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Zucker

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[54] **TAIL TIE SYSTEM**

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[73] Assignee: **Hudson Pulp & Paper Corporation,** Palatka, Fla.

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[52] **U.S. Cl.** **93/1.1;** 156/253; 156/513

[51] **Int. Cl.²** **B65H 75/28;** B31F 5/02

[58] **Field of Search** ..... 93/1.1, 1 R; 156/253, 513; 83/2, 30, 660

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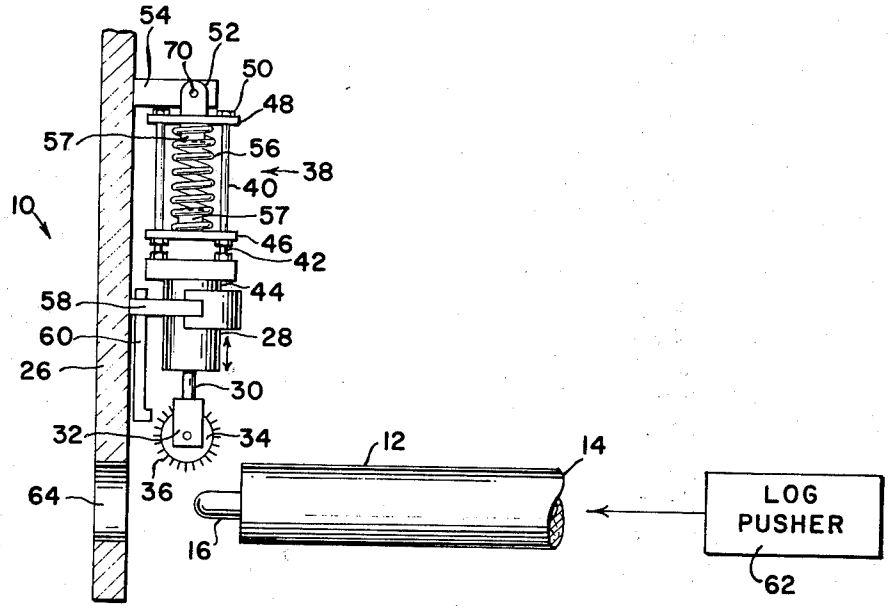
[57] **ABSTRACT**

The free tail end of a roll of paper is secured to the underlying layer of the roll by spreading the fibers of the paper at a plurality of a predetermined independent and discrete locations, and thereafter allowing the spread fibers to interlock with each other. This tail tie arrangement is achieved by pressing a plurality of individual pins or teeth into the surface of the paper roll, adjacent to the free or tail end thereof, under a predetermined pressure. On release of the pressure on the pins the spread fibers in the successive layers will interlock with each other.

11 Claims, 8 Drawing Figures



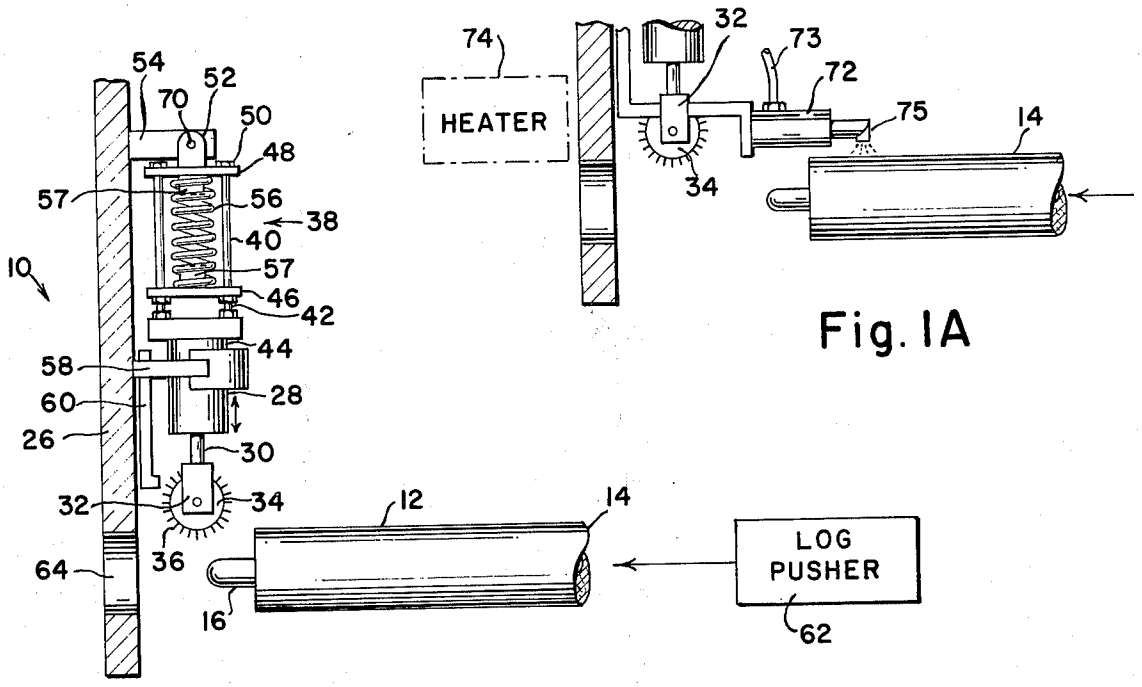
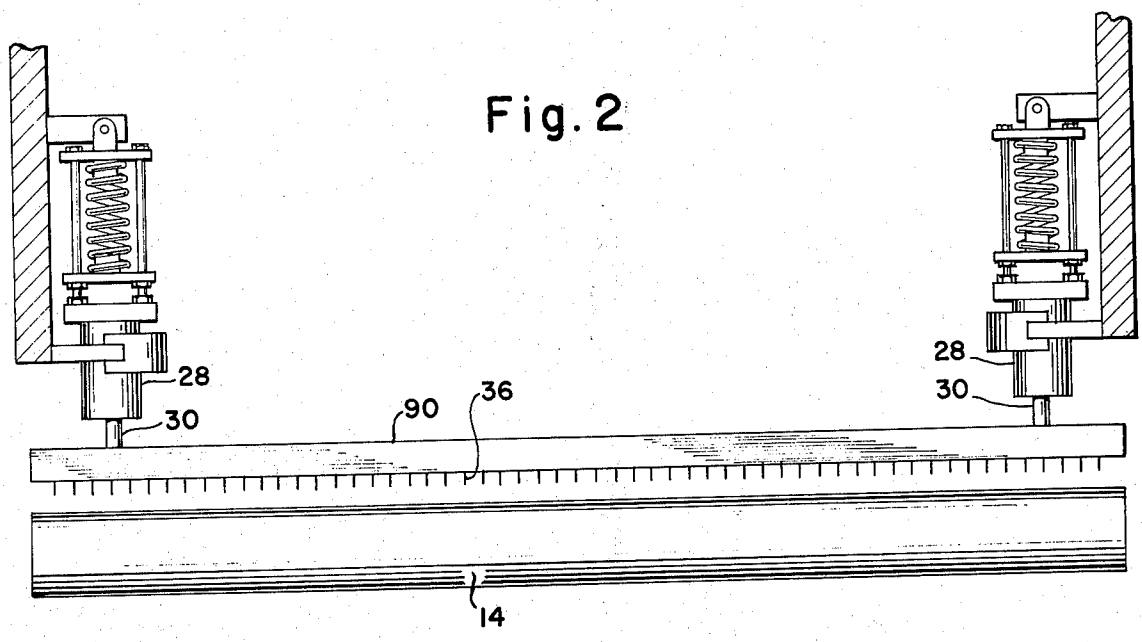


Fig. 1A

Fig. 1

Fig. 2



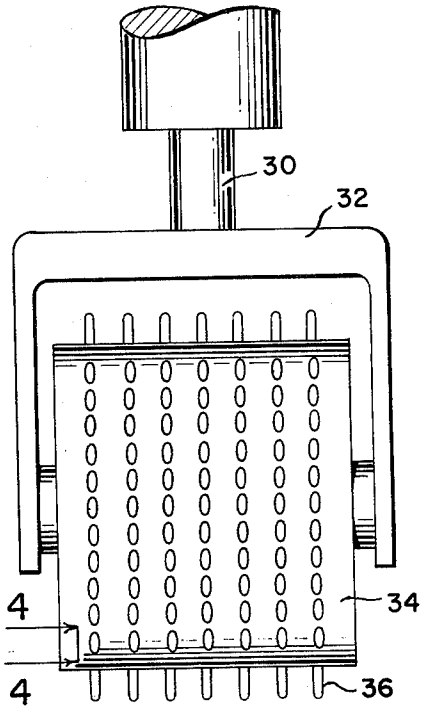


Fig. 3

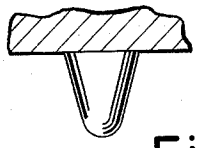


Fig. 4

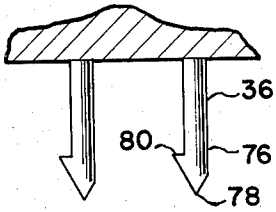
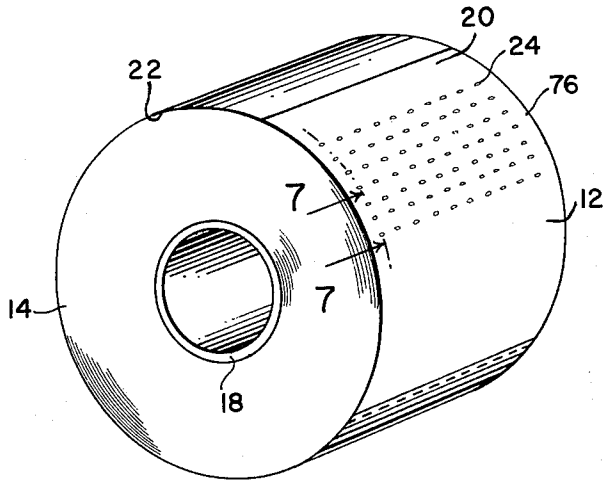


Fig. 5

Fig. 6



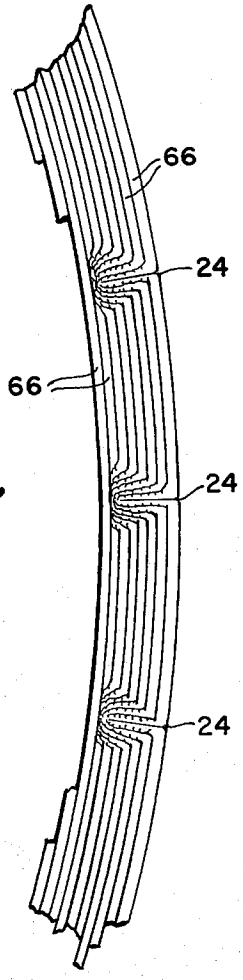


Fig. 7

TAIL TIE SYSTEM

The present invention relates to paper rolls, and more particularly to a method and apparatus for securing the tail or free end of a roll of paper to the roll.

In the manufacture of paper rolls, such as for example toilet paper or hand towels, one problem with which manufacturers experience difficulty is in securing the free end of the wound roll to the roll so that it can be conveniently wrapped in a later operation. Heretofore, this securement of the tail end of the paper to the remainder of the roll has been achieved by the use of a glue or adhesive material spread along or adjacent the tail of the paper on the roll. Unfortunately, the use of an adhesive, or even water, for tail tying in this manner has several undesirable effects, including the fact that a relatively sloppy appearance is made for the end of the roll. Since such rolls are often placed in transparent wrappers, sloppy or ineffective tail ties, resulting from the use of glue in previously proposed tail tying systems, is readily apparent to the customer. Moreover, it will be appreciated that the use of a glue to adhere the paper is an additional cost to the manufacturer in the production of a rolled paper product.

Accordingly, it is an object of the present invention to eliminate the need for, or use of, glue in tail tying operation.

Another object of the present invention is to tie the tail end of a paper roll in a convenient and inexpensive manner.

Yet another object of the present invention is to tie the ends of paper on a roll by causing interlocking of the fibers from which the paper is formed.

The above, and other objects, features and advantages of the present invention, will be described herein with reference with the accompanying drawings wherein:

FIG. 1 is a schematic elevational view of an apparatus for tail tying the end of a roll of paper in accordance with the present invention;

FIG. 1A is an elevational view, similar to FIG. 1, showing another embodiment of the present invention;

FIG. 2 is an elevational view, similar to FIG. 1, of yet another embodiment of the present invention;

FIG. 3 is an enlarged end view of the presser head or roller used in the embodiment of the invention shown in FIG. 1;

FIG. 4 is an enlarged end view taken along line 4—4 of FIG. 3 showing one embodiment for the pins used in the presser heads of the present invention;

FIG. 5 is an enlarged sectional view, similar to FIG. 4, showing another embodiment of pin used in the invention;

FIG. 6 is a perspective view of a roll of toilet paper having its tail end tied in accordance with the present invention; and

FIG. 7 is a sectional view taken along line 7—7 of FIG. 6.

Referring now to the drawings in detail, and initially to FIGS. 1 and 6 thereof; it will be seen that a device 10, constructed in accordance with the present invention, treats the outer layer or surface 12 of a prerolled roll of paper 14 such as for example toilet paper or paper towels, in order to secure the outer layer of paper on the roll to the remainder of the roll itself. Preferably roll 14 is a relatively long roll of paper supported in device 10 by a mandrel 16 that extends through the center core 18 of the roll. The roll is treated along its entire length by the apparatus of the present invention as described hereinafter, and is later severed in sections, perpendicularly to its major axis so as to form individual rolls of paper.

Roll 14 has a free end or tail 20 (FIG. 6) which the apparatus 10 secures to the remainder of the layers 22 in the roll by forming a plurality of depressions 24 along the surface 12 of roll 14. Depressions 24 serve to cause the fibers of the paper to interlock with one another at the depressions, thereby to lock the tail of the paper to the roll.

In the embodiment of the invention shown in FIG. 1 it will be seen that the device 10 includes a frame 26 on which a ram 28 is mounted. Ram 28 is a double acting pneumatic or hydraulic ram, as desired, having an actuating rod 30 on which is mounted a yoke 32 (see FIG. 3). Yoke 32 provides rotational support for a roller 34 having a plurality of individual pins 36 mounted thereon in any convenient manner.

The Pins 36, described hereinafter, form the individual depressions 24 in roll 14 to lock the tail of the roll to the remainder of the paper therein.

Ram 28 is pivotally mounted on frame 26 through a spring biasing structure 38 which includes a plurality of vertically extending bars 40 secured at their lower ends 42 to the upper end of the ram's cylinder 44. A first plate member 46 is secured to the rods 40 and cooperates with another plate member 48 through which the upper ends of rods 40 freely extend. Plate 48 is in turn pivotly mounted, by a rigid extension 52, on an arm 54 secured to frame 26.

The upper end of each rod 40 has a nut 50 secured thereto so as to prevent the rods 40 from being inadvertently withdrawn from plate 48. Because of the free mounting of rods 40 in plate 48, ram 28 can move vertically with respect to plate 48; however a spring 56 is positioned between plates 46 and 48, and normally urges the ram 28 into its downward position. Spring 56 is held in its position between plates 46 and 48 by opposed extensions or blocks 57 on each of these plates.

Cylinder 44 also has a pair of guide arms 58 mounted thereon (only one of which is seen in FIG. 1, the other being on the opposite side of the ram) which define a space therebetween which receives a vertically extending bar 60. The latter is secured to yoke 32, in any convenient manner. Accordingly it will be appreciated that the cooperation between bar 60 and arms 58 prevents rotation of the actuater rod 30 in cylinder housing 44.

In the operation of device 10, a paper roll 14 is supplied, in any convenient manner, from a conventional paper winder device (not shown) along mandrel 16. The latter is mounted in frame 10 in any convenient manner to receive the roll 14 from the winder. The paper roll or log 14 is urged along mandrel 16 from right to left below roller 34 by a pusher, such as a hydraulic ram or the like, identified schematically as element 62 in FIG. 1. Movement of log 14 in this manner causes its periphery 12 to engage the pins 36 on roller 34.

As soon as log 14 engages roller 34 ram 28 is actuated to depress roller 34 downwardly towards the central axis of roll 14, but through a relatively small distance and with a light pressure. The pressure used to depress roller 34 is selected so as to cause the pins 36 on the roller to depress the first several layers (for example 3 to 6 layers) of paper on the roll 14. Of course,

as log **14** moves beneath roller **36** in this manner, the roller will rotate in a clockwise direction along the surface of the roll. In this connection frame **10** is provided with an opening **64** formed therein through which roll **14** can pass.

The pressure applied to log **14** by pins **36** causes the fibers of the paper at each depression **24** (see FIG. 7) to be spread away from the pins. However, as soon as the depressions are free of the pins **36,** which formed them, the natural resiliency of the paper causes the depressions to attempt to turn to their original position. This rebound, or slight relief, in the paper from the pressure causes the spread fibers of each of the layers to tend to move back towards one another, whereby they interfere with the spread fibers of adjacent layers causing the fibers to be interlocked. This interlocking of the fibers is sufficient to hold the paper layers **66** of the paper roll against one another. In this manner the tail or free end **20** of the paper roll is held in its fixed position against the adjacent layer of paper and thus is tied to the roll. This tie is sufficiently strong to hold the tail of the paper roll in place for the wrapping operation and, in addition, an improved appearance is provided for the roll.

Because of the pivotal mounting arrangement for ram **28,** the ram can move or pivot slightly about its mounting axis **70** when the end of log **14** first enters the apparatus. This allows the entire unit to pivot a few degrees forward at roller **34** so as to provide for smooth entry of the log beneath the roller at the initiation of the operation. On the other hand, the spring shock absorber **56** is used to absorb the initial impact of the log on the depression roller **34** and to accommodate variations in the thickness of the paper along the roll. In addition, the pneumatic cylinder **28** maintains a constant pressure on any diameter log (because variations in diameter are accommodated by the spring **56** rather than the cylinder) so that a uniform tie is provided along the entire length of the relatively long log **14.**

Although highly satisfactory tail ties have been and are achieved by the apparatus of FIG. **1** improved tail ties can be achieved, in the manner illustrated in FIG. **1A,** simply by wetting or moistening the paper log **14** before it is engaged by the roller **34.** This is accomplished by providing a water supply valve **72,** mounted on yoke **32** in any convenient manner to control supply of water from a source or supply line **73.** This valve may be electrically controlled and timed so as to be operated with the arrival of the log **14** at the roller area to spray water from line **73** through nozzle **75** onto the paper. Wetting the paper roll in this manner improves the interlock between the fibers since the resistence of the fibers to spreading under the influence of the pins **36** is decreased.

In most cases it is not necessary to dry roll **14** after wetting since only a minimum amount of water is required. However, depending on the paper being treated, if drying is required a heater **74** may be used adjacent roller **34** to dry the paper as soon as it passes beneath roller **34.** Heater **74** may take any convenient construction, and need not be described in detail; however it is contemplated that one form the heater can consist of is an electrically heated roller having a flat surface which engages the periphery of roll **14** along the strip **76** of depression **24.**

The configuration of pins **36** can take a number of convenient forms; for example, as shown in FIGS. **3** and **4,** pins **36** simply can be tapered pins, generally oblong or oval in section and having side walls tapered perpendicular to the direction of rotation of the roller. These pins serve to spread the fibers apart because of their tapered configuration. As mentioned it is the spread fibers which interlock upon the rebound of the paper upon release of pressure from the roll which produces the efficient tail tie of the present invention.

Another embodiment of pins used in the present invention have barbed ends **76** with fine points **78.** These pins will penetrate the paper layers **66** upon application of force by ram **28.** The tapered configuration of the ends of these pins of FIG. **5** not only aides in their penetration of the layers but also serves to spread the fibers in the paper layers. In addition, because of the barbs or hooks **80** on the pins, when the points **78** are pulled upwardly out of paper layers **66,** due to rotation of roll **34,** the barbs will pull some of the paper fibers from the bottom layers through upper layers, thus causing further interlocking of the fibers. In this manner a dual interlocking is achieved which provides an improved tail tying arrangement.

Although the interlocking depressions **24** along log **14** have been described as being formed by the roller arrangements of FIGS. **1** and **1A,** it is contemplated that other convenient structures can be used for the purpose of forming such depressions in the paper layers. For example as illustrated in FIG. **2,** in lieu of a roller, a flat head **90** is provided having a plurality of pines **36** extending downwardly therefrom. The head is mounted by rams **28,** which correspond substantially to the ram structure described with respect to the embodiment of FIG. **1** with the head **90** being secured to the actuator rods **30** of the rams.

In this embodiment of the invention **10***g* 14 is placed below head 90 and the head is depressed by the rams 28 to apply pressure to the paper through the pins 36. These pins operate in substantially the same manner as described above with respect to FIG. 1 in that the pins serve to spread the fibers of the paper layers, causing them to interlock upon release of the pressure.

Although the number of teeth used on roller **36,** or plate **90,** may be varied as desired in order to vary the degree of tie obtained by the system, it has been found that a roller having between **25** and **85** teeth per **6** inch circumference along its periphery, with between **8** and **14** rows of teeth per **2** inch width, achieves highly satisfactory results. In addition, although the pins have been described and shown in the drawings as being arrayed in the straight rows and columns, it is contemplated that the particular pattern of the pins may be varied so as to provide an embossment, picture, name, initials or other design to the surface of the roll while simultaneously providing the desired tail tie for the end of the paper on the roll.

Although several embodiments of the present invention have been described herein, with reference to the accompanying drawings, it is to be understood that the invention is not limited to those embodiments, and that various changes and modifications may be effected therein by one skilled in the art without departing from the scope or spirit of this invention.

What is claimed is:

1. The method of securing the free tail end of paper on a roll comprising engaging a portion of the surface of said tail end of paper with a plurality of individual pins, urging said pins against said paper towards the

center of the roll to depress individual areas of the paper roll beneath said pins for several layers of paper, thereby to spread the fibers of said paper in said areas; thereafter removing said pins from engagement with said paper, whereby said spread fibers interlock to hold said layers of paper together; and wherein said pins are mounted on a roller and said engaging step includes the step of moving said roller along the surface of said roll parallel to the central axis of said roll.

2. The method as defined in claim **1** wherein said urging step comprises pushing said pins generally radially inwardly toward the central axis of said roll.

3. The method as defined in claim **2** including the step of wetting said tail end of said roll prior to said engaging and urging steps.

4. Apparatus for securing the free tail end of paper on a roll thereof comprising means for supporting said paper roll in a predetermined position, a pressure head having a plurality of individual barbed pins mounted thereon for engaging said roll at said predetermined position, and means for moving said head, under pressure, into and out of engagement with said roll whereby the fibers of said paper are spread by said pins when they are engaged with the roll and said fibers interlock when the pin pressure thereon is relieved, thereby to interlock the first several layers of paper on the roll.

5. The apparatus as defined in claim **4** wherein said pressure head comprises a roller having a plurality of said pins mounted thereon and extending radially therefrom.

6. The apparatus as defined in claim **5** including means for lightly moistening a portion of said roll prior to its engagement by said pins.

7. The apparatus as defined in claim **5** wherein said moving means comprised a double acting ram having an actuator rod, said roller being rotatably mounted on said rod.

8. The apparatus as defined in claim **7** including a frame, said ram being resiliently mounted on said frame for movement in the direction of its axis and perpendicular to said roll whereby the resilient mounting of the ram accommodates variations in the thickness of said roll.

9. The apparatus as defined in claim **8** wherein said ram is pivotally mounted in said frame for movement in a plane containing said roll.

10. The apparatus as defined in claim **9** wherein said pins are generally conical in shape.

11. Apparatus for securing the free tail end of paper on a roll thereof, said apparatus comprising a frame, means in said frame for supporting said paper roll in a predetermined position, a pressure head comprising a roller rotatably mounted on said frame and having a plurality of individual radially extending pins therefrom for engaging said roll at said predetermined position, means for moving said roller, under pressure, into and out of engagement with said roll, and means for moving said paper roll with respect to said roller in a direction parallel to the central axis of the roll and transverse to the axis of rotation of the roller whereby when said roller is engaged with the paper roll it rotates along the surface of the paper roll on said pins thereby to spread the fibers of the paper when the pins are engaged with the roll, said fibers interlocking when the pins are removed from the roll, thereby to interlock the first several layers of paper on the roll.

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