

[54] **TAPE-CLAMPING DEVICE**

[75] Inventors: **Paul Gutjahr**, Zurich; **Hans Luthi**, Egg, both of Switzerland

[73] Assignee: **Erapa AG**, Zumikon, Switzerland

[22] Filed: **Nov. 18, 1974**

[21] Appl. No.: **524,394**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 356,517, May 2, 1973, abandoned.

[30] **Foreign Application Priority Data**

May 26, 1972 Switzerland..... 7800/72

[52] **U.S. Cl.**..... 100/26; 24/248 FS; 100/33 PB

[51] **Int. Cl.²**..... **B65B 13/18**

[58] **Field of Search**..... 140/93.4; 254/79, 51, 52; 24/248 FS, 680, 134 P, 249 FP; 100/26, 29, 32, 33 PB

[56]

References Cited

UNITED STATES PATENTS

1,219,593	3/1917	Scott	24/248 FS
1,482,247	1/1924	Nowland	140/93.4
3,146,695	9/1964	Van Debilt	100/26 X
3,196,779	7/1965	Embree	100/26 X
3,612,481	10/1971	Guy	254/51

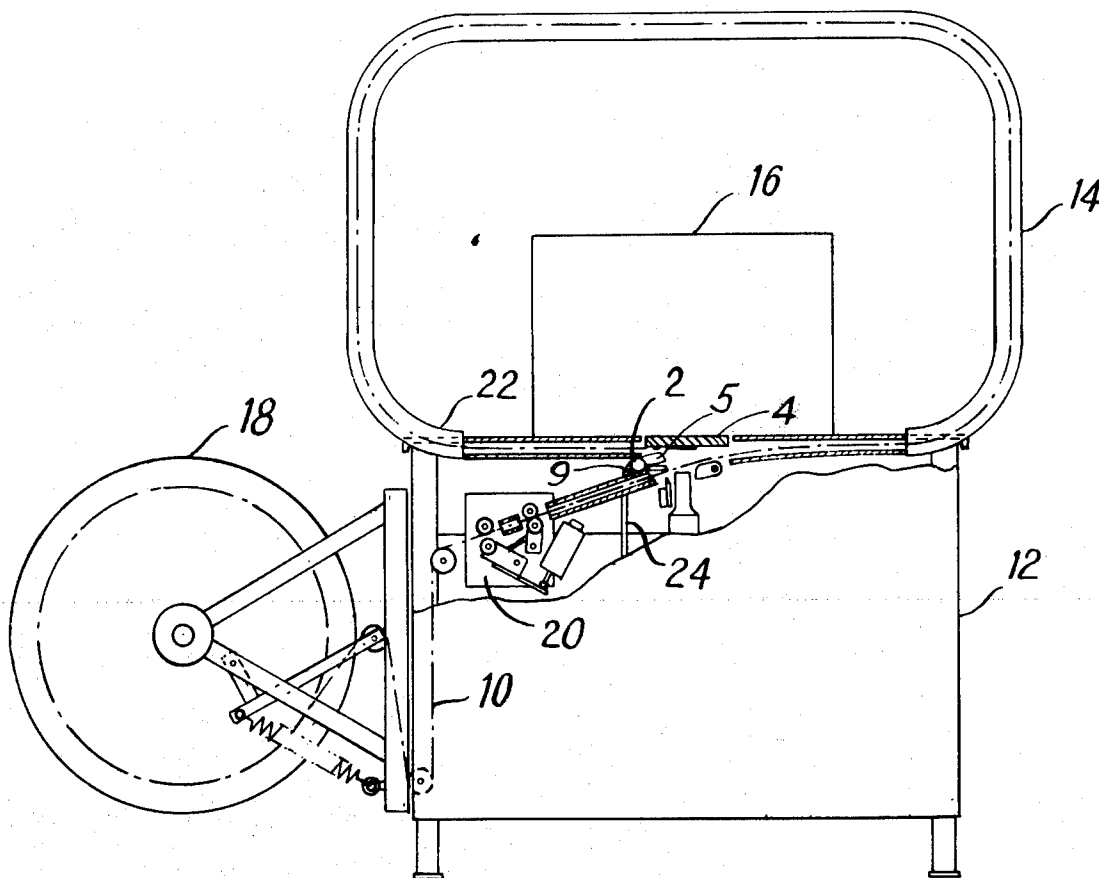
Primary Examiner—Billy J. Wilhite

[57]

ABSTRACT

A tape-clamping device for a machine for girding or stringing packages with plastic tape, the device having a clamping member rotatable toward a fixed clamping jaw, the clamping member being kept in its clamping position by self-restraint when the tape is passed between the clamping jaw and the clamping member and is moved into tape tensioning position.

2 Claims, 7 Drawing Figures



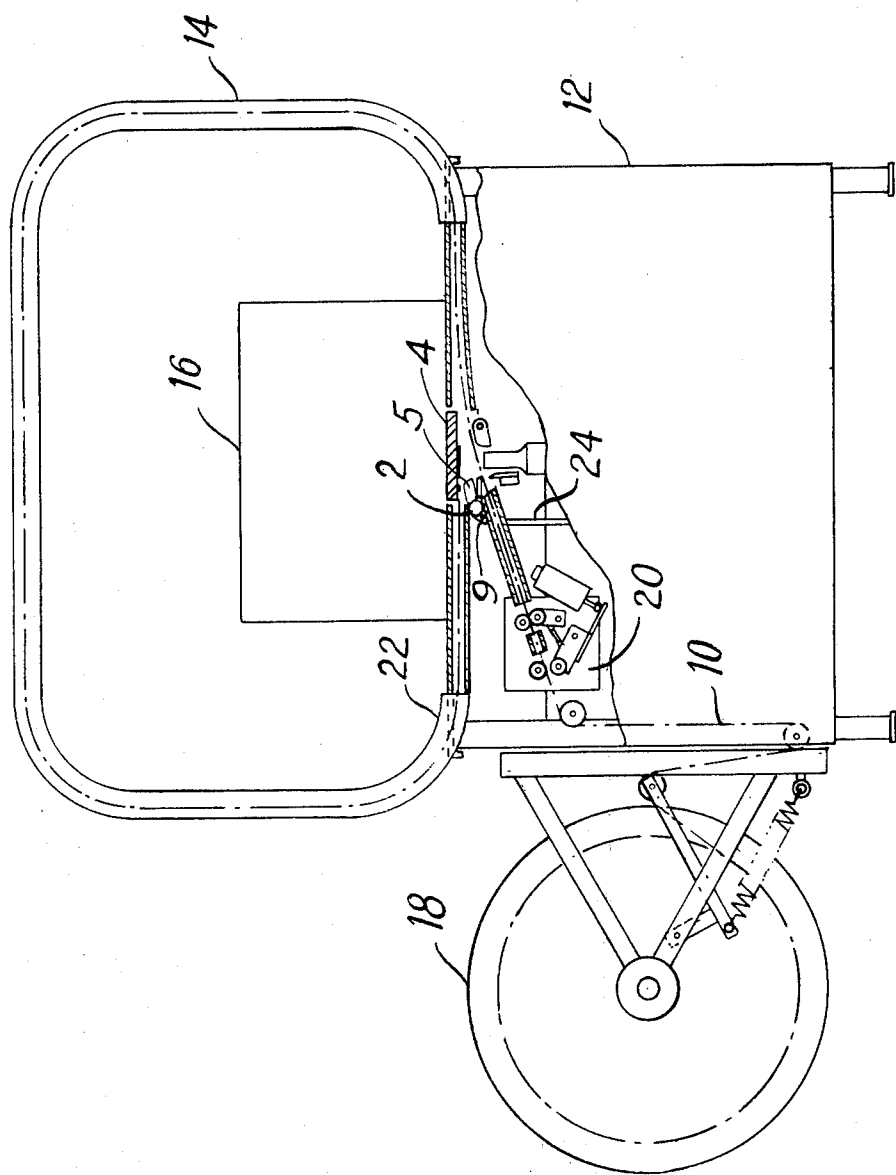


FIG. 1

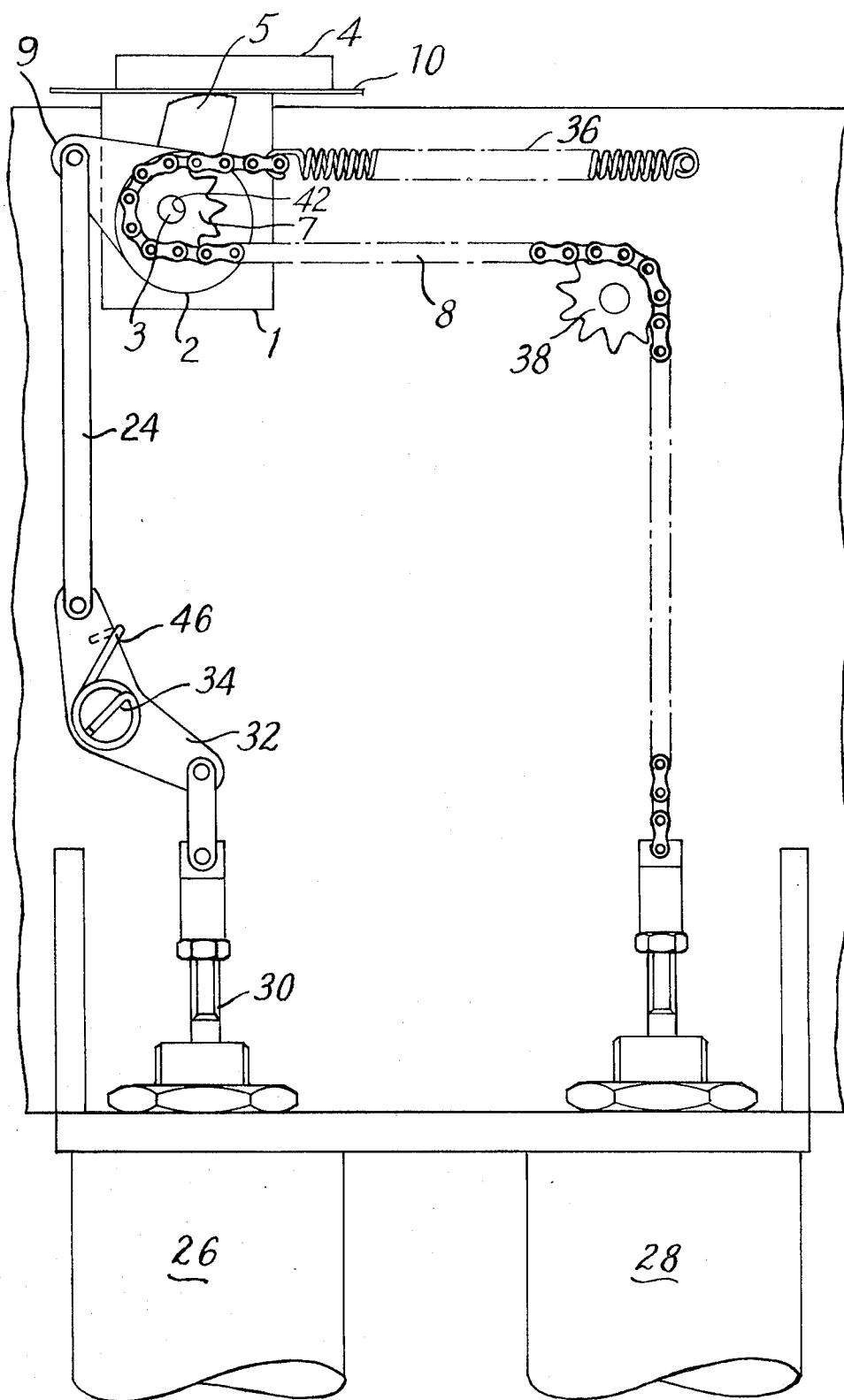
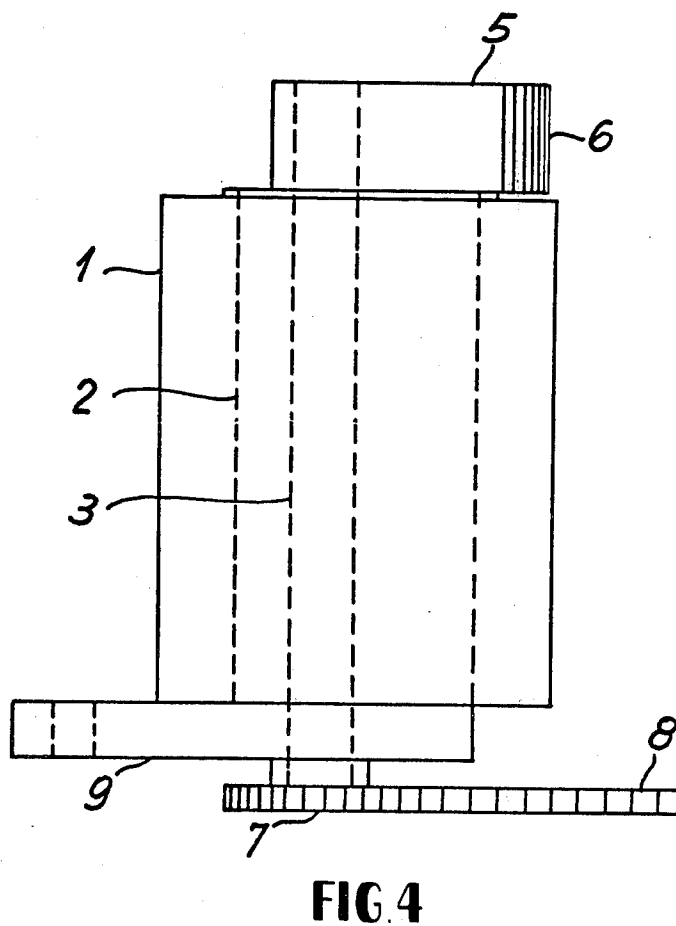
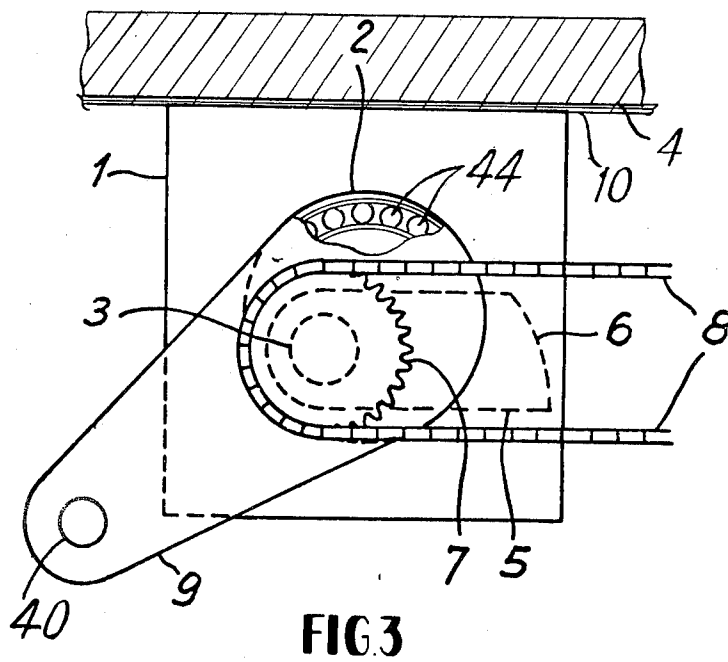


FIG 2



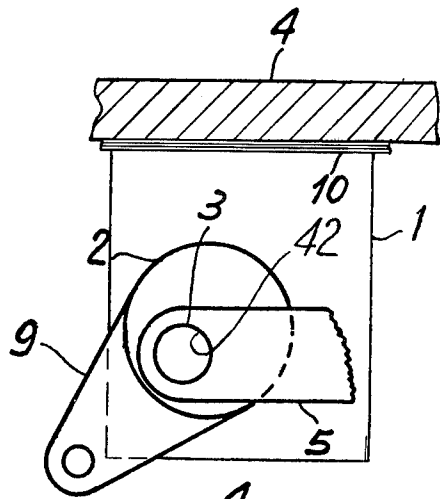


FIG 5

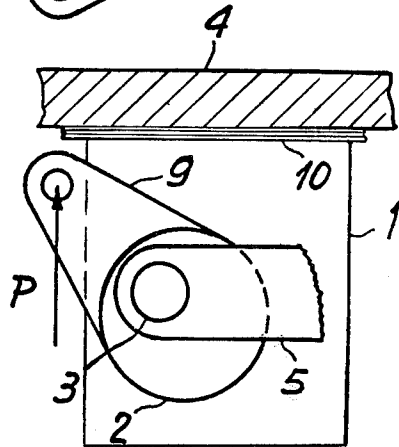


FIG 6

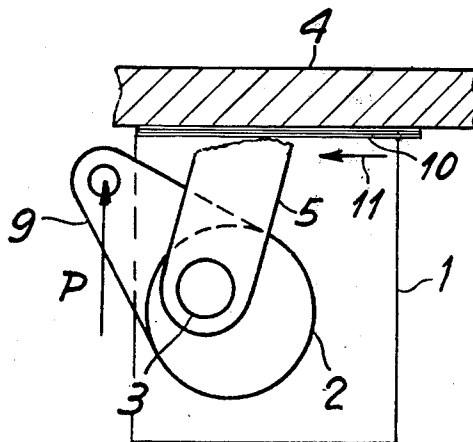


FIG 7

TAPE-CLAMPING DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part application of copending U.S. Pat. application Ser. No. 356,517, filed May 2, 1973, now abandoned.

The invention relates to a tape-clamping device for a machine for girding or stringing packages with plastic, cloth, paper or metallic tape, the device having a clamping member rotatable toward a fixed clamping jaw, the clamping member being kept in its clamping position by self-restraint when the tape is passed between the clamping jaw and the clamping member and is moved into tape tensioning position.

BACKGROUND OF THE INVENTION

Known tape-clamping devices of this type have the disadvantage that, in order to release the clamping effect, relatively strong release forces must be applied to the clamping member for removing the same from the clamping position, whereupon the tape may be damaged at the point of force application by the roughened surface of the clamping member. As a result, the tensile strength of the tape may be greatly reduced.

SUMMARY OF THE INVENTION

In the tape-clamping device of the invention, this disadvantage is eliminated (1) by making the distance between the shaft of a rotatable clamping member and the clamping jaw variable; (2) by the shaft assuming a position of operation under the influence of a retaining force, the position being determined by the desired operating characteristics of the clamping member; and (3) when the retaining force is removed by the shaft being moved back to a rest position while the clamping member is under the influence of the force exerted by the tensioned tape, such rest position is farther from the clamping jaw than the position of operation, whereupon the clamping member disengages the tape almost without friction.

BRIEF DESCRIPTION OF THE DRAWING

The drawings show schematically an embodiment of the invention.

FIG. 1 is an elevation view of a machine for girding or stringing packages utilizing the tape-clamping device according to the present invention;

FIG. 2 is a schematic diagram of the tape-clamping device as combined with solenoid activators;

FIG. 3 is a side view of the tape-clamping device of the invention;

FIG. 4 is a top view of the tape-clamping device of the invention; and

FIGS. 5 through 7 show three different positions of the device during its operation.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates the manner in which the tape-clamping device is beneficially utilized in a machine for girding or stringing packages. In FIG. 1, a frame 12 supports a hollow looped track 14 within which a package 16 is placed. A storage drum 18 supplies plastic tape 10 through a tape guide assembly 20 and about the interior of the looped track 14. When the tape 10 reaches the end 22 of the looped track, it progresses to the right

(as shown in FIG. 1) until it lies adjacent the bottom surface of fixed clamping jaw 4. A reciprocating rod 24 pivotally connects with a rotatable lever arm 9 which cooperates with a cylindrical portion 2 (FIG. 4) carrying a clamping member 5 eccentrically located on one of the planar surfaces of cylinder 2. A more detailed drawing of the device can be seen in FIG. 2 which shows the tape-clamping device according to the invention as combined with solenoid actuators 26 and 28.

In FIG. 2, the position of shaft 3 about which clamping member 5 rotates is movable toward and away from fixed clamping jaw 4 by the action of reciprocating rod 24 which in turn is reciprocated by action of solenoid actuator 26. In the two stable positions of the shaft 30 (of solenoid actuator 26), rod 24 assumes an operating position and a rest position for the clamping member 5 by the pivotal action of lever 32 about pivot point 34. In FIG. 2, the operating position of rod 24 is upwardly (as shown in FIG. 2), while the rest position for the device is with the rod 24 in a downward position.

In addition to the ability of the clamping device to be moved by translational movement toward and away from fixed clamping jaw 4, clamping member 5 is rotatable about shaft 3 by the action of chain 8 and solenoid actuator 28. Again having reference to FIG. 2, when the solenoid actuator 28 assumes its two stable positions, the chain 8 is pulled or released against the action of spring 36 about chain sprockets 7 and 38 to rotate clamping member 5 about the axis about shaft 3. Clamping member 5, shaft 3, and chain sprocket 7 are fixedly interconnected with one another, shaft 3 being journaled in concentrically located hole 42.

In the description which follows, it should be understood that fixed clamping jaw 4 and bearing bracket 1 are fixedly mounted to an appropriate frame structure (not shown) portion of frame 12.

With reference to FIG. 3, a clamping member 5 is shown rotatable about a shaft 3, the shaft being movable toward and away from fixed clamping jaw 4. The clamping jaw 4 and the bearing bracket 1 are mounted on a suitable frame structure (not shown) so as to be rigidly mounted with respect to one another. The clamping member 5 has an arcuate tape-engaging end surface 6 remote from and non-concentric with the axis of the shaft 3. A rotatable lever arm 9, in cooperation with rotatable cylinder 2, comprises means for positioning the shaft 3 of the clamping member 5 relative to the clamping jaw 4 from a rest position to an operating position, the rest position being farther from the clamping jaw 4 than the operating position. The clamping member is thus kept in a clamped position against the tape by self-restraint when a length of tape is passed between the clamping jaw 4 and the shaft 3 of the clamping member 5 is moved to its operating position. The end of lever 9 is provided with an aperture 40 constituting means for receiving the application of a retaining force to hold lever 9 and cylinder 2 in the operating position. The chain 8 and sprocket 7 constitute means for rotating the clamping member 5 about shaft 3. Thus, upon release of the retaining force, the shaft 3 of the clamping member 5 is moved substantially laterally of the tape to the rest position to disengage the clamping member from the tape substantially without friction.

A rotatable cylinder 2 is mounted in bearing bracket 1 on rollers, preferably needle bearings 44. Rotatable cylinder 2 is provided with an eccentric hole 42 which functions as a bearing for shaft 3 of clamping member 5 which can be rotated toward a fixed clamping jaw 4

(FIGS. 5 through 7). Clamping member 5, which is provided with an arcuate roughened engagement surface 6, is mounted on one end of shaft 3, whereas the other end of the shaft supports a chain sprocket 7 which can be driven by a chain 8 to rotate clamping member 5. For this purpose the lower portion of chain 8 (FIGS. 2 and 3) can be connected to the armature of a solenoid 28 which, when energized, effects a counterclockwise rotation of clamping member 5 from the rest position shown in FIG. 3 into the clamping position shown in FIG. 7. When a drive mechanism of this type is used, a resetting spring 36 can be attached to the upper end of chain 8.

On the side remote from clamping member 5, rotatable cylinder 2 is provided with a lever arm 9, with the aid of which cylinder 2 can be rotated clockwise by a certain angle from the rest position shown in FIG. 3 into an operating position shown in FIG. 6 in which shaft 3 assumes such position predetermined by the function and characteristics of clamping member 5. Cylinder 2 may also be driven by a solenoid activator 26, the armature of which can be coupled to the free end of lever arm 9 by, say, rod links 24, 32, 30 (FIG. 2).

The operation of the tape-clamping device will be described with reference to FIGS. 5 through 7, in which the plastic tape to be clamped is denoted by the numeral 10.

FIG. 5 shows the entire device in the rest position. In order to transfer clamping member 5 into the clamping position, rotatable cylinder 2 is rotated clockwise via lever arm 9 into the position shown in FIG. 6. In this position, shaft 3 of clamping member 5 is transferred from its rest position (FIG. 5) into the position of operation (FIG. 6) in which the clamping member is closer to the clamping jaw 4 than it is in the rest position. A retaining force P which acts upon the free end of lever arm 9 keeps rotatable cylinder 2 in this position. The retaining force may be applied by any of a variety of known means of applying force to the end of a lever arm, the arrangement of FIG. 2 being illustrative of a preferred embodiment.

Clamping member 5 is then rotated counterclockwise into the clamping position shown in FIG. 7. Clamping member 5 is self-restrained in the clamped position by tape 10 which is tensioned in the direction of arrow 11; the clamping effect increases in the usual manner with increasing tension in the tape.

As may best be observed by reference to FIG. 3, the tape-engaging end of clamping member 5 is arcuate and non-concentric with the axis of shaft 3.

The contour of the curved engagement surface 6 of the clamping member 5 is preferably part of a logarithmic spiral. The origin of the spiral coincides with the axis of rotation shaft 3. This contour will practically be machined in form of an arc of circle.

It is known that this spiral has a constant angle between any radius vector and its tangent. This angle, being formed by the surface of the fixed clamping jaw 4 and by the line connecting the point of contact of the engagement surface 6 with the center of motion of the clamping member 5, amounts to about 75°. Since this angle is constant for different tape thicknesses, the resetting force, too, will maintain its equal value if the tape tension is unchanged.

The rotation of the rotatable cylinder 2 is limited. This limitation may be obtained by outside stops (not shown) or by the limits of the armature stroke of the electromagnet solenoid 26.

Of importance is the position of the stop defining the clamping position of the clamping member 5. This stop is preferably adjustable.

Rolling elements 44 are used to support cylinder 2 in bearing bracket 1 because otherwise sliding friction would result which may be too strong to cause a restoring motion as described.

In practice, the eccentricity of the axis of rotation of the clamping member 5 with respect to the axis of rotation of the rotatable cylinder 2 amounts to 2 mm.

In order to remove the clamping device, retaining force P is removed, i.e., solenoid 26 generating the retaining force is deenergized, whereupon shaft 3, along with clamping member 5, disengages from clamping jaw 4 under the influence of the force exerted by stretched tape 10 upon clamping member 5, with shaft 3 passing into the rest position (FIG. 5), while clamping member 5 disengages tape 10 almost without friction. Cylinder 2 is then rotated counterclockwise.

In order to transfer cylinder 2 into a definite rest position, a resetting force, preferably a force produced by a restoring spring 46, is allowed to act upon lever arm 9. The range of angular rotation of cylinder 2 is limited by stops (not shown) which cooperate with lever arm 9 and can be adjusted.

A relatively small retaining force P suffices in the tape-clamping device described above for keeping shaft 3 in the position of operation and, hence, clamping member 5 in the clamping position. The force required is much smaller than that which is needed in the known devices when the clamping member is to be released. Moreover, since friction, which otherwise plays a role when the clamping member is forcibly removed from the tape surface, is almost completely eliminated, the quality of the tape is not affected by releasing the tape.

In a preferred embodiment the retaining force in point P amounts to about 1/20th of the force acting on the axis of the clamping member 5. As an example, when the angle mentioned above amounts to 75°, and when the tape tension amounts to 70 kps, then the force acting on the axis of the clamping member 5 amounts to about 270 kps, and the retaining force P would be 13.5 kps.

If the armature of the electromagnet solenoid 26 is coupled directly to the free end of the lever arm 9, then force P must be generated by the solenoid. A smaller electromagnet may be used in case of indirect coupling using a lever gear 32, for example, to reduce the force which must be exerted by the solenoid 26.

Contrary to the matter in which tape-clamping devices of the prior art have been designed, utilizing the device according to the present invention, the operating position of shaft 3 of clamping member 5 is always the same, irrespective of the thickness of the tape 10. Furthermore, the point of contact between the clamping member 5 and the clamped tape 10 always has the same position with respect to the fixed clamping jaw 4. Thus, the clamping conditions are always the same for tapes of different thicknesses in a very large range. The angular adjustment of the clamping member 5 is different for a thin tape than for a thick tape, but the engagement surface 6 of clamping member 5 is spiral-shaped with respect to shaft 3, as mentioned above, and thus permits the securing of a predetermined angle of engagement of the tape by clamping member 5 substantially independent of the thickness of the tape within a large range of thicknesses.

5

Because of the small angle which the axis of shaft 3 needs to travel between the operating and rest positions of cylinder 2, when the clamping member 5 is moved to its rest position, shaft 3 is moved substantially linear in a direction substantially perpendicular to the clamping surface of clamping jaw 4.

The arcuate end surface of the clamping member will thus automatically accommodate a wide range of tape thickness without varying the amount of pressure applied to the shaft of the clamping member, without affecting integrity of the clamping force against the tape, and without requiring an infinitely varying positioning of shaft 3.

What is claimed is:

1. A tape-clamping device comprising:

a clamping member rotatable about a shaft movable toward and away from a fixed clamping jaw, said clamping member having an arcuate tape-engaging end surface remote from and non-concentric with the axis of said shaft;

positioning means for positioning the shaft of the clamping member relative to the clamping jaw from a rest position to an operating position, the rest position being farther from the clamping jaw than the operating position, said clamping member being kept in a clamped position against the tape

6

by self-restraint when a length of tape is passed between the clamping jaw, and the shaft of the clamping member is moved to its operating position;

means for receiving the application of a retaining force to hold said positioning means in said operating position; and

means for rotating said clamping member about said shaft;

whereby upon release of said retaining force, the shaft of said clamping member is moved substantially laterally of said tape to said rest position to disengage the clamping member from the tape substantially without friction.

2. The tape-clamping device according to claim 1 wherein:

said positioning means comprises a rotatable cylinder; and

the shaft of the clamping member is rotatably supported eccentrically on one planar end portion of said rotatable cylinder, the other planar end of said cylinder being provided with rotating means;

said rotatable cylinder is supported on rollers in a bearing bracket; and

said positioning means is adapted to rotate said cylinder within a limited range of angular rotation.

* * * * *

30

35

40

45

50

55

60

65