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Stauffer

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[54] **TAPE-WRAPPING METHOD AND APPARATUS**

[75] Inventor: **Du Wayne W. Stauffer,** Fort Wayne, Ind.

[73] Assignee: **Garlock Inc.,** Palmyra, N.Y.

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[52] **U.S. Cl.** **242/7.02,** 156/189, 156/392, 156/446, 156/543, 226/113, 242/7.23, 242/55

[51] **Int. Cl.** **B65h 17/42,** B65h 81/00

[58] **Field of Search** 242/55, 75.3, 7.23, 242/67.2, 54, 7.02; 156/543, 189, 162, 361, 113, 392, 446; 226/115, 114

[56] **References Cited**

UNITED STATES PATENTS

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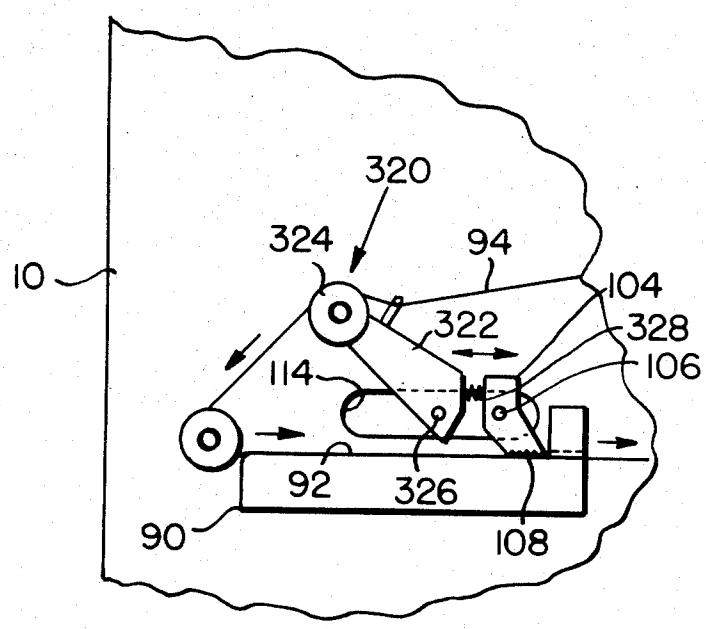
Primary Examiner—Billy S. Taylor

Attorney—Schovee & Boston

[57] **ABSTRACT**

An improvement in a method and apparatus for wrapping polytetrafluoroethylene tape onto the screw threads of fluid conduits for fluid sealing purposes. The wrapping is accomplished during, and in response to, a single up-down cycle of a linear gear rack, and comprises feeding the tape onto the workpiece during the up-stroke of the gear rack, and rotating the workpiece to wrap it with tape during the down-stroke of the gear rack. This provides a significant reduction in the length of stroke required and also in cycle time, over the known device using the down-stroke to accomplish both the feeding and the wrapping.

15 Claims, 2 Drawing Figures



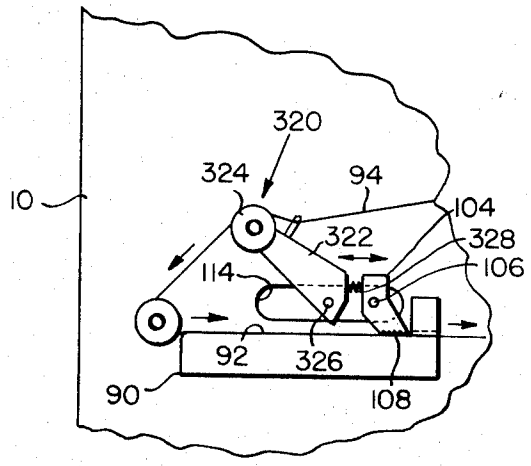


FIG. 1

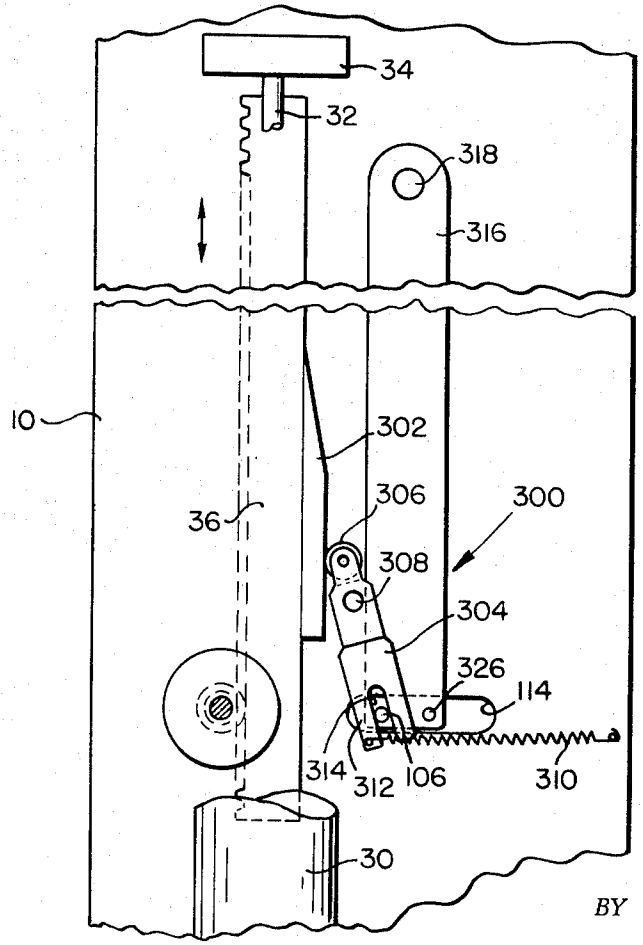


FIG. 2

INVENTOR.
DuWayne W. Stauffer

BY

Schover + Boston

ATTORNEYS

TAPE-WRAPPING METHOD AND APPARATUS

CROSS REFERENCE TO RELATED APPLICATION

This invention is an improvement over the invention described in U.S. Pat. No. 3,320,342; the disclosure in said U.S. Pat. No. 3,320,342 is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to tape-wrapping apparatus and method, and in particular to an improved apparatus and method providing faster operation and a smaller machine.

2. Description of the Prior Art

The present invention is an improvement in the tape-wrapping method and apparatus described in U.S. Pat. No. 3,320,342. In that patent, a linear, reciprocating gear rack is employed that first feeds tape into contact with a workpiece (such as a threaded nipple) to be wrapped by the tape, and that then rotates the workpiece to wrap the tape onto the workpiece. The feeding and rotating are both accomplished during a single up-down cycle of the gear rack, and in fact, both steps are accomplished during the down-stroke of the rack. According to the improvement of the present invention, the tape is fed into contact with the workpiece during the up-stroke of the gear rack, leaving the entire down-stroke available for rotating the workpiece to wrap it with the tape, thus reducing the overall length of the stroke of the gear rack and of the pneumatic power cylinder, and also reducing the cycle time for each job.

It is therefore an object of the present invention to provide an improved tape-wrapping apparatus and method, and in particular, to provide a smaller machine that operates faster.

SUMMARY OF THE INVENTION

According to the present invention, a workpiece is wrapped with tape during, and in response to, a single up-down cycle of a linear gear rack, by feeding the tape into contact with the workpiece during the up-stroke of the gear rack, and by rotating the workpiece to wrap it with the tape during the down-stroke of the gear rack.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be more fully understood by reference to the following detailed description thereof, when read in conjunction with the attached drawings, wherein like reference numerals refer to like elements, and wherein:

FIG. 1 is a simplified, schematic front view of the preferred embodiment of the present invention, and corresponds to FIG. 1 of U.S. Pat. No. 3,320,342, and

FIG. 2 is a simplified, schematic rear view of the preferred embodiment of the present invention, and corresponds to FIG. 2 of U.S. Pat. No. 3,320,342.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The preferred embodiment of the present invention will now be described with detailed reference to the drawings. It is noted that, where possible, the reference numerals employed in this description will be identical with those reference numerals employed in U.S. Pat. No. 3,320,342. The new elements of the present invention are referred to with reference numerals starting at 300. The basic machine described in U.S. Pat. No. 3,320,342, is the same as that of the present invention, and thus the entire machine need not be described in detail here, but rather reference is hereby made to U.S. Pat. No. 3,320,342, incorporated herein by reference, for any additional information on the present invention. This invention differs from that described in U.S. Pat. No. 3,320,342, primarily in the means for feeding the tape **94** into contact with the workpiece (not shown here, but see the nipple **202,** removably held on spindle **56,** in FIG. **3** of U.S. Pat. No. 3,320,342). In U.S. Pat. No. 3,320,342, this feed means included, for example, the guide block **116,** the crank **120,** the lever **126** and the pin **143.** The description of the tape feed means starts in the patent at column **5,** line **9.** In addition to the present invention employing a different tape feed means, the knife mechanism shown in FIGS. **1–5** in U.S. Pat. No. 3,320,342 is not used in the present invention. A knife means forms no part of the present invention, and any suitable knife means, including manually cutting, can be used.

With reference now to the drawings, FIG. **1** is a front view of the machine of the present invention and shows a frame **10** on which a tape supply roll (not shown) is mounted for supplying tape **94** to be wrapped onto a workpiece (not shown). The wrapping is accomplished by first feeding the tape **94** to the workpiece and then rotating the workpiece to wrap the tape **94** around it. The feeding and rotating steps in both the present invention and in the invention of U.S. Pat. No. 3,320,342 are accomplished during a single up-down cycle of a vertical gear rack **36.** The gear rack is preferably driven by a double acting pneumatic power cylinder **30.**

In the present invention, the cylinder **30** is mounted on the floor (not shown) of the machine with its piston rod **32** extending upwardly therefrom and connected to a yoke **34** secured, in turn, to the upper end of the gear rack **36,** by means not shown. The gear rack **36** always completes its previous cycle with the gear rack in its down position (the up position is shown in FIG. **2**). Thus, each up-down cycle includes first an upward stroke and then a downward stroke. The device described in U.S. Pat. No. 3,320,342 employed the downward stroke of the gear rack to accomplish both the feeding of the tape **94** to the workpiece, and the rotating of the workpiece to wrap the tape onto the workpiece. According to the present invention, the feeding step is accomplished on the upward stroke, so that the entire downward stroke can be used for wrapping, whereby both the total movement and the cycle time can be reduced by about 20 percent. Since the present invention employs the same means for rotating the workpiece to wrap the workpiece described in U.S. Pat. No. 3,320,342, such means need not be described in detail here.

Before describing the details of the tape **94** feed means **300** of the present invention, reference will first be made to FIG. **1** and to that part of the feed means of the present invention that is substantially the same as the corresponding part of the feed means of U.S. Pat. No. 3,320,342. FIG. **1** shows a tape feed block **90** mounted on the frame **10.** The feed block **90** has a groove **92** in its upper surface, in which groove **92** the tape **94** travels. The tape **94** is fed to the right as shown in FIG. **1** by means of a tape foot or finger **104,** having serrations **108** on its bottom. FIG. **1** corresponds to FIG. **2** in that both show the finger **104** after it has just

completed feeding the tape to the rotating means (not shown).

The feeding means **300** of the present invention for moving the finger **104** to feed the tape **94,** during the upward stroke of the gear rack **36,** will now be described in detail. Referring to FIG. **2,** the feeding means **300** includes a cam **302** on the lower portion of the gear rack **36** and a yoke **304** having a cam follower **306** (preferably a rotatable wheel) riding on the cam **302.** The yoke **304** is mounted on the frame **10** for pivotal movement about a pivot **308,** and the cam follower **306** is spring biased into contact with the cam **302** by means of a tension spring **310** connected between the frame **10** and a bifurcated end **312** of the yoke **304.** A shaft **106** is connected to the finger **104** and extends through a slot **114** in the frame **10** and then into a slot **314** in the bifurcated end **312** of the yoke **304.** In addition, a vertical slide arm **316** is pivotally mounted to the back of the frame **10** at a pivot **318.** The shaft **106** is rigidly connected to the slide arm **316** at a point on the slide arm coinciding with the horizontal centerline of the slot **114.** The shaft **106** is freely slidable in the slot **114,** and the finger **104** is mounted for free arcuate movement on the shaft **106.** The slide arm **316** is located approximately perpendicular to the length of the slot **114,** and slide arm **316** has a sufficient length that the movement of the shaft **106** is substantially horizontal and parallel to the groove **92.**

From the above description, it will be seen that during the upward stroke of the gear rack **36,** the cam **302,** cam-follower **306** arrangement causes the yoke **304** to rotate clockwise (in FIG. **2**) about the pivot **308,** causing the shaft **106** and the finger **104** to be moved to the left (in FIG. **2**), to feed the tape **94** to the right (as viewed in FIG. **1**).

In addition to the above-described structure, the present invention includes a guide assembly **320** see FIG. **1**). The guide assembly **320** includes a support **322** and an idler roller **324** rotataby mounted on the support **322.** The guide assembly **320** is rigidly connected to a shaft **326** that extends through the slot **114** and is rigidly connected to the slide arm **316.** A small compression spring **328** is positioned between the support **322** and the finger **104,** to spring bias the serrations **108** of the finger **104** into contact with the tape **94** in the groove **92.**

As the finger **104** moves to the right as viewed in FIG. **1** to feed the tape **94** to the workpiece, the simultaneous movement to the right of the guide assembly **320,** releases tension on the tape **94,** to aid the finger **104** in feeding the tape **94.**

When the gear rack **36** begins its downward stroke, the spring **310** pulls the finger **104** and the guide assembly **320** back to their original position (not shown) to the extreme right (as viewed in FIG. **2**). When the tape is being wrapped on the workpiece, it slides with respect to the finger **104;** the tape **94** can push the finger **104** out of the way and cause the finger to pivot slightly in a counterclockwise direction, as viewed in FIG. **1,** against the force of the small spring **328.**

As mentioned above, the present invention does not employ the tape cutting means described in U.S. Pat. No. 3,320,342, because in that device the knife was in the closed position during all of the up-stroke. While any suitable knife can be used in the present invention, including manually cutting the tape, it is preferred to use a knife that is pivoted out of the way except when actually doing the cutting, and that is actuated to do the cutting in response to movement of the gear rack during its down-stroke.

The present invention has the advantage over the machine of U.S. Pat. No. 3,320,342, for example, of being able to wrap workpiece diameter sizes of from ⅛ to ¾ inch, with a power cylinder having only a 4 inch stroke, whereas the device of U.S. Pat. No. 3,320,342 would require a **5** inch stroke for the same job. This is about a 20 percent reduction in cycle time and in total movement.

Throughout the present specification and claims, the term "up-down cycle of the gear rack" is intended only to be relative. For example, the apparatus can be mounted upside-down from that shown in the drawings, or even mounted at 90° to that shown. In either case, the terms "up-down cycle" and "forward-return" are intended to also include down-up, right-left, or any other forward-back or back-forward cycles. While a double-acting pneumatic power cylinder **30** is preferred for use in driving the gear rack **36,** other motive means can be used. While the wrapping roller means described in U.S. Pat. No. 3,320,342 are preferred, other wrapping means can be used.

The invention has been described in detail with particular reference to the preferred embodiment thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention as described hereinabove and as defined in the appended claims.

I claim:

1. In a tape-wrapping apparatus for wrapping a workpiece with a length of tape by means of a linear gear rack during a single up-down cycle of the gear rack, and including means responsive to movement of said gear rack for feeding tape into contact with said workpiece and means responsive to movement of said gear rack for rotating said workpiece to wrap said tape around said workpiece, the improvement wherein:

a. said feeding means comprises means for feeding said tape during the up-stroke of said gear rack, and includes a tape feed block and a movable tape foot in contact with said block for holding a length of said tape therebetween, and means responsive to movement of said gear rack in said up-stroke for moving said tape foot relative to said feed block to feed said tape; and wherein

b. said rotating means comprises means for rotating said workpiece during the down-stroke of said gear rack.

2. The apparatus according to claim **1** wherein said moving means includes a cam surface on said gear rack, a yoke including a cam follower at one end thereof and means connecting the other end of said yoke to said tape foot, pivot means on said yoke in between said two ends, and means for biasing said cam follower into contact with said cam.

3. The apparatus according to claim **2** wherein said connecting means comprises said other end of said yoke including a slot, and a pin connected to said tape foot and riding freely in said slot.

4. the apparatus according to claim **3** including an elongated slide arm positioned approximately perpendicularly to the plane of movement of said tape foot and being rigidly connected adjacent one end thereof to said pin, and said slide arm being pivotally connected at the other end thereof for free swinging move-

ment at said one end thereof, for supporting said tape foot shaft in a substantially horizontal plane troughout the movement of said tape foot.

5. The apparatus according to claim 4 including a guide assembly connected to said one end of said slide arm for movement with said tape foot, for releasing tension on said tape during feeding of said tape.

6. The apparatus according to claim 5 wherein said guide assembly includes an idler roller for said tape and including a spring connected between said bobbin assembly and said tape foot for biasing said tape foot toward said tape feed block.

7. The apparatus according to claim 6 wherein said workpiece is a screw threaded member, said tape is polytetrafluoroethylene, and including a double acting pneumatic power cylinder for driving said gear rack.

8. A method for wrapping the threads of a workpiece with a predetermined length of tape during a single forward-return cycle of movement of a linear gear rack comprising: moving a linear gear rack in a forward stroke and feeding a free end of said tape toward and into contact with the workpiece during and in response to said forward stroke of said gear rack, and then moving said linear gear rack in a return stroke and rotating the workpiece, during and in response to said return stroke of said gear rack, a sufficient amount to completely wrap all of said predetermined length of tape onto said workpiece.

9. The method according to claim 8 wherein said feeding step comprises feeding tetrafluorethylene tape onto screw threads of a cylindrical workpiece.

10. The method according to claim 8 wherein said feeding step comprises contacting a portion of said tape between a stationary tape feed block and a movable tape foot and moving said tape foot in response to said forward stroke of said gear rack to move said free end of said tape into contact with said workpiece.

11. The method according to claim 10 wherein said moving step comprises converting movement of said gear rack during said forward stroke to longitudinal movement of said tape foot across said tape feed block from a starting position to an end position and including returning said tape foot to said starting position during said back stroke of said gear rack.

12. The method according to claim 8 including guiding a relatively long strip of tape that includes said predetermined length of tape, through a guide path, and reducing the length of said guide path simultaneously with said feeding step to reduce tension on said tape during said feeding step.

13. Apparatus for wrapping the threads of a workpiece with a predetermined length of tape during a single forward-return cycle of movement of a linear gear rack comprising:

a. a linear gear rack;

b. means for moving said gear rack in a forward stroke and then in a return stroke;

c. means for feeding a free end of said tape toward and into contact with the threads of a workpiece during and in response to movement of said gear rack in said forward stroke; and

d. means for rotating a workpiece and for wrapping all of said predetermined length of tape onto the threads of a workpiece, during and in response to movement of said gear rack in said return stroke.

14. The apparatus according to claim 13 including means on said apparatus adjacent said feeding means for removably holding a workpiece having threads to be wrapped with said tape.

15. The apparatus according to claim 13 including means for guiding tape through a guide path from a tape supply to said feeding means, said guiding means including means for reducing the length of said path simultaneously with feeding tape to said workpiece, to reduce tension on said tape during said feeding step.

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