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(54) Banding apparatus providing reduced banding material buckling

(57) A banding material mechanism (20m) and band tightening tool (18m) using the same are disclosed, wherein there is a reduced likelihood of the banding material (28) buckling in the tool. The gripping mechanism includes gripping body (30m) and a banding material gripper component (56m) ("gripper") that reciprocates within the gripping body (30m) for iteratively: (i) gripping the banding material (28) so that a band being formed from the banding material can be tightened, and (ii) releasing the banding material (28) so that the gripper (56m) can slide along the banding material as the gripping body (30m) moves forwardly over a further length of excess banding material in preparation for performing (i) again. The gripper (56m) has a banding material contacting portion (228) with a shape that cooperatives with a slot (198) provided within a banding material support platform (48m) of the gripping body (30m) such that during (i) above, the banding material is deformed into the slot thereby reducing a likelihood that (i) results in a hump in the banding material forwardly of the gripper that could prevent the gripper from effectively sliding over the banding material in (ii).

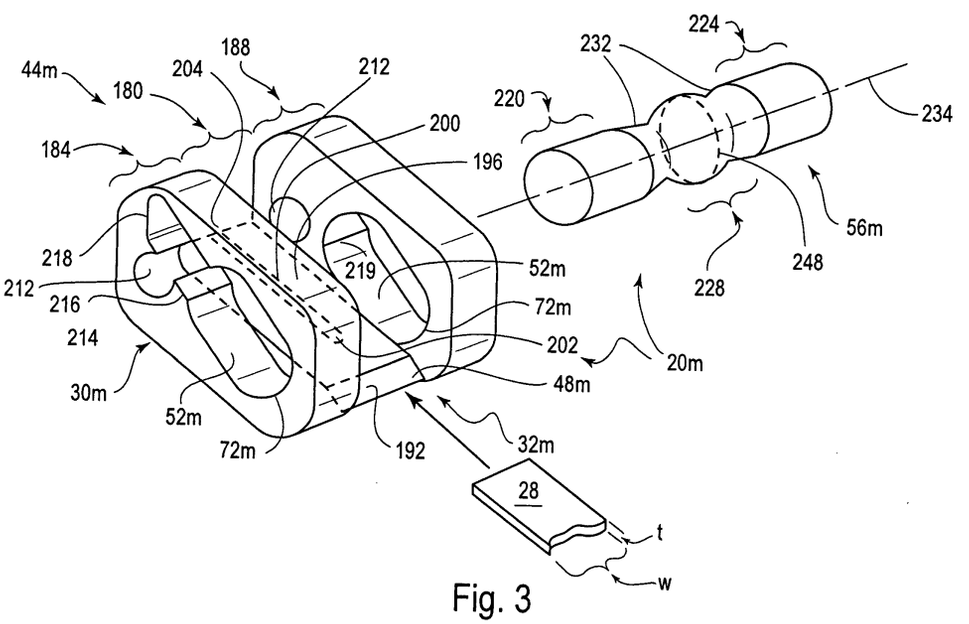

Fig. 3

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Description

Related Field of the Invention

[0001] The present invention is related to band tightening devices for use in banding objects, and in particular, for banding objects wherein the banding material has a reduced likelihood of buckling within such a band tightening device.

Background

[0002] Various embodiments of band tightening tools are known, wherein such tools are used for fixedly securing bands about objects. In particular, such bands may be composed of, e.g., a plastic or metal, and the objects may be, e.g., sensors, heat shields, cables, poles and pipes. In some known band tightening tools, such as the band tightening tool disclosed in U.S. Patent No. 5,566,726, filed June 2,1994 fully incorporated herein by reference, there is a band gripping mechanism (also denoted a "tension block") that repeatedly grips a banding material, and pulls portions of the banding material from about an object(s) being banded, thereby tensioning the banding material about the object(s). More particularly, during tightening of a band, such a band gripping mechanism is alternately:

(a) moved along a length of the banding material in a first (non-tensioning) direction to thereby reach a position on the banding material that can be gripped for subsequently pulling on the length of the banding material that is surrounding the object(s) being banded so that the band further tightens about the object(s) , and

(b) once fully moved in the first direction, the gripping mechanism is then pulled in an opposite second (tensioning) direction whereby a "gripper" (such as a cylindrical pin having a cylinder axis parallel with a width of the banding material) securely grips the banding material so that the banding material is further tensioned about the object(s) being banded as the gripping mechanism is moved in the second direction.

[0003] Such a gripper may be biased by a spring or other biasing devices to contact the banding material, at least at the commencement of the pulling of the gripping mechanism in the second direction. Moreover, such biasing must be of sufficient force to cause the gripper to securely grip the banding material. Additionally, as the gripper mechanism is pulled in the second direction, the gripping pin must apply a banding material gripping force that is sufficient to overcome any counterforce, from the band being tensioned, that the banding tool is capable of producing in the band. Accordingly, the gripper can deform the banding material in an area extending around where the gripper contacts the banding material during the band tensioning step (b) above. In particular, the banding material deformations can include depressions (and/or protrusions or raised portions) in the banding material immediately adjacent to the gripper. Moreover, when the gripping mechanism has moved its full extent in step (b) above (i.e., in the second direction) and reverses direction for moving in the first direction (i.e., step (a) above), the gripper must release its grip from the banding material. Thus, the gripping force on the banding material must be reduced at least enough so that the gripper slides over, or moves relative to, an additional length of the banding material as the gripper mechanism moves in the first direction. However, for the gripper to appropriately slide or move relative to the banding material requires that such deformed or raised portions of the banding material must not inhibit the relative movement of the gripper mechanism. In at least some circumstances, when the gripper attempts to move past such raised portions, the gripper contacts these portions with sufficient impact causing buckling of the banding material in the band tightening tool (i.e., between the gripping mechanism and the band being formed). Moreover, such buckling of the banding material within the band tightening tool can jam the tool thereby causing an operator to start the band tightening process over, and/or entirely replace the banding material being used to form the band.

[0004] Fig. 1 is illustrative of the above described steps (a) and (b). In Fig. 1 various portions of a prior art band tightening tool 18 are illustrated, and in particular, this figure shows two internal components of the band tightening tool: a gripping mechanism 20, and spaced apart therefrom, an additional gripping assembly 24, wherein the banding material 28 threads through both the mechanism 20 and the assembly 24. The gripping mechanism 20 includes a gripping body or block 30 with a proximal end 32, wherein the proximal end is relatively closer to the band 36 being formed about an object(s) 40 than the distal end 44 of the gripping body 30. Note that the dashed outline shows the furthest movement of the proximal end in the first direction of step (a) above. The gripping body 30 further includes a platform 48 for supporting the banding material as it passes through the gripping body. The gripping body 30 also includes an opening 52 that inclines toward the platform 48 as the opening extends toward the proximal end 32 of the gripping body. The gripping mechanism 20 further includes a cylindrical gripping pin (or gripper) 56 that is moveable within the opening 52. The gripping mechanism 20 additionally includes a biasing component (not shown) for biasing the gripping pin 56 in the direction of arrow 60. Accordingly, when the gripping mechanism 20 moves in the direction of arrow 64, the gripping pin 56 slides on the surface of the banding material 28. However, when the gripping mechanism 20 is moved in the second direction (i.e., the direction of arrow 68), the gripping pin 56 moves toward the proximal end 72 of the opening 52 and frictionally binds between the banding material 28

and an opposed portion of the proximal end 72, thereby gripping the banding material.

[0005] The gripping assembly 24 includes an inclined opening 76 and a gripping pin 80 that is moveable therein, wherein the pin 80 is biased toward the proximal end 84 of the opening 76. Thus during operation, in step (a), the pin 80 of the gripping assembly 24 frictionally binds between the banding material 28 and an opposed portion of the proximal end 84, thereby gripping the banding material 28 so that a band tension counterforce in the direction of arrow 88 does not pull the banding material 28 from the band tightening tool 18 (which includes both the gripping mechanism 20 and the gripping assembly 24) as the gripping mechanism 20 moves in the direction of arrow 64. Once the gripping mechanism 20 has completed its movement toward the gripping assembly 24, in step (b) above, the mechanism 20 reverses direction thereby causing the gripping mechanism to securely grip the banding material 20 and pull it in the direction of arrow 68 (as long as the force for moving the gripping mechanism 20 in the direction 68 overcomes any band tension counterforce in the direction of arrow 88). Since movement of the banding material 28 in the direction 68 causes the gripping pin 80 to release its grip on the banding material, additional banding material is pulled into the band tightening tool 18 thereby further tightening the band 36 about the object(s) 40.

[0006] However, since the gripping pin 56 can cause the banding material 28 to deform producing depressions 92 and/or raised portions 96, when the gripping mechanism 20 commences to move in the direction of arrow 64, such deformed portions of the banding material can prevent the gripping pin 56 from properly unbinding from the proximal end 72 of the opening 52. Thus, as the gripping mechanism 20 moves toward the gripping assembly 24, the banding material 20 may form a buckle 100 and jam the band tightening tool.

[0007] Accordingly, it is desirable to enhance such a band tightening tool so that the above described buckling of the banding material does not cause the tool to jam. More particularly, it is desirable to substantially prevent such banding material buckling in the tool. The invention as described hereinbelow provides such an enhancement to a band tightening tool.

Summary

[0008] The present invention is a banding material gripping mechanism and band tightening tool or apparatus for using the same, wherein there is a reduced likelihood of the banding material buckling in the tool. In particular, the present invention performs the operations of steps (a) and (b) described in the Background section hereinabove, but performs these steps with novel configurations of the gripping body and the gripper that reduce banding material buckling. In particular, the gripping body includes a central recess, and two extended portions (also denoted "wings" herein) on parallel sides of the central recess and defining the walls of the recess. More specifically, the central recess is bounded by: (i) a platform surface for supporting or guiding the banding material as the steps (a) and (b) described in the Background section above are performed, and (ii) the two walls provided by the wings of the gripping body, wherein the platform surface is therebetween. Provided within the platform surface is a novel slot whose width and length are aligned, respectively, with the width and length of the banding material traversing the platform surface when the steps (a) and (b) are iteratively performed. The slot operably cooperates with a gripper having a novel configuration, wherein the gripper includes a banding material gripping portion shaped for deforming the banding material into the slot when a banding material deforming force is applied to the gripper. The banding material gripping portion has a shape that protrudes into the banding material a furthest extent substantially at banding material locations both in line with a length of the slot, and substantially at a proximal end of the slot (i.e., the slot end where the banding material first comes in proximity to the slot). Thus, when the banding material deforms into the slot, the energy that could otherwise result in a banding material raised portion in front of (i.e., proximally) of the gripper (as described in the Background section hereinabove) is now substantially directed into deforming the banding material into the slot. Moreover, in at least some embodiments, the shape of the gripping portion may be convex relative to a width of the banding material thus causing the banding material surface being contacted by the gripping portion to become concave, and such concavity further reduces the formation of such raised portions proximal of the gripper band material deforming area.

[0009] It is also an aspect of the invention that such in slot banding material deformations are substantially adjacent to the proximal terminating end of the slot. Thus, such deformations can also serve as locks for further preventing the banding material from retracting from the band tightening tool to thereby relieve the band tightening tension.

[0010] It is also an aspect of the present invention that the gripping mechanism of the present invention may be used in prior art band tightening tools as a replacement for prior art gripping mechanisms.

[0011] Other features and benefits of the present invention will become evident from the accompanying figures, and their description including the Detailed Description hereinbelow.

Brief Description of the Drawings

[0012]

Fig. 1 shows the components and operation of a prior art embodiment of the portion of a band tightening tool 18, wherein this portion tightens a banding material 28 about one or more objects 40.

Fig. 2 shows an embodiment of the internal band tightening components of a band tightening tool 18m according to the present invention, wherein a novel gripping body 30m is employed for tightening the banding material 28 without buckling the banding material and jamming the band tightening tool 18m.

Fig. 3 shows a perspective view of the gripping mechanism 20m.

Fig. 4 shows a top view of the gripping body (equivalently gripping block) 30m.

Fig. 5 shows a side view of the gripping mechanism 20m.

Fig. 6 shows an end view of the gripping body 30m.

Fig. 7 shows a side view of the gripping mechanism 20m with a series of banding material 28 deformed portions 200 in the slot 198.

Detailed Description

[0013] Figs. 2 through 7 are illustrative of the present invention. Many of the components and/or features identified in these figures correspond to components and/or features of the prior art as illustrated in Fig. 1 and described in Background section above. Accordingly, the components and/or features of the present invention that correspond with labeled components and/or features of Fig. 1 are labeled with the same numeral in Figs. 2-7. However, such components and/or features of the present invention are also further identified by a suffix of an "m" following each such numeral label to thereby indicate that such components and/or features may be enhanced and/or modified to more effectively provide the benefits of the present invention.

[0014] Referring to Fig. 2, an embodiment of a band tightening tool 18m is illustrated, wherein this tool substantially reduces or entirely prevents the jamming of the tool due to the buckling of the banding material 28 discussed with reference to Fig. 1. The present embodiment of the tool 18m is pneumatic, wherein there are two pneumatic cylinders 120 and 124 for, respectively, tensioning the banding material 28 when forming a band, and actuating a tool head 134 that both cuts the banding material and forms a band lock for securing the tensioned band about the obj ect(s) being banded. In particular, the pneumatic cylinder 120 provides the force for moving the clevis 138 in the direction of arrow 142, and thereby causing the tensioning arm 146 to pivot about pin 150 so that the tensioning arm opposite end 154 moves in the direction of arrow 158, and compresses the spring 162 via linkage 166. Additionally, since the arm end 154 is pivotally secured via pin 170 to a gripping mechanism 20m, this gripping mechanism is also urged in the direction of arrow 158 by the force from the pneumatic cylinder 120. Thus, under the urging of this force, the gripping mechanism 20m pulls the banding material 28 (not shown in Fig. 2) as described in step (b) of the Background section hereinabove. Subsequently, when the clevis 138 is fully extended in the direction of arrow 142, the cylinder 120 pressure is reduced, and spring 162 reverses the pivoting movement of the tensioning arm 146 about the pin 150. Thus, the clevis 138 moves in the direction opposite to arrow 142, and the gripping mechanism 20m moves in the direction of arrow 64 thereby moving along a length of the banding material to reach a new position on the banding material for again gripping and inducing additional tension in the banding material.

[0015] Referring to Figs. 3 through 8, a novel embodiment of the gripping mechanism 20m according to the present invention is illustrated. The gripping mechanism 20m includes a gripping body or block 30m with a proximal end 32m and distal end 44m, wherein, when assembled within a band tightening tool (e.g., tool 18m), the proximal end 32m is relatively closer to a band (e. g., band 36 of Fig. 1) being formed about an object(s) than the distal end 44m. The gripping body 30m, in turn, includes a central recess 180 that extends from the proximal end 32m to the distal end 44m. The recess 180 is bounded by a first wing 184 and a second wing 188, wherein in at least one embodiment, the wings 124 and 128 are mirror images of one another. The recess 180 is also bounded by a platform 48m, wherein the platform extends between the wings 184 and 188, and also extends from a more proximal end 190 (Fig. 4) to a more distal end 192. The platform 48m retains the banding material 28 within the gripping body 30m as the banding material passes therethrough, and is used in gripping the banding material 28. As best shown in Fig. 4, the platform 48m includes:

(i) a banding material ramp 194 (see Figs. 3 and 5 as well) for assuring that a free end of the banding material 28 enters the recess 180,

(ii) a surface 196 for supporting and/or contacting the banding material 28 as it passes through the recess 180, and

(iii) a slot 198 substantially in a center area between the wings 184 and 188, wherein the slot is for receiving a deformed portion 200 (Fig. 7) of the banding material 28 resulting from a gripping of the band material by a gripper 56m (described hereinbelow). Moreover, note that the slot 198 has a proximal end 202 and a distal end 204, wherein the slot proximal end 202 is relatively closer to the gripping body proximal end 32m (but as illustrated, the slot proximal end may be offset distally from the proximal end 32m). Additionally, since each deformed portion of the banding material 28 moves from the slot proximal end 202 toward the distal end 44m as the excess banding material taken from a band being formed, the slot 198 extends to the distal end 44m of the gripping body 30m, and more particularly, the slot distal end 204 extends through the end 192 of the platform 48m and its surface 196.

[0016] The surface 196 extends from the ramp 194 to the distal end 192 of the platform 48m. The surface 196 includes a gripping area 208 generally identified by the shaded area of Fig. 4, wherein this area is where the gripper 56m grips the banding material 28. More specifically, the gripping area 208 is between the ramp 194 and the slot proximal end 202. However, in some embodiments, the slot 198 may extend into the gripping area 208, e.g., depending on the shape of the slot 198 and/or the shape of the gripper 56m.

[0017] The gripping body 30m also includes a bore 212 (Figs. 2 and 3) that extends completely through both the wings 184 and 188 of the gripping body. The bore 212 is the retainer for the pin 170 (Fig. 2) that operably attaches the tension arm 146 to the gripping body 30m.

[0018] The gripping body 30m further includes at least one (and preferably two mirror image) openings 52m in the wings184 and 188, wherein each of these openings inclines toward the platform 48m (i.e., the surface 196) as the opening extends toward the proximal end 32m of the gripping body. Note that the angular range of this inclination may be in a range of 25 to 45 degrees relative to, e.g., the surface 196, and more preferably 30 to 40 degrees, and most preferably about 35 degrees. Each of the openings 52m has a profile of an elongated circle having a circular proximal end 72m, and a distal end 214, each with a same diameter. The proximal end 72m of each opening 52m may extend to or traverse into the surface 196, and the proximal end 72m may be closer to the proximal end 32m of the gripping block than is the slot proximal end 202.

[0019] As mentioned above, the gripping mechanism 20m also includes a gripper 56m. An embodiment of the gripper 56m is shown in Fig. 3. The gripper 56m may include mirror image cylindrical end portions 220 and 224 as well as a central truncated spherical portion 228. The end portions 220 and 224 are connected to the spherical portion 228 by a pair of truncated generally conical portions 232. Note, that the gripper 56m may be machined from a single metal cylinder having its central axis 234 coincident with the central axes of the cylindrical end portions 220 and 224, and having a diameter substantially identical to the diameter of these end portions 220 and 224.

[0020] When the gripper 56m is provided within the gripper block 30m, each of the cylindrical end portions 220 and 224 resides within one of the openings 52m such that the spherical portion 228 is positioned substantially midway between the wings 184 and 188. Note that the diameter of the end portions 220 and 224 is only slightly smaller than the diameter of the proximal and distal ends 72m and 218 of the openings 52m. However, the diameter difference is effective for allowing each of the cylindrical end portions 220 and 224 to substantially freely slide within its opening 52m.

[0021] The gripping body 30m further includes a pair of gripper biasing recesses 216, one in each of the wings 184 and 188. Within each wing, its biasing recess 216 is generally cylindrical in shape, closed to the central recess 180, and open on the side of the wing that is opposite the wing side facing the central recess. Moreover, the proximal end 218 of each biasing recess 216 opens into the distal end 214 of the adjacent opening 52m in the same wing. Additionally, each biasing recess 216 may be of sufficient length (between its proximal end 218 and its distal end 222) for effectively seating a biasing component such as compression spring 240 (Fig. 2) for biasing the gripper 56m in the direction of arrow 60. Thus, since the biasing component in each of the recesses 216 provides substantially the same compressive resistance to a corresponding one of the cylindrical end portions 220 and 224, and since there is a relatively small tolerance (in the traverse directions to arrow 60) between each opening 52m and its contained cylindrical end portion, the gripper's central axis 234 remains substantially parallel to the surface 196 and any banding material 28 provided therebetween.

[0022] Thus in operation, each of the cylindrical end portions 220 and 224 of the gripper 56m is provided in one of the openings 52m so that these end portions can slidably move within their corresponding openings 52m. In particular, the gripper 56m is able to at least move (relative to the gripping block 30m) between: (1) a "released state", wherein the truncated spherical portion 228 slides on the surface of the (any) banding material 28 (when the gripping block 30m moves the direction of arrow 64), and (2) a "gripping state", wherein the cylindrical end portions 220 and 224 move synchronously toward the proximal ends 72m of the openings 52m and the spherical portion 228 grips the (any) banding material 28 provided on the gripping area 208. More precisely, in the released state, the gripper 56m is positioned generally at location 244 (Fig. 5) wherein it slides along the banding material 28 that is sandwiched between the truncated spherical portion 228, and a portion of the slot 198 distal to its proximal end 202. However, when the gripping block 30m reverses direction (thereby moving in the direction of arrow 68), the gripper 56m continues to move in the direction of arrow 64 (at least relative to the gripper block) due to: (a) the inertia of the gripper, (b) the biasing component, and/or (c) the frictional pull from the banding material 28 attempting to relieve the band tightening tension. Accordingly, a substantially increased force is exerted on the truncated spherical portion 228 to force it into the banding material 28 (due to the inclination of the openings 52m relative to the platform surface 196). The increased force corresponds with the spherical portion 228 overlying the slot proximal end 202 (or equivalently, the spherical portion forcibly moving into the surface of the banding material along an extent of the banding material whose opposite side is substantially adjacent to the slot proximal end). Thus, as the spherical portion 228 forcibly travels into the banding material 28 surface, the portion 228 effectively deforms or pushes the banding material 28 into the slot proximal end 202 thereby creating a deformed portion

252 in the slot 198 as shown in Fig. 7. Alternatively stated, the surface of the banding material 28 contacted by the increased force on the spherical portion 228 deforms to conform to the contour of the curvature of the spherical portion 228, and since the circumference 248 (Fig. 3) of the spherical portion extending furthest from the central axis 234 is substantially aligned with the central longitudinal axis 248 (Fig. 4) of the slot 198, the banding material is effectively pushed into the slot 198 near or at its proximal end 202. Furthermore, each deformed portion 252 of the banding material 28 in the slot 198 may act much like a temporary band lock when it is against the slot proximal end 202. Thus, the banding material 28 is less likely to slip from the gripper 56m than prior art versions thereof.

[0023] In one preferred embodiment, the slot 198 has depth 256 (Fig. 5) that is at least equal to the thickness of the "t" (Figs. 2 and 7) of the banding material 28. Moreover, the width 260 (Fig. 4) of the slot 198 may be in the range of 40% to 60% of the width "w" (Fig. 3) of the banding material 28. Furthermore, the ratio of the slot depth 256 to its width 260 may be about 0.2. Additionally, the spherical portion 228 may have a diameter of at least the width 260 of the slot 198.

[0024] Fig. 7 shows a side view of the gripping mechanism 20m wherein the gripper 56m is in the process of creating a deformed portion 252 in the slot proximal end 202, and wherein the figure also shows previously created deformed portions 252 that have moved some length through the extent of the slot 198. Note that since the slot 198 extends to the distal platform end 192 (Fig. 4), the banding material downstream (i.e., distally) from gripping area 208 tends to remain in contact with the platform surface 196, and thus freely slides between the platform 48m and the pin 170.

[0025] Various modifications of the above-described gripper mechanism 20m are also within the scope of the invention. For example, the spherical portion 228 may have a larger diameter. That is, a diameter substantially equal to the width "w" of the banding material 28, and large diameters are also within the scope of the invention. It is also contemplated that the spherical portion 228 may be replaced with a portion having a different shape than a sphere. For example, an ellipsoid (e.g., with its major axis aligned with the central axis 234) may be used. Alternatively, a cylinder may be used, wherein the cylinder is oriented (relative to the central axis 234) in the same manner as the end portions 220 and 224, and, wherein this cylinder has a thickness (along the central axis 234) of less than the width 260 of the slot 198. Furthermore, the slot 198 need not have a rectangular cross section as shown in Fig. 6. For example, the slot cross section may be trapezoidal, wherein the longer of the parallel sides corresponds with the opening of the slot 198 into the surface 196. Moreover, there may be a replacement for the spherical portion 228 that has similar but a reduced or offset trapezoidal profile such that the difference between the trapezoidal slot cross section and the trapezoidal profile is related to the thickness "t" of the banding material 28.

[0026] Regardless, of the shape of the band deforming portion 228 and the cross section of the slot 198, it is within the scope of the present invention that the gripper 56m deforms the banding material 28 in a manner that such any raised portion of the banding material 28 is substantially reduced over such raised portions that are produced by, e.g., the prior art embodiments discussed in the background section hereinabove. For instance, the present invention precludes upstream (i.e., more toward a band being created) creation of a buckle 100 (Fig. 1). In particular, one or more of the following techniques may be used to preclude such buckles:

(1) Provide deformations in the banding material 28 that are curved across the width "w" of the banding material 28 so that the banding material is, e.g., concave across its width; and

(2) Provide deformations in the banding material 28 wherein the deformations reside substantially in the slot 198.

[0027] Additionally, it is also within the scope of the present invention to provide two or more slots 198 together with a corresponding deforming portion 228 of the gripper 56m, wherein the deforming portion 228 has a shape effective for providing at least one of (1) and (2) above for a plurality banding material 28 width extents. Thus, e.g., there may be two slots 198 spaced apart so that they are near the edges of the banding material 28, and the deforming portion 228 may be shaped so as to have a profile substantially similar to a figure "8".

[0028] The foregoing description of the present invention has been presented for purposes of illustration and description. Furthermore, the description is not intended to limit the invention to the form disclosed herein. Consequently, variations and modifications commensurate with the above teachings, and the skill or knowledge of the relevant art, are within the scope of the present invention. The embodiments described hereinabove are further intended to explain the best mode(s) known for practicing the invention and to enable others skilled in the art to utilize the invention in such, or other, embodiments and with various modifications required by their particular applications or uses of the present invention. It is intended that the appended claims be construed to include alternative embodiments to the extent permitted by the prior art.

Claims

1. A method for holding a banding material, comprising:

providing a band tightening tool including a gripping mechanism having a gripper and a slot

with a slot proximal end; and
gripping, adjacent to said slot proximal end, contacted portions of said banding material.

2. The method of Claim 1 further including, after said gripping, releasing said banding material by relative movement of said gripper.

3. The method of Claim 2 wherein said gripper moves relative to a gripping body of said gripping mechanism.

4. The method of Claim 1 wherein said gripper includes a banding material contacting portion that engages said contacted portions of said banding material, and in which said gripper contacting portion has an extent of movement that substantially includes said slot proximal end.

5. The method of Claim 1 wherein said gripping step includes deforming at least some of said contacted portions of said banding material into said slot adjacent to said proximal end thereof.

6. The method of Claim 1 wherein said banding material has a thickness and said slot has a depth that is at least equal to said banding material thickness.

7. The method of Claim 3 wherein said gripping body has a distal end that is more adjacent to a distal end of said slot than to the slot proximal end.

8. An apparatus for holding a banding material, comprising:

a gripping mechanism including:
a gripping body having at least a first opening and a platform surface with a slot formed therein, said gripping body having a proximal end and a distal end and said slot having a proximal end and a distal end; and
a gripper that is relatively movable in at least said first opening;

wherein said gripper has a gripping state and a released state and when said gripper is in said gripping state, said gripper is adjacent to said slot proximal end.

9. The apparatus of Claim 8 wherein said gripper includes a banding material contacting portion that substantially overlies said slot proximal end when said gripper is in said gripping state.

10. The apparatus of Claim 8 wherein said slot distal end is closer to said gripping body distal end than said slot proximal end is to said gripping body proximal end.

11. The apparatus of Claim 8 wherein a first distance is defined between said slot proximal end and said gripping body proximal end and a second distance is defined between a proximal end of said first opening and said gripping body proximal end and in which said first distance is greater than said second distance.

12. The apparatus of Claim 8 wherein said slot distal end extends through an end of said platform surface.

13. The apparatus of Claim 8 further including a depth of said slot, wherein said depth is at least equal to a thickness of said banding material.

14. The apparatus of Claim 8 wherein said slot has an aspect ratio defined by depth to width and in which said aspect ratio is less than about 0.2.

15. The apparatus of Claim 8, wherein said banding material has contacted portions are wherein when one of said contacted portions is engaged by said gripper when said gripper is in said gripping state: (i) a relative movement between said gripper and said banding material is prevented, and (ii) said one contacted portion substantially overlies said slot proximal end.

16. The apparatus of Claim 8 wherein said gripping body includes a first wing and a second wing with said slot located therebetween and in which said first opening is formed in said first wing and a second opening is formed in said second wing, said gripper being held in said first and second openings.

17. The apparatus of Claim 16 wherein said gripper includes a first gripper end element, a second gripper end element and an intermediate gripping element therebetween, said intermediate gripping element having a periphery and in which contacting portions are part thereof.

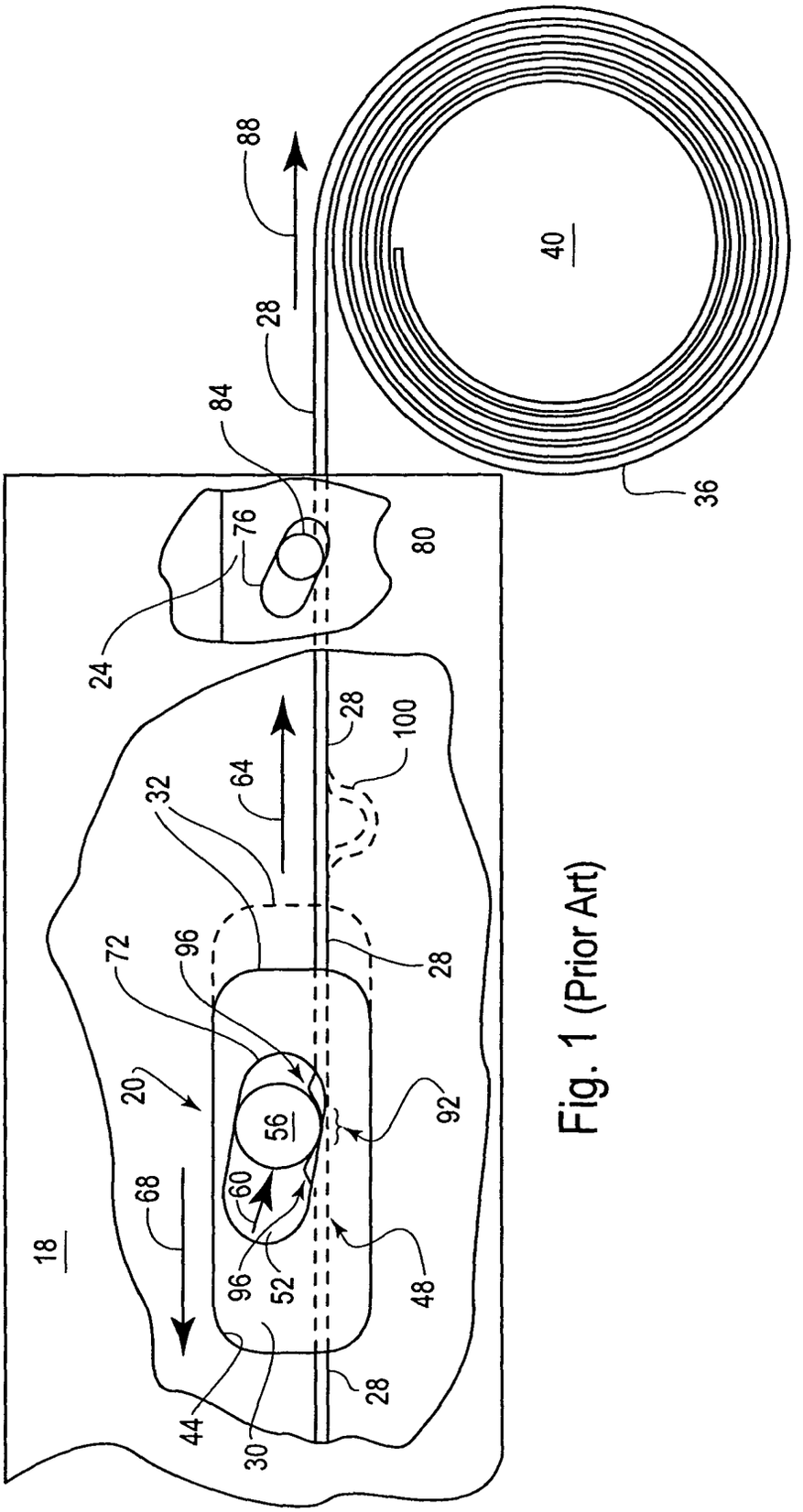
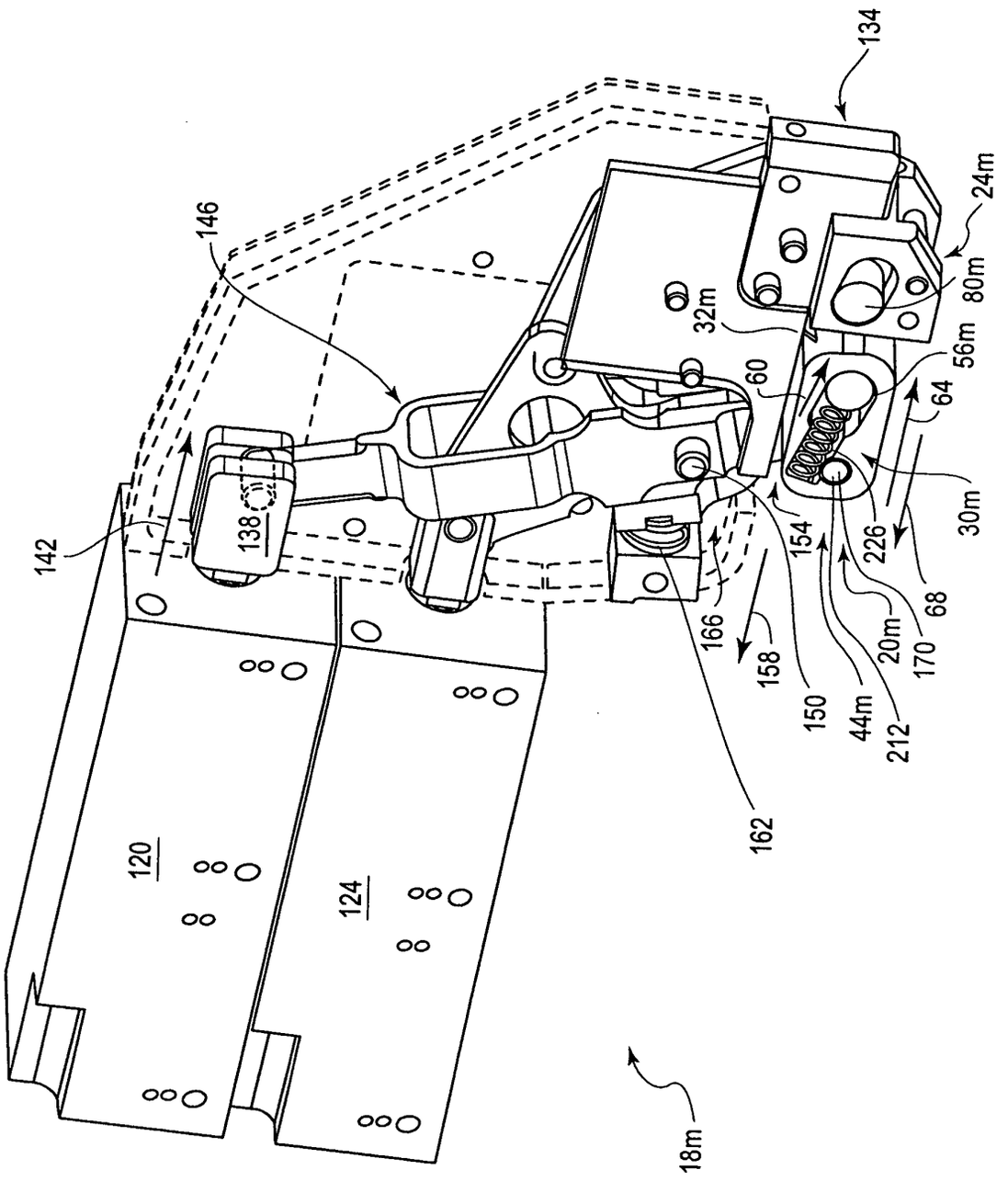


Fig. 1 (Prior Art)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212
162
120
124
18m

Fig. 2

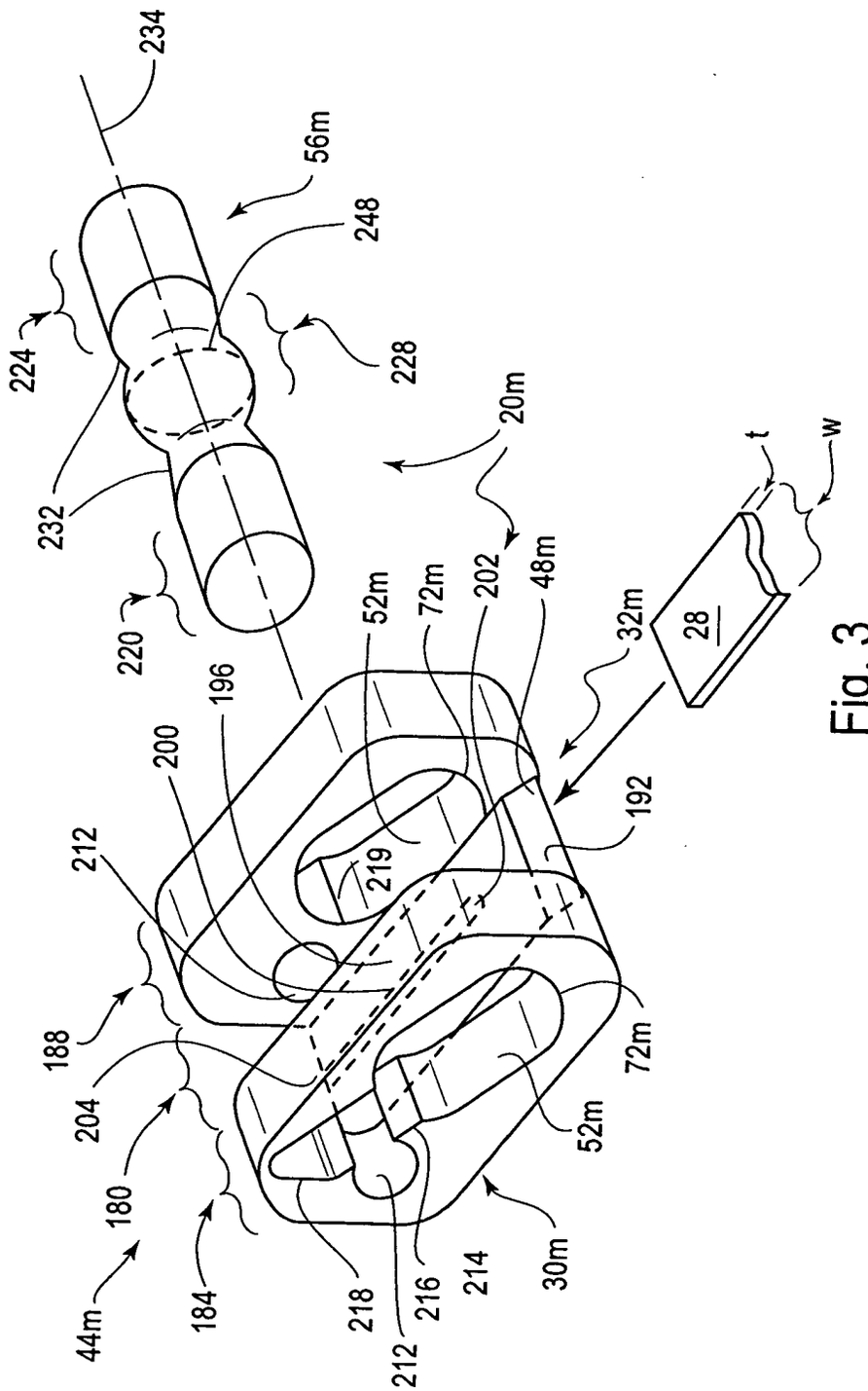
234
56m
248
224
228
20m
232
220
202
48m
52m
72m
196
200
212
219
192
32m
28
t
w
188
204
180
184
44m
218
216
214
30m
52m
72m
212

Fig. 3

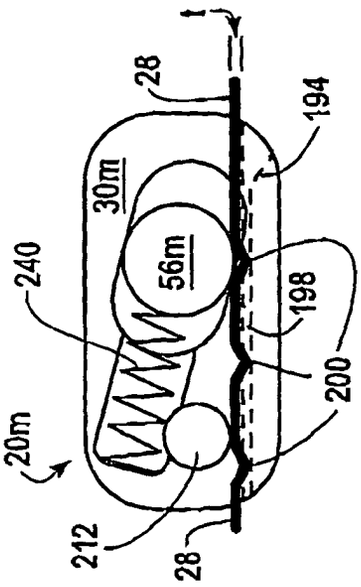

Fig. 7

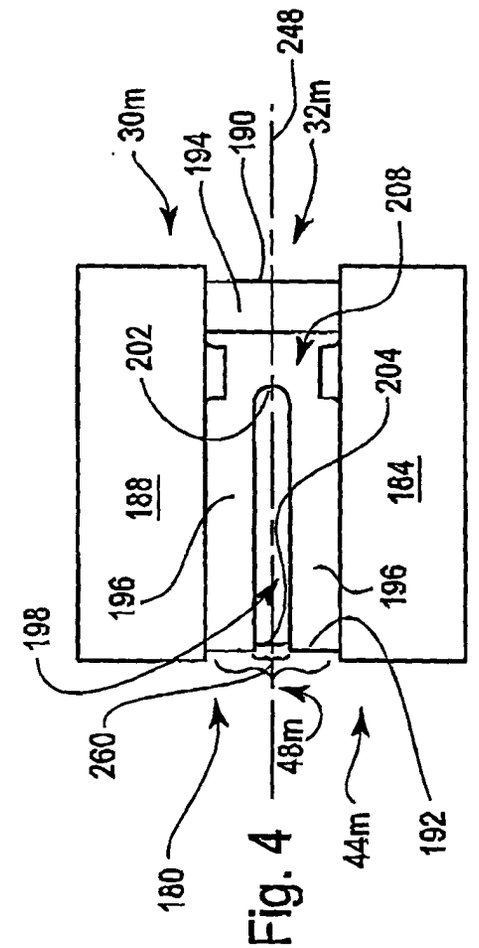

Fig. 4

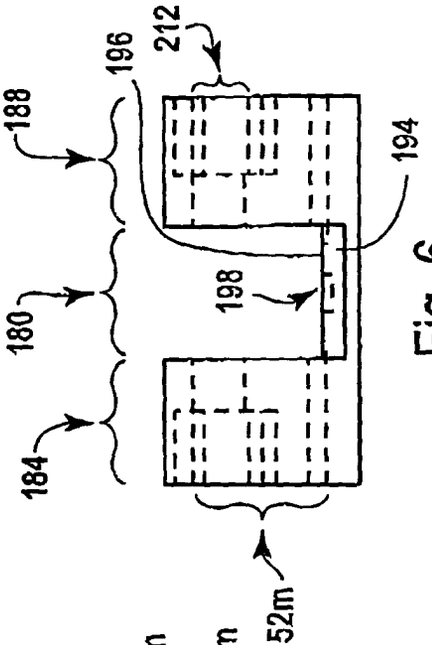

Fig. 6

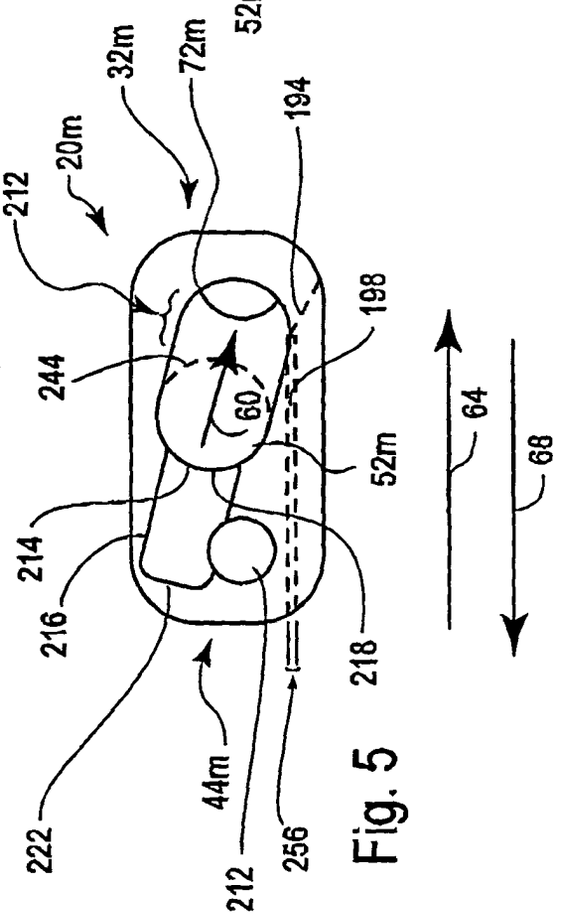

Fig. 5

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Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 April 2005	Ungureanu, M

CATEGORY OF CITED DOCUMENTS

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