction by a small spring 196. The lower edge 198 of the ejector impinges upon the upper edge of a seal 176, and lower end 200 of the ejector finger engages against the inner face of the seal, the finger being recessed at 202 to accommodate the seal. Downward movement of the ejector assembly 178 engages the ejector shoulder 198 against a seal, and further downward movement strips the forwardmost seal from the front or outer end of the magazine 158 to load it into the jaw assembly 22, the magazine being recessed at 199 to provide a guide with the ways 192 for the seal.

The jaw assembly 22 is mounted on the guide block 134, which is secured to the shelf 38 by bolts 135, and includes a pair of jaws 204 which are substantially the mirror images of each other and are of substantial thickness, as can be readily appreciated from Fig. 9. The jaws 204 are mounted for pivotal movement on a pair of pins 206 which pass through apertures 208 at approximately the longitudinal center of the jaws, the jaws being formed with hubs 210 to accommodate the apertures 208 and for a further purpose. The pivot pins have their lower ends guided in longitudinally extending slots 212 (Figs. 3, 6 and 8) formed in the upper face of an upwardly extending forward portion 214 of the guide block 134 and have their upper ends guided in similar slots 213 formed in the underside of the magazine block 160 (Fig. 2).

At their rear ends the jaws 204 are fitted with pins 216 which project through openings 218 in the jaws and have their lower ends guided in longitudinally extending slots 220 in the intermediate portion of the guide block 134 and have their upper ends guided in similar longitudinal slots 221 in the underside of the magazine block 160 (Fig. 2). The slots 220 are open at their forward ends to communicate with a transverse or cross-slot 222 and the slots 221 communicate at their forward ends with a cross-slot 223 to accommodate the forward and then outward or sideward movement of the pins 216. The pins 216 are connected by links 224 positioned above and below the jaws 204 to a rear actuating pin 226 which has its lower end projecting into a longitudinal slot 228 in the guide block 134. The pin 226 has a head 229 which rests on the uppermost link 224 and which is received in an aperture 230 in the upper projection 232 of a yoke 234.

The yoke comprises a block 236 formed with a longitudinal bore 238 at its rear face to receive the stud or projecting end 240 of the push rod 44. A pin 242, having a head 244, is fitted through aligned openings 246 in the yoke block 236 and 248 in the push rod projection 240 to lock the yoke and the push rod together with the rear flat face of the yoke block abutting against the shouldered end 250 of the push rod 44. The lower end of the pin 226 projects through apertures formed in the forward extensions 252 and 254 of the yoke block, and the lower pair of links 244 have their rear or inner ends located between the projections 252 and 254. On its lower face the yoke block 236 is formed with a depending tongue 251 which slides in an upwardly opening slot 253 in the guide block 134 to guide the yoke for rectilinear movement.

The forward extensions 232, 252 and 254 of the yoke block 236 are, as seen in the plan views (Figs. 3, 6 and 8), narrower than the base of the block to present a forwardly facing shoulder 256 which bears against camming surface 258 on projection 260 of the strap guiding jaw or finger 142 so that, when the push rod 44 moves forwardly, the abutment face 256 cams the finger outwardly about the pivot pin 144.

As noted previously herein, the strap travel limiting barrier 112, slidable between advanced and retracted positions in the bore 114, is moved by the elbow linkage 116 comprising levers 262 and 264 pivotally mounted on an upwardly projecting pin 266 fixed in the guide block 134. A coil spring 272 is confined between the shoulders 268 and 270 on the levers 262 and 264, respectively, to bias the shoulders and levers away from each other. An actuator finger 274 is welded to the upper surface of the forwardly extending lever and has its tip projecting through a slot 278 formed in the inner side of the face plate 96 and into a notch 276 in the barrier 112. The linkage 116 is pivoted in the clockwise direction about the pin 266 by a camming surface 280 on the adjacent jaw 204 abutting against a surface 282 on the link 262 to withdraw the barrier. When the yoke 234 is retracted to withdraw the jaw assembly, the cam surface 288 on the projecting end 284 of the lever 264 is engaged by the corner 290 and face 286 of the yoke block 236, and the linkage 116 is pivoted in the counterclockwise direction to restore the barrier 112 to strap travel blocking position. If the bound bundle has not been cleared from the front of the joint forming mechanism and the completed joint lies in the path of the barrier to arrest its movement, the spring 272 will be collapsed to permit temporary movement of the lever 264 relative to the lever 262. As soon as the bundle is removed, the spring 272 will snap the arm 262 and barrier 112 to the positions shown in Fig. 3.

At the end of the strap travel, operating fluid is admitted to the cylinder 48, and the piston 60 moves forward until the shoulder 82 contacts the stop ring 80, thereby moving the piston 70, piston rod 72, and push rod 44 forwardly. This moves the jaw assembly 22 forwardly on the guide block 134 and the pivot pins 206 are moved until they contact the forward ends of the slots 212 to terminate their longitudinal movement. By the time the pivot pins 206 have reached the end of their forward movement, the pins 216 have emerged from the slots 220, and further forward movement of the push rod 44 moves the pin 226 forwardly, thereby swinging the pins 216 outwardly in the transverse slot 222 through the links 224 (Fig. 6). As the pins 216 are moved outwardly, the rear ends of the jaws 204 are moved outwardly, and the barrier 112 is withdrawn from strap

blocking position. Simultaneously, the yoke **234** pivots the strap guiding finger **142** outwardly and to the position shown in Fig. 6. Forward hooked ends **292** of the jaws **204** are rocked toward each other to fold the flanges **176***f* of the seal blank **176** about the overlapping strap portions and to anchor the leading end **102***f* of the strap.

As best seen in the plan views, and in Fig. 9, the inwardly hooked end **292** of each jaw **204** has, at the lower half of the jaw, a curved face **294** terminating in a horizontal shelf **296**. Above the shelf **296** and below the hub **210**, each jaw is formed with a longitudinally extending slot **298** which, at the forward end of the jaw, has its upper part defined by an inwardly projecting shoulder **300** forming an angular pocket or recess **302**. Cutting surfaces **304** and **306** are formed on the shoulder **300** above and below the pocket **302**. As the jaws **204** are pivoted toward each other, the vertical edge **308** of the shoulder **300** engages the flange **176***f* of the seal **176** and folds it from the position shown in Fig. 3 to that shown in Fig. 6.

As the jaws **204** have their hooked ends **292** rocked toward each other, the curved faces **294** contact and move the strap end **102***f* toward the stationary clamping block **108** (Fig. 5), and the lower edges **291** of the jaws offset and clamp the strap against a corner **293** on the block **108**, there anchoring the strap end **102***f* against movement relative to the seal **176** and the jaw assembly **22**. The strap end **102***f* passes under the curved faces **294** of the jaws and across an inclined face **295** on the clamping block **108**.

A floating anvil or chair **310**, having a flat forward face **312**, and inwardly arcuate intermediate portions **314**, is carried between the hubs **210** of the jaws **204**. When a seal **176** is snapped into position, its flat back plate portion is brought to bear against the forward face **312** of the anvil **310** and its flanges **176***f* are received within the recesses **302** of the jaws **204** to seat upon the shelf **296** immediately below the recess **302**. In positioning the seal **176** properly within the jaws, the ejector finger **200** guides the seal so that its back plate bears against the face **312** of the anvil. Because the anvil floats between the hubs **210** of the jaws **204**, it is moved forwardly and rearwardly with the jaws, and its position relative to the pivot pins **206** does not change. It provides a support for the overlapping strap ends and embracing seal during the joint formation, as will appear hereinafter.

It will be observed from Fig. 6 that the flanges **176***f* of the seal blank **176** are not tightly folded about the overlapping strapping portions but are somewhat loose relative thereto so that the standing portion **102***s* of the strapping may be pulled downwardly (Fig. 5) and through the folded seal **176** and past the anchored strap end **102***f* to shrink the bundle encircling loop tightly about the bundle and to apply a tension thereto. It is preferred that seals of the type disclosed in the copending applications of George A. Crosby, Serial Nos. 306,144 (issued as Patent No. 2,710,435, dated June 14, 1955) and 336,078, filed April 25, 1952 and February 10, 1953, respectively, and entitled "Seal Blank" be used so that the flanges **176***f* may be properly folded without binding the strapping portion **102***s* against movement.

When the strapping has been properly tensioned, fluid is admitted to the cylinder **58** between the pistons **60** and **70**, and the piston **70** moves forwardly and away from the tubular extension **62** until the piston rod shoulder **86** abuts against the stop surface **88** of the cup **90**. This slight additional movement of the joint forming mechanism moves the pin **226** forwardly from the position shown in Figs. 5 and 6 to that shown in Figs. 7 and 8 and also moves a pair of notchers **318** forwardly to form or cut notches **316** in the embracing seal **176** and overlapping portions of the strapping **102**. The notchers **318** are relatively thin plates or blades having V-shaped beveled cutting edges **320** at their forward ends, as best seen in the plan views. The lower notcher **318** slides in the slots **298** in the jaws **204**, and the upper notcher slides on top of the jaws **204** and floating anvil **310**. The rear ends of the notchers are received in slots **322** formed in the yoke block **236**, the slots being separated by a forwardly projecting finger **324** which terminates short of the pin **226**. It should also be noted that the top links **224** rest on top of the uppermost notcher **318**, and that a relatively compact jaw assembly from top to bottom is thus provided. Each of the notchers **318** is slotted adjacent its rear end at **326** to pass the pin **226** which, during a portion of the joint forming operation, moves forwardly relative to the notchers **318**, as may be seen by comparing Figs. 3 and 6. The sides of the notcher blades **318** are recessed slightly at **325** to pass between the forward pins **206** which maintain the notchers properly aligned as they are moved forwardly to deform the strapping and embracing seal.

During the cutting stroke of the notchers **318**, the bases of the slots **322** contact ends **328** of the notchers to provide a positive drive between the yoke **234** and the notchers **318** to move them forwardly of the jaws **204**. As the notchers are moved forwardly, their cutting edges **320** coact with the cutting edges **304** and **306** of the jaws **204** partially to shear the strapping **102** and embracing seal **176** and bend slightly diagonal cut-out tabs **316** in the completed joint **176***j*. Except for the point where the tabs **316** are formed, the jaws **204** support the sandwich of strapping and seal against the chair **310** and restrain it against forward movement in the jaw assembly.

Simultaneously with the formation of the joint, the strapping **102** bound about the bundle is severed from the source of strapping by a movable cutter **330** comprising a block having a top plane surface **332** and double cutting edges **334**, one of which is positioned to coact with the cutting edge **336** on the stationary cutter **108** (Fig. 7). The cutter block **330** is advanced by contact of the forward faces of the fingers **252** and **254** of the yoke **234** with the rear face **338** of the block. The latter is moved to the position shown in Fig. 7 to sever the completed joint **176***j* from the standing strap portion **102***s*, and to bend in the strap tab end **102***t*. The clearance space behind the curved faces **294** in the jaws **204** receives the strap tab end **102***t* as the cutting edge of the cutter **330** pushes it toward the bundle, and the strap end **102***t* is bent sharply toward the bundle at the bottom of the joint to prevent it from projecting outwardly and its sharp edges from injuring a person handling the bound bundle or snagging on other bundles. The cutter block **330** is guided for reciprocation by interlocking tongues **340** and grooves **342** formed on the guide block **134** at the forward end thereof and in the sides of the cutter block **330**, respectively (Fig. 4).

A pin **344**, fitted in a bore **346** in the cutter block **330** and passing through an aperture **348** in the forward end of a cutter return link **350**, has its head **352** slidably bearing on a rearward projection **354** on the lower back guide **104** of the assembly forming the guide slot **124** for the strap **102**. The pin **344** and return link **350** move forwardly with the cutter block **330** but the cutter and guide link **350** are retracted by contact of the lower end **356** of the pin **226** with an upstanding lip **358** on the link **350** so that, when the push rod **44** is retracted and the jaw assembly **22** is moved from its advanced position as shown in Figs. 7 and 8 to its retracted or initial position, as shown in Figs. 2, 3 and 4, the pin **226** will withdraw the cutter block **330** from its strap severing position.

As noted previously, the cutter block **330** is provided with dual cutting edges **334** in order to increase its life, and the stationary cutter **108** is similarly formed with two cutting edges **336**. The movable cutter block **330** may be turned end for end by removing the stationary cutter **108** and the strap guide blocks **104** and **106** to drop the pin **344** so that its head **352** rests upon a shelf

360 which is secured to the frame 34 by bolt 362. This frees the movable cutter 330 which may be drawn outwardly of the head and turned end-to-end and replaced, the pin 344 being moved to its normal position as shown in Fig. 2 to connect the cutter block to the retracting link 350. It will be observed from Figs. 2, 5 and 7 that, as the retracting link 350 slides upon the shelf 38 of the frame 34, it is guided between the inner cheeks 364 of the guide block 134 at the forward end thereof.

The joint forming mechanism of the present invention operates in the following manner: The strapping 102 is pushed through the guide slot 124, the slot 138 on the rear face of the stationary cutter and clamping block 108, past the front of the jaw assembly 22, through the slot 110 in the barrier 112, and around the track which encircles the bundle so that the free strap end 102*f* impinges against the inclined face 140 of the strap guiding finger 142 and the free end of the strap wedges against the inclined face 118 of the barrier 112 and the strap 102 passing through the slot 110 to terminate strap feed. A control is operated in the machine, of which the joint forming mechanism is a part, to initiate retraction of the strap by pulling the standing portion 102*s* thereof downwardly, as seen in Figs. 2, 5 and 7, to take up the slack and shrink the strap loop about the bundle. Simultaneously, operating fluid is admitted to the cylinder 48 to advance the piston 60 until the piston shoulder 82 contacts the stop ring 80. The piston 70 is advanced in the cylinder 58, and the piston rod 72 and push rod 44 are moved forwardly a corresponding distance.

Forward movement of the push rod 44 moves the yoke 234 forwardly to advance the rear pin 226. The forward motion of the pin 226 is communicated through the intermediate pins 216 and the diagonally extending links 224 to the jaws 204 which are first advanced on the longitudinally movable pivot pins 206, and then, as the pivot pins 206 are stopped by contact with the front ends of the slots 212, the jaws have their hooked ends 292 rocked toward each other as the intermediate pins 216, having emerged from the rear guide slots 220, move outwardly in the transverse slots 222.

Simultaneously with the forward movement of the yoke 234, the strap guiding finger 142 is swung outwardly by contact of the corner 256 of the yoke with the camming surface 258 of the inward projection of the finger 142. The barrier 112 is also retracted by the outward swinging movement of the left jaw (the lowermost jaw as seen in the plan views, Figs. 3, 6 and 8) against the surface 282 of the link 262. The seal ejector assembly 178 is moved upwardly as the ejector arms 180 are cammed upwardly by the transverse pin 184 riding up on the push rod cam 188. The front of the jaw assembly is thus cleared to permit shrinkage of the strap loop about the bundle being bound.

The inward rocking or pivotal movement of the jaw tips 292 causes the latter to draw the free strap end 102*f* toward the machine head, and the lower edges 291 of the jaws to offset and clamp the strap against the shoulder 293 on the block 108. At the same time the flanges 176*f* of the seal blank 176 are folded about the overlapping portions of the strap 102 (Fig. 6). The seal is not folded so tightly as to inhibit pulling the standing strap portion 102*s* relative to the anchored end 102*f* and the folded seal 176, and the strap is retracted and tensioned about the bundle until the predetermined tension has been imparted to the strap.

When the proper tension has been applied to the strap, the machine is operated to introduce pressure fluid through the fitting 76 to the cylinder 58 and between the pistons 60 and 70. This moves the piston 70 until the piston rod shoulder 86 abuts against the stop face 88 of the cup 90. This movement is transmitted through the push rod 44, yoke 234, rear pin 226, and intermediate pins 216, to the jaws 204 which are given a slight further rocking movement to clamp the seal flanges 176*f* very firmly about the overlapping strapping portions. At the same time the inner ends of the slots 322 of the yoke push forward on the rear faces 328 of the notchers 318 to cause their V-shaped cutting edges 320 to coact with the cutting edges 304 and 306 of the jaws 204 to form or cut notches 316 in the overlapping portions of the strapping 102 and seal 176 and to push the cut-out metal toward the bundle being bound.

Simultaneously with the notching of the seal 176 and strapping 102, the cutter block 330 is moved forward by engagement of the forward faces of the yoke projections 252 and 254 against the rear face 338 of the cutter block. The cutting edge 334 of the block shears the standing portion 102*s* of the strap against the cutting edge 336 of the stationary cutter 108. The tab end 102*t* of the strap between the joint and the cutter block which is sheared from the standing portion is bent sharply toward the bundle across the top face of the cutter block and into the recesses 294 in the jaw tips so that it does not project outwardly at a sharp angle to serve as a possible source of personal injury to a person subsequently handling the bound bundle. It should be noted that there is a rather substantial advancing movement of the notchers 318 and the cutter block 330 while the jaws 204 do not move forward during this operation. Thus the major body of the seal and strapping is held against movement, and the only movement is that imparted to the cut-out joint tabs 316 and the strap end 102*t*.

At the conclusion of the joint forming operation, the bound bundle is severed from the strapping leading to the source of strap supply, such as a coil mounted on the reel, and reversal of the joint forming mechanism is effected. This is accomplished by venting the cylinders 48 and the cylinder 58 between the pistons 60 and 70, and admitting fluid under pressure through the fitting 78 at the forward face of the piston 70. The piston 70 moves rearwardly until the piston 60 encounters the stop 83, drawing the piston rod 72 and push rod 44 rearwardly. This motion is transmitted to the yoke 234 and the pin 226 is drawn to the left, as seen in Figs. 2, 3, and 5 to 8. This rearward movement draws the intermediate pins 216 first inwardly in the transverse slots 222 and then causes them to enter the rear longitudinal slots 220. The inner ends of the jaws 204 are swung inwardly and, when the pins 216 enter the slots 220, the rearward motion is transmitted to the pins 206. As the jaws 204 have their inner ends swung inwardly and their outer ends pivoted outwardly, the forward ends of the jaws are spread to receive a seal.

At the conclusion of the retraction, the pin 184, connected to the seal ejector arms 180, rides off the cam surface 188, and the spring 183 snaps the seal ejector assembly 178 downwardly, carrying a seal from the front of the magazine 158 to loading position between the jaws. The seal bears against the upper surfaces of the jaw shelves 296 and the top 332 of the cutter block 330. This is the proper location for the seal for a subsequent joint forming operation. The seal ejector finger 193 has its lower end 200 pressing the base of the seal against the forward face 312 of the anvil 310.

During the withdrawal of the jaw assembly, the yoke edge 290, engaging the surface 288 of the lever 264, cams the lever in the counterclockwise direction, and this motion is transmitted through the spring 272 to the forward lever 262 which moves the barrier 112 into strap path blocking positions with the slot 110 positioned to receive the first run of the strap 102 as it encircles the bundle. The yoke also rides off the cam surface 258 of the strap guide finger 142 and the spring 152 moves this finger into strap guiding position, as seen in Fig. 3.

It should be noted that the means for operating the jaw assembly of this joint forming mechanism is intended to be illustrative rather than limitative because other means may be substituted for the double-piston, double-cylinder

combination 24 for advancing and retracting the yoke 234 and the other components of the jaw assembly 22.

While a preferred embodiment of the joint forming mechanism constituting this invention has been shown and described, it will be apparent that numerous modifications and variations thereof may be made without departing from the underlying principles of the invention. It is, therefore, desired by the following claims to include within the scope of the invention all such variations and modifications by which substantially the results of this invention may be obtained through the use of substantially the same or equivalent means.

What is claimed as new and desired to be secured by United States Letters Patent is.

1. In a joint forming mechanism for uniting the overlapping portions of bundle binding strapping and embracing seal in a tension resisting joint, the combination of a pair of jaws having forward hooked tips, each jaw having plane bounding faces at opposite sides thereof arranged to be coplanar with the bounding faces of the other jaw, means mounting said jaws for rectilinear and pivotal movements so that said hooked tips may be pivoted toward and away from each other when said jaws are in an advanced position, means connected to said jaws rearwardly of said mounting means for moving said jaws forwardly and rearwardly and for pivoting said jaws in said advanced position, said jaws having pockets behind their hooked tips to receive the flared flanges of a seal and having shoulders at the edges of said pockets to fold the seal flanges about the overlapping strapping portions when said jaw tips are rocked toward each other, a pair of notches slidable in the direction of rectilinear movement of said jaws, one of said notchers being carried by said jaws between their faces and the other notcher being slidable across one pair of said jaw faces, said jaw tips having cutting edges to coact with said notchers to deform the strapping and embracing seal to unite them in a tension resisting joint, and said jaw moving means including means for moving said notchers relative to said jaws.

2. In a joint forming mechanism for uniting the overlapping portions of bundle binding strapping and embracing seal in a tension resisting joint, the combination of a pair of jaws having forward hooked tips, each jaw having plane bounding faces at opposite sides thereof arranged to be coplanar with the bounding faces of the other jaw, means mounting said jaws for rectilinear and pivotal movements so that said hooked tips thereof may be pivoted toward and away from each other when said jaws are in advanced position, means connected to said jaws rearwardly of said mounting means for moving said jaws forwardly and rearwardly and for pivoting said jaws in said advanced position, said jaws having pockets behind their hooked tips to receive and having shoulders at the edges of said pockets to fold a seal about the overlapping strapping portions when said jaw tips are pivoted toward each other, a pair of notchers slidable in the direction of rectilinear movement of said jaws, said jaws having facing longitudinally extending slots in which one of said notchers is slidable, the other notcher being slidable across one pair of jaw faces, said jaw tips having cutting edges at said slots and said faces to coact with said notchers to deform the strapping and embracing seal to unite them in a tension resisting joint, and said jaw moving means including means for moving said notchers relative to said jaws.

3. In a joint forming mechanism for uniting the overlapping portions of bundle binding strapping and embracing seal in a tension resisting joint, the combination of a pair of jaws having forward hooked tips, each jaw having plane bounding faces at opposite sides thereof arranged to be coplanar with the bounding faces of the other jaw, pivot pins mounting said jaws for pivotal and rectilinear movement so that said hooked tips may be pivoted toward and away from each other at one end of said rectilinear movement, means connected to said jaws rearwardly of said pivot pins for moving said jaws forwardly and rearwardly and for pivoting said jaws about said pins, a strap anchoring member mounted forwardly of said jaws and past which one end of the strapping projects, said jaw tips having means cooperable with said member when said jaws are in a forward position and said tips are rocked toward each other to anchor said one strapping end against longitudinal movement, said jaws having pockets behind their hooked tips to receive the flared flanges of a seal and having shoulders at the edges of said pockets to fold the seal flanges about the overlapping strapping portions when said jaw tips are rocked toward each other, a pair of notchers slidable in the direction of rectilinear movement of said jaws, one of said notchers being carried by said jaws between their faces and the other notcher being slidable across one pair of said jaw faces, said jaw tips having cutting edges to coact with said notchers to deform the strapping and embracing seal to unite them in a tension resisting joint, and said jaw moving means including means for sliding said notchers relative to said jaws.

4. In a joint forming mechanism for uniting the overlapping portions of bundle binding strapping and embracing seal in a tension resisting joint, the combination of a pair of jaws having forward hooked tips, each jaw having plane bounding faces at opposite sides thereof arranged to be coplanar with the bounding faces of the other jaw, pivot pins mounting said jaws for pivotal movement so that said hooked tips may be pivoted toward and away from each other, means guiding said pivot pins for limited rectilinear movement of said pins and said jaws, means connected to said jaws rearwardly of said pivot pins for moving said jaws and pins forwardly and rearwardly and for pivoting said jaws about said pins, a member mounted forwardly of said jaws and having an edge past which one end of the strapping projects, said jaw tips having edges cooperable with said member edge when said jaws are in their forward position and said tips are rocked toward each other to offset said strapping end toward said joint forming mechanism and to anchor it against longitudinal movement, said jaws having pockets behind their hooked tips to receive the flared flanges of a seal and having shoulders at the edges of said pockets to fold the seal flanges about the overlapping strapping portions when said jaw tips are rocked toward each other, a pair of notchers slidable in the direction of rectilinear movement of said jaws and pivot pins, one of said notchers being carried between said jaws and the other notcher being slidable across one pair of jaw faces, said jaw tips having cutting edges to coact with said notchers to deform the strapping and embracing seal to unite them in a tension resisting joint, and said jaw moving means including means for sliding said notchers relative to said jaws.

5. In a mechanism for uniting the overlapping portions of bundle binding strapping and embracing seal in a tension resisting joint, the combination including a pair of holding jaws having forward hooked tips formed with inwardly facing recesses, means mounting said jaws for rectilinear and pivotal movements so that said hooked tips may be pivoted toward and away from each other when said jaws are in an advanced position, a stationary cutter mounted forwardly of said jaws in their rearward position and having a cutting edge past which one strapping portion extends, means connected to said jaws rearwardly of said mounting means for moving said jaws forwardly and rearwardly and for pivoting said jaws in said advanced position about said stationary cutter, a movable cutter mounted for rectilinear movement and having a cutting edge cooperable with said stationary cutting edge to sever said strapping portion adjacent a joint held by said jaws and to bend into said jaw recesses the strapping end projecting from the joint, and said means for moving said jaws including means for moving said movable cutter toward said stationary cutter.

6. In a joint forming mechanism for uniting the overlapping portions of bundle binding strapping and embracing seal in a tension resisting joint, the combination of a pair of jaws having forward hooked tips, means mounting said jaws for rectilinear and pivotal movements so that said hooked tips may be pivoted toward and away from each other when said jaws are in an advanced position, means connected to said jaws rearwardly of said mounting means for moving said jaws forwardly and rearwardly and for pivoting said jaws in said advanced position, said jaws having pockets behind their hooked tips to receive a seal and having shoulders at the edges of said pockets to fold it about the overlapping strapping portions when said jaw tips are pivoted toward and away from each other, said jaw tips being formed with cutting edges on said shoulders, rectilinearly movable notcher means supported by said jaws and cooperable with said cutting edges to deform the strapping and embracing seal and to unite them in a tension resisting joint, and said means for moving said jaws including means for simultaneously moving said notcher means.

7. In a joint forming mechanism for uniting the overlapping portions of bundle binding strapping and embracing seal in a tension resisting joint, the combination of a pair of jaws having forward hooked tips, each jaw having plane boundary faces at opposite sides thereof arranged to be coplanar with the boundary faces of the other jaw, means mounting said jaws for rectilinear and pivotal movements so that said hooked tips may be pivoted toward and away from each other when said jaws are in an advanced position, means connected to said jaws rearwardly of said mounting means for moving said jaws forwardly and rearwardly and for pivoting said jaws in said advanced position, said jaws having pockets behind their hooked tips to receive a seal and having shoulders at the edges of said pockets to fold it about the overlapping strapping portions when said jaw tips are pivoted toward and away from each other, a longitudinally extending slot formed on the inner side of each jaw and terminating in the jaw tip, said jaw tip being formed with cutting edges at said slot and on the adjacent jaw face, a rectilinearly movable notcher blade slidable in said slots and a second rectilinearly movable notcher blade slidable on said last mention jaw faces, said blades having cutting edges cooperable with said cutting edges on said jaws to deform the strapping and embracing seal and to unite them in a tension resisting joint, and said means for moving said jaws including means for moving said notcher blades simultaneously therewith.

8. In a joint forming mechanism for uniting the overlapping portions of bundle binding strapping and embracing seal in a tension resisting joint, the combination of a pair of jaws having forward hooked tips, means mounting said jaws for rectilinear and pivotal movements so that said hooked tips may be pivoted toward and away from each other when said jaws are in an advanced position, means connected to said jaws rearwardly of said mounting means for moving said jaws forwardly and rearwardly and for pivoting said jaws in said advanced position, said jaws having pockets behind their hooked tips to receive a seal and having shoulders at the edges of said pockets to fold it about the overlapping strapping portions when said jaw tips are pivoted toward and away from each other, a longitudinally extending slot formed on the inner side of each jaw and terminating in the jaw tip, said jaw tip being formed with cutting edges at said slot and on the adjacent jaw face, a rectilinearly movable notcher blade slidable in said slots and a second rectilinearly movable notcher blade slidable on said jaw faces, said blades having cutting edges cooperable with said cutting edges on said jaws to deform the strapping and embracing seal and to unite them in a tension resisting joint, and said means for moving said jaws including means for moving said notcher blades.

9. In a mechanism for uniting the overlapping portions of bundle binding strapping and embracing seal in a tension resisting joint, the combination comprising a pair of pivotally mounted joint embracing and holding jaws having forward hooked tips formed with inwardly facing recesses, a stationary cutter mounted forwardly of said jaws and having a cutting edge past which one strapping portion is adapted to project, a movable cutter having a cutting edge cooperable with said stationary cutting edge to sever the strapping portion adjacent the formed joint and to bend toward the bundle the strapping tab projecting from the joint into said jaw tip recess, and said stationary and movable cutting edges lying within said jaw recesses when said jaw tips are pivoted toward each other.

10. In a mechanism wherein the overlapping portions of bundle binding strapping and an embracing seal have been united in a tension resisting joint, the combination of a cutter, joint embracing jaws to hold the joint against movement, means for advancing said cutter to cut the strapping and thereafter to bend the tab adjacent the joint in the direction of the bundle, and a recess in said jaws into which said tab is bent.

11. A jaw for use in a joint forming mechanism to form a tension resisting joint in overlapping portions of bundle binding strapping and an embracing seal, comprising a unitary body formed at one end with a hooked tip and with apertures at the opposite end and at substantially the midpoint thereof, a longitudinal slot in one side of said body extending from the end opposite said hooked tip and toward said tip to terminate in a curved end in said tip, said body to one side of said slot being formed with a recess at said hooked tip extending from said slot to the body face and adapted to receive the edge of a seal flange, the wall of said slot opposite said recess forming a shelf against which the seal flange is adapted to bear, and said hooked tip being formed with an inwardly facing arcuate surface extending from said shelf toward the opposite face of said body.

12. A jaw for use in a joint forming mechanism to form a tension resisting joint in the overlapping portions of bundle binding strapping and an embracing seal, comprising a unitary body formed at one end with a hooked tip, a longitudinal notcher guiding slot in one side of said body extending substantially the length of said body from the end opposite said hooked tip and toward said tip to terminate in a portion curved in the same direction as said tip is hooked, said body to one side of said slot being formed with a recess at said hooked tip extending from said slot to the body face and adapted to receive the edge of a seal flange, and the wall of said slot opposite said recess forming a shelf against which an end edge of the seal flange is adapted to bear.

13. A jaw for use in a joint forming mechanism to form a tension resisting joint in the overlapping portions of bundle binding strapping and an embracing seal, comprising a unitary body formed at one end with a hooked tip, a longitudinal notcher guiding slot in one side of said body extending substantially the length of said body from the end opposite said hooked tip and toward said tip to terminate in a portion curved in the same direction as said tip is hooked, and said hooked tip being formed with an inwardly facing concave surface extending from said slot toward one face of said body.

14. A jaw for use in a joint forming mechanism to form a tension resisting joint in the overlapping portions of bundle binding strapping and an embracing seal, comprising a unitary body formed at one end with a hooked tip, a longitudinal notcher guiding slot in one side of said body extending substantially the length of said body from the end opposite said hooked tip and toward said tip to

terminate in a portion curved in the same direction as said tip is hooked, and cutting edges formed on said body at the curved end of said slot and the adjacent face of said body.

References Cited in the file of this patent

UNITED STATES PATENTS

1,809,480 Glardon ---------- June 9, 1931
1,984,652 Ott ---------- Dec. 18, 1934
2,080,329 Mortimer ---------- May 11, 1937
2,298,658 Spencer ---------- Oct. 13, 1942
2,315,596 Childress ---------- Apr. 6, 1943