

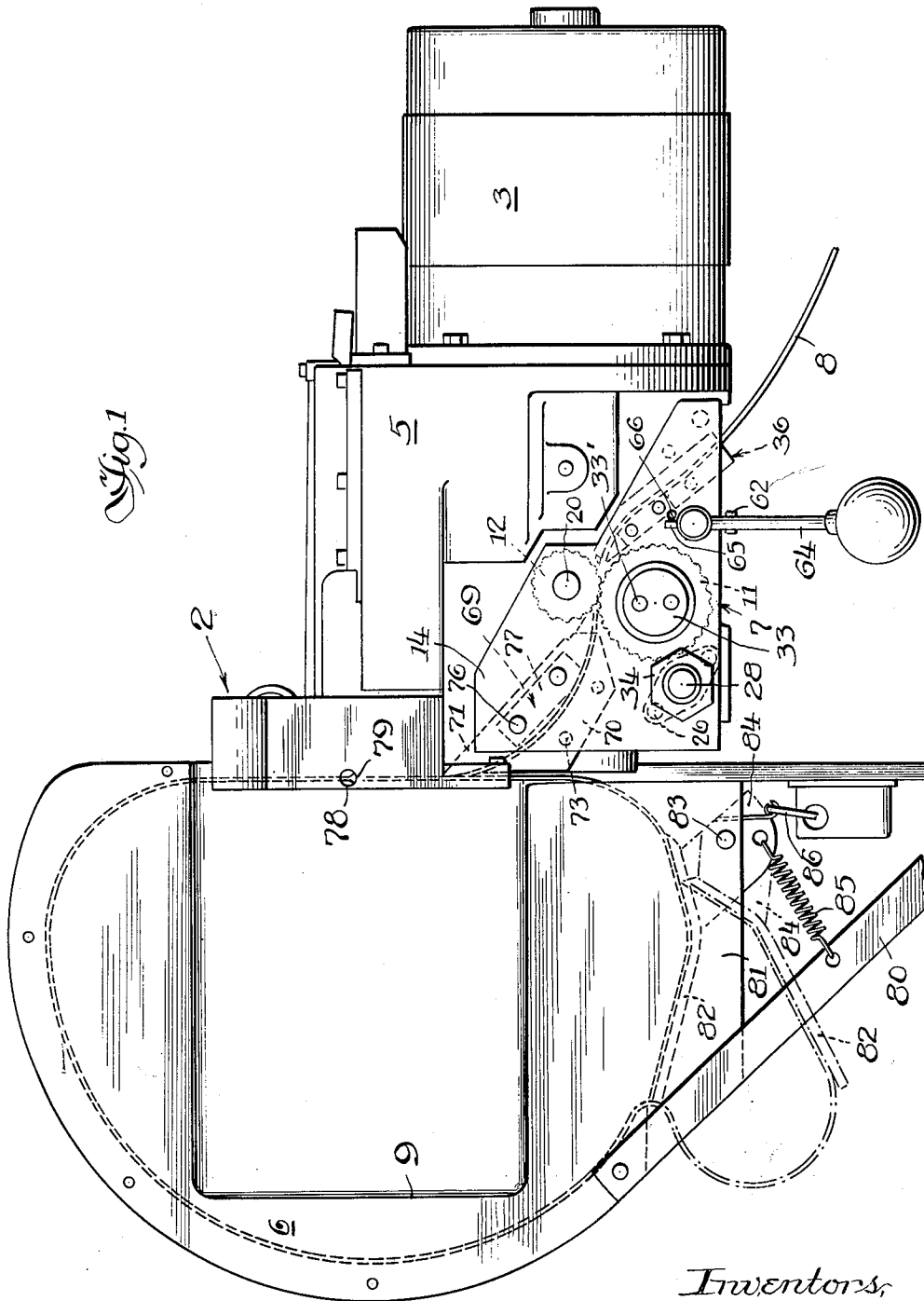
May 7, 1963

H. T. MARTIN ET AL
POWER STRAPPING MACHINE

3,088,397

Filed July 19, 1960

3 Sheets-Sheet 1



Inventors,
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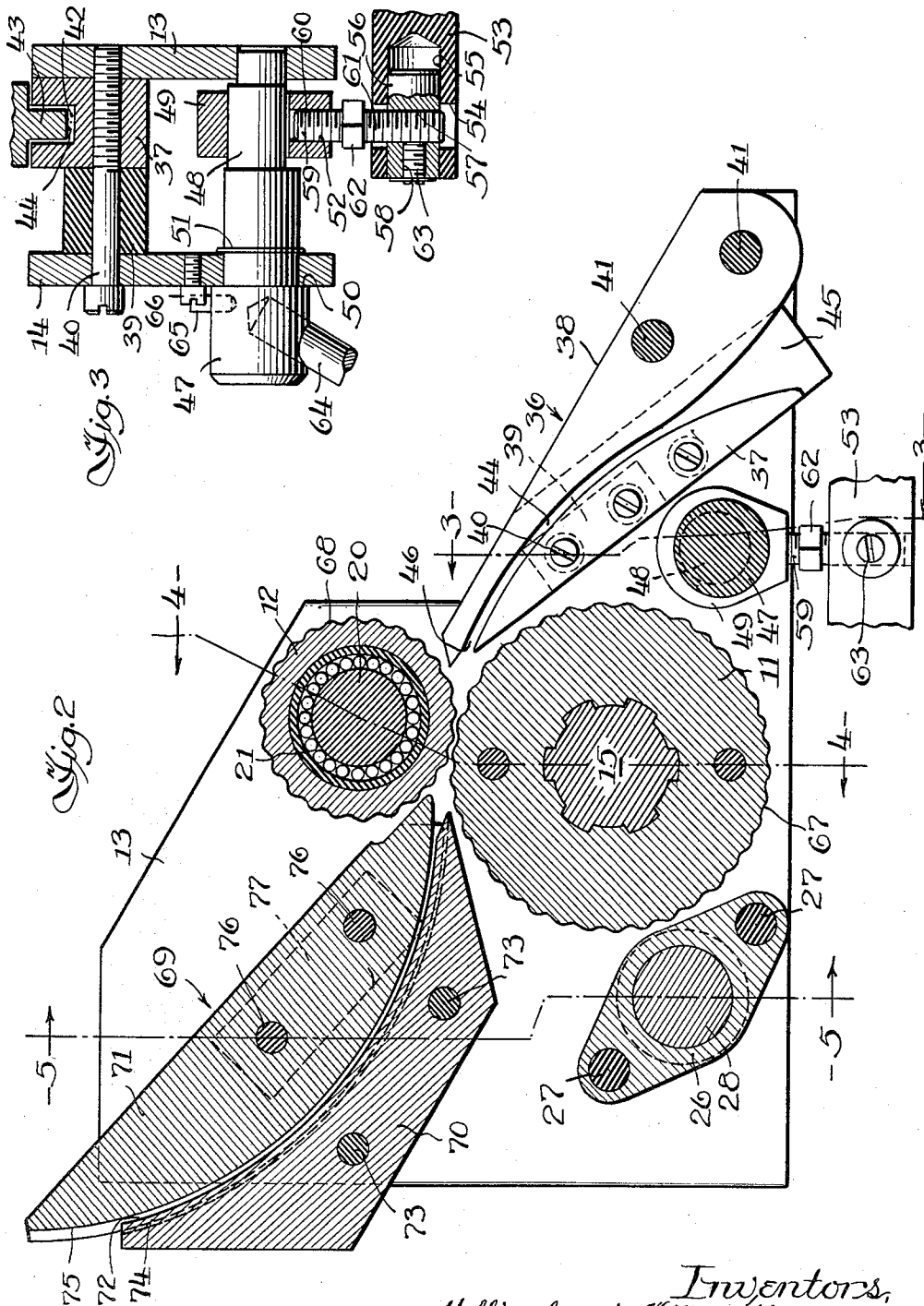
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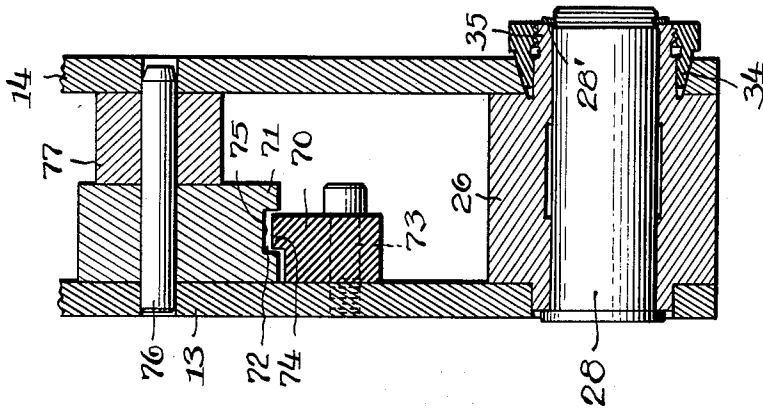


Fig. 5

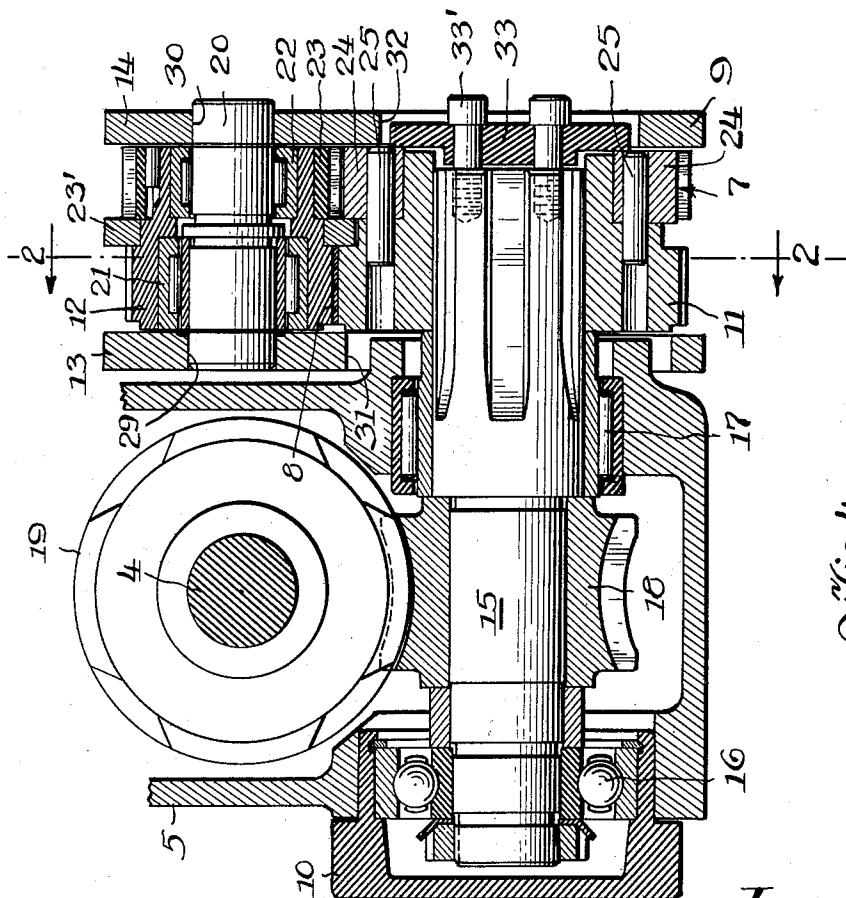


Fig. 4

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POWER STRAPPING MACHINE

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3 Claims. (Cl. 100—26)

This invention relates to an improved power strapping machine and, more particularly, with means for corrugating the strapping transversely as it is fed through the machine.

While the improvement comprising the present invention may be incorporated into many different strapping machines, for the sake of clarity it is described with particular reference to the type of strapping machine disclosed in Crosby et al. Patent No. 2,915,003, issued December 1, 1959.

As described in that patent, a power strapping machine capable of automatic or semi-automatic operation may have a strap feeding and tensioning mechanism, various guides for the strap, a bundle enclosing loop, a joint sealing mechanism, a strap cutting mechanism and a reversible motor for operating the several parts of the machine.

In such machines, flat strapping is fed through a pressure-feed roll assembly. This assembly consists of a feed roll and a pressure or guide roll so arranged as to form a nip through which the strapping travels. To effect positive feeding, the surfaces of one of these rolls are generally knurled to grip the strap.

In most strapping machines, it is generally necessary to pull the strapping slightly outward from the strapped bundle at the time the overlapping portions of the strapping are clamped together. This slight outward movement is necessary to permit insertion and formation of the metal seal which holds the overlapped portions of the strap together. Where the bundle has sufficient elasticity to re-expand and thereby absorb the slack created, no problem is presented. However, if the bundle has no elasticity, an undesirable slack remains.

An illustrative embodiment of this invention includes a pair of feed rolls whose peripheral surfaces are provided with a continuous series of transverse corrugations which mesh with each other. In addition, both feed rolls are driven by interconnected gears to insure meshing of their corrugated surfaces at all times.

Flat strap which passes between these contoured feed rolls is corrugated transversely, i.e., the corrugations extend across the width of the strap. Alternatively, preformed corrugated strapping may also be used if so desired. During such use, the series of transverse corrugation on the feed rolls correspond to the corrugations on the preformed strap and a very positive drive of the strap occurs. In prior machines, this was never heretofore possible.

Transversely corrugated strap has many advantages over flat strap. One of the most outstanding of these is that the strap is longitudinally resilient.

When such strap is used to tie a bundle, its corrugations permit expansion during insertion of the sealing mechanism between the bundle and the strap after the strap has been pulled to its desired tension. Upon retraction of the tool, the corrugations cause a substantial recovery of the original desired tension in the strap thereby producing a tightly bound package capable of withstanding rugged handling and shipping treatment thereafter. The resiliency of the strap also permits swelling of the bundle as sometimes happens with paper rolls and bags without breaking the strap or damaging the bundle.

As indicated above, machines embodying this invention not only efficiently and effectively handle and work with corrugated or "marcelled" strap during all phases of

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their operation, including feeding and retracting and tensioning the same, but are also effective to utilize plain flat strap and provide the same with the desired corrugated configuration. Therefore, the need for providing the machine with special, preformed strap is eliminated. However, the machine is nevertheless fully capable of handling precorrugated strap, if so desired.

To facilitate the insertion of a leading end of a new length of strap between the feed rolls, the shaft of one of the feed rolls is journaled between a pair of parallel plates that are capable of being moved pivotally a limited distance to increase the space between said feed roll and its mate feed roll. The parallel plates with the first mentioned feed roll thereinbetween are moved by an eccentric shaft. Stop means adjacent the eccentric shaft insure proper spacing between the pair of feed rolls when they are moved into their normal operating position after the leading end of the strap is positioned therebetween.

An illustrative embodiment of the present invention is more particularly described by reference to the accompanying drawings in which:

FIGURE 1 is a broken side elevation of a power strapping machine which incorporates an embodiment of this invention;

FIG. 2 is an enlarged vertical cross-sectional view of the strap feed, crimp and guide mechanism shown in FIG. 4, taken along line 2—2;

FIG. 3 is a vertical cross-sectional view, taken along line 3—3 of the strap feeding and crimping mechanism of FIG. 2;

FIG. 4 is a vertical cross-sectional view, taken along line 4—4 of the feeding and crimping mechanism of FIG. 2; and

FIG. 5 is a vertical cross-sectional view, taken along line 5—5 of the feeding and crimping mechanism of FIG. 2.

Referring particularly to the drawings, strapping machine 2 is powered by a reversible electric motor 3, through main drive shaft 4, located in housing 5. A worm gear 19 (FIG. 4) encircling shaft 4 drives worm wheel 18 which is keyed to shaft 15. A closed strapping guide chute 6 and a feed and tension assembly 7 is affixed to housing 5. Into the feed and tension assembly is fed strap 8 which consists of a flat metal strip of suitable length, drawn from a supply roll (not shown). The feed and tension device is so arranged that it directs strap 8 into and around the closed guide chute 6, which has a bundle receiving opening 9 therein.

The feed and tension assembly 7, whose side view is shown in FIGURE 1 and more specifically in FIGURE 2, comprises a feed roll 11 and a pressure roll 12. Feed roll 11, as shown in FIGURE 4, is mounted between two normally vertical and substantially parallel plates 13 and 14. Roll 11 is powered by shaft 15 rotatably mounted in ball bearings 16 and roller bearings 17. The ball bearing end of shaft 15 is enclosed by end closure 10 to protect it against dirt and the like.

Shaft 20, shown located about shaft 15 in FIGS. 1, 2 and 4, is journaled in plates 13 and 14 in a parallel relationship to shaft 15. Pressure roll 12 rotates on shaft 20 by means of roller bearings 21 and 22. About half of the peripheral surface of pressure roll 12 adjacent plate 14 is recessed and a gear 23 is keyed thereon. Collar 23' is mounted between gear 23 to provide a shoulder on the feed roll 12. This collar acts as a guide for the pressure roll being channeled in a groove in feed roll 11, preventing undue lateral movement between plates 13 and 14. Gear 24, secured to feed roll 11 by pins 25, intermeshes with gear 23 to drive pressure roll 12.

To insure a parallel relationship between plates 13 and 14 and alignment of the several apertures therein,

the two plates, as shown in FIG. 5, are mounted on a bushing 26 which is secured to plate 13 by bolts 27 shown in FIG. 2. The bushing is rotatable on pin 28 held within the bushing by retaining ring 28'.

Plate 14 is tapered adjacent bushing 26 and a tapered nut 34 is screwed on threaded neck 35 of bushing 26 to engage the tapered edge of plate 14. Nut 34 adjusts the vertical position of plate 14 relative to plate 13 to maintain shaft 20 in parallel relationship to shaft 15. This arrangement enables the pivotal movement of plates 13 and 14 and pressure roll 12 about pin 28 while the parallel relationship between shafts 15 and 20 is maintained.

Within plates 13 and 14 are apertures 31 and 32 respectively through which shaft 15 extends (see FIG. 4), the apertures are of sufficient diameter to provide clearance for shaft 15 and for end plate 33 affixed by screws 33' to the outer end of shaft 15. Thus, shaft 15 and feed roll 11 are free of any connection with plates 13 and 14. Therefore, any pivotal movement of plates 13 and 14 about pin 28 causes an alteration in the distance between feed rolls 11 and 12.

As seen in FIGURES 1 and 2, the strap 8 is normally fed into a lower guide assembly 36 to the bite or nip between feed rolls 11 and 12 and then through an upper guide assembly 69, all located to a substantial extent between plates 13 and 14. The lower guide assembly comprises a pair of complementary inter-fitting guide members 37 and 38. As shown best in FIGURE 3, guide member 37 is held between plates 13 and 14 by a plurality of bolts 40 (see FIG. 2) and a spacer 39. Guide member 38 is secured to plate 13, in spaced relationship to guide member 37 by a plurality of bolts 41.

The surface of guide member 37, facing guide member 38 is provided with a longitudinal groove 42, into which rib 43 of guide member 38 extends for substantially the complete path formed between the two guide members. The height of rib 43 is less than the depth of groove 42, the end result of which is a slot 44 which guides the strapping placed thereinbetween. A flared entrance 45 is formed at the lower end of this guide assembly to facilitate insertion of the strap.

To enable variation in the distance between feed rolls 11 and 12 which facilitates insertion of the strap into the nip of the feed rolls, the parallel plate assembly, shown in FIG. 5 which supports feed roll 12, is made movable with respect to power shaft 15 upon which feed roll 11 is keyed. This is accomplished, as best shown in FIGS. 2 and 3, by providing a stepped eccentric shaft 47, journaled between the plates 13 and 14, and having a rotatable ring member 49 on its stepped eccentric intermediate section 48. Shaft 47 is held against axial movement by an annular shoulder 50 and a retaining ring 51.

Ring member 49 on section 48 of shaft 47 has an inside diameter larger than the diameter of section 48 and is provided with a threaded recess 52 extending upwardly from its bottom. A double ended screw 59, provided with oppositely directed threads 60 and 61 at its opposite ends, is threaded into recess 52. Its opposite end extends into a vertical bore 54 in frame member 53, which is directly below ring member 49, and is integral with the frame of the machine. Vertical bore 54 has a slightly larger diameter than the double ended screw 59.

Frame member 53 contains a horizontal recess 55 intersecting bore 54. The recess contains a stud 56, which is provided with a threaded vertical bore 57 into which double ended screw 59 is threaded. A set screw 63, threaded into recess 58 of stud 56, engages screw 59 to hold it against rotation. A nut 62, which may either be integral with screw 59, or rigidly secured thereto in any suitable manner, facilitates turning screw 59 to raise or lower bearing 49. When the desired position is obtained, set screw 63 is tightened, thereby retaining bearing 49 in the adjusted position.

A handle 64 extends at an angle from shaft 47. As seen in FIGURE 1 a pin 65, projecting laterally from

eccentric shaft 47, engages a stop member 66, projecting outwardly from plate 14, to stop the rotation of eccentric shaft 47 when feed roll 12 is in its uppermost position.

As handle 64 is turned in either direction, eccentric section 48 of shaft 47 rotates within ring member 49. Since ring member 49 is fixed to frame member 53 through screw 59 and stud 56, plates 13 and 14 pivot about pin 28. And since both guide assemblies 36 and 69 and shaft 20, on which feed roll 12 is mounted, are either bolted to or journaled in apertures in plates 13 and 14, these move with the plates. Shaft 15, not being integral or affixed to plates 13 and 14, remains stationary. A clearance sufficient to permit the leading end of strap 8 to be inserted into the nip of the feed rolls is thereby created.

After the leading edge of the strapping is engaged by the feed rolls, through the manipulation of handle 64 described above, it is fed into the upper guide assembly 69.

It might be here noted that the peripheral surfaces of the feed rolls are corrugated transversely, as indicated at 67 and 68. These corrugations intermesh to form a corrugating zone between the feed rolls. In this zone the metal strapping is impressed with a continuous series of transverse corrugations.

As indicated above, when the corrugated strapping leaves the feed rolls, it passes through upper guide assembly 69. This assembly, as more clearly shown in FIGURE 5, comprises a pair of interfitting guide members 70 and 71 which together define an upwardly extending arcuate slot 72 (see FIG. 2). Slot 72 is so formed in its upward path that it directs the strapping to guide chute 6 (see FIG. 1).

Guide member 70 is secured to plate 13 by a plurality of bolts 73. As shown in FIGURE 5, it has an up-standing rib 74 extending into a recess 75 in the under-surface of guide member 71. The height of rib 74 is less than the depth of recess 75 so that a slot 72 is formed between the two members to act as an effective guide for the strapping.

Guide member 71 is secured to plate 13 and spaced from plate 14 by a plurality of friction studs 76 and spacer 77.

After the strapping leaves slot 72 it is guided to a barrier 78 (FIG. 1) having a V-shaped throat 79 therein. The apex of throat 79 is only wide enough to permit one thickness of the corrugated strapping to pass there-through. Accordingly, after strapping 8 passes through it and follows guide chute 6 to form a loose loop about a bundle positioned in the bundle receiving opening 9, it is stopped from a second encircling movement by said throat 79.

Guide chute 6 is supported adjacent housing 5 by brackets 80 and 81. A dropout jaw 82, mounted on plate 84, is pivoted to bracket 81 by pin 83. A tension spring 85 biases the dropout jaw into a closed loop position.

As indicated above after strapping 8 is guided around chute 6 and is stopped and held by throat 79. Continued feeding of the strapping causes dropout jaw 82 to pivot counterclockwise, thereby bulging excess strapping outwardly as shown in FIG. 1.

The bottom edge of plate 84 is in engagement with a switch 86. Its downward pivotal movement actuates the switch to reverse motor 3. Reversal of motor 3 causes a reversal in the direction of rotation of feed rolls 11 and 12. This movement causes a "backing out" of the strapping. This tightens the strapping around the bundle held in opening 9. The revised direction of the feed rolls also causes tensioning of the strapping. When a predetermined tension is applied to the strapping, motor 3 is automatically stopped, and the juxtaposed portions of the strapping are sealed together by a metal clamp. The strapping, after being sealed is cut on the far side of the seal to release the bundle from the continuous roll

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of strapping. The tension regulating, joint sealing means and strap cutting means are fully disclosed in the Crosby et al. patent above identified.

During the joint sealing operation, the strap must be pulled slightly outward from the bundle to enable the metal clamp to be inserted and fastened over the overlapping end portions of the strapping.

The transverse corrugations, impressed in the strapping throughout its length by the improved device of this invention, permits the absorption of any slack created by the sealing operation. Thus, the tension in the strapping is substantially unchanged from that originally applied.

While one might suggest that corrugated strapping instead of flat strapping could have been used originally without the need for corrugating feed rolls and the attendant mechanism therefor, it is preferred to utilize the machine of this invention because of several advantages. The bulkiness of pre-corrugated strapping limits the length of strapping that can be wound on the supply roll. Furthermore, a supply roll with flat strapping thereon is more easily handled. In addition, a greater degree of care is required to insert a corrugated strap in order to register the corrugation with the corrugations of the feed rolls.

In addition to these advantages desired in the product, the combination of a positive drive in the machine of this invention for each of the feed rolls and the intermeshing corrugated peripheral surfaces thereof insures a unique positive feeding of the strapping in either direction without slippage and without the use of strap gripping elements that may bite into the strapping and thereby weaken it.

While we have described a preferred embodiment of the invention in considerable detail, it will be understood that the description is intended to be illustrative, rather than restrictive. Many details of the structure may be modified or changed without departing from the spirit or scope of the invention.

We claim:

1. In a strapping machine having a frame, the improvement comprising a pair of feed rolls having intermeshing transversely corrugated peripheral surfaces, one of said feed rolls being rotatably mounted between two plates, a rotatable eccentric shaft mounted within said plates and having a ring member journaled therein and adjustably secured to said frame for movement of said plate-mounted feed roll relative to the other feed roll and

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interrelated reversible drive means for driving both of said feed rolls while said corrugated surfaces intermesh.

2. In a strapping machine having a frame, the improvement comprising a pair of feed rolls having intermeshing transversely corrugated peripheral surfaces and interrelated drive means for reversibly driving both of said feed rolls in either direction, said feed rolls being normally positioned with said peripheral surfaces spaced from each other a distance substantially equal to the thickness of the flat strapping to be fed therethrough to corrugate said strapping as it is moved between said feed rolls, one of said feed rolls being rotatably mounted between two parallel side plates, a rotatable eccentric shaft mounted within said plates and having a ring member journaled thereon adjustably secured to said frame, intermeshing gears affixed to said feed rolls, and reversible drive means for driving said gears while said corrugated surfaces intermesh.

3. In a strapping machine, a frame, a first feed roll rotatably mounted on said frame, a pair of parallel plates pivotally mounted on said frame, a second feed roll mounted between said plates in parallel relationship to said first feed roll, said feed rolls having their peripheral surfaces in close proximity to each other, means for driving said first feed roll, gears interconnecting said feed rolls, a shaft rotatably mounted between said parallel plates and having an eccentric portion thereon operatively connected to said frame to move said plates and said second feed roll relative to said first feed roll when said shaft is rotated, to permit insertion of one end of a length of strapping therebetween, said first and said second feed rolls having transversely extending intermeshing corrugations on their peripheral surfaces, whereby strapping positioned between said feed rolls is corrugated as said feed rolls are rotated.

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