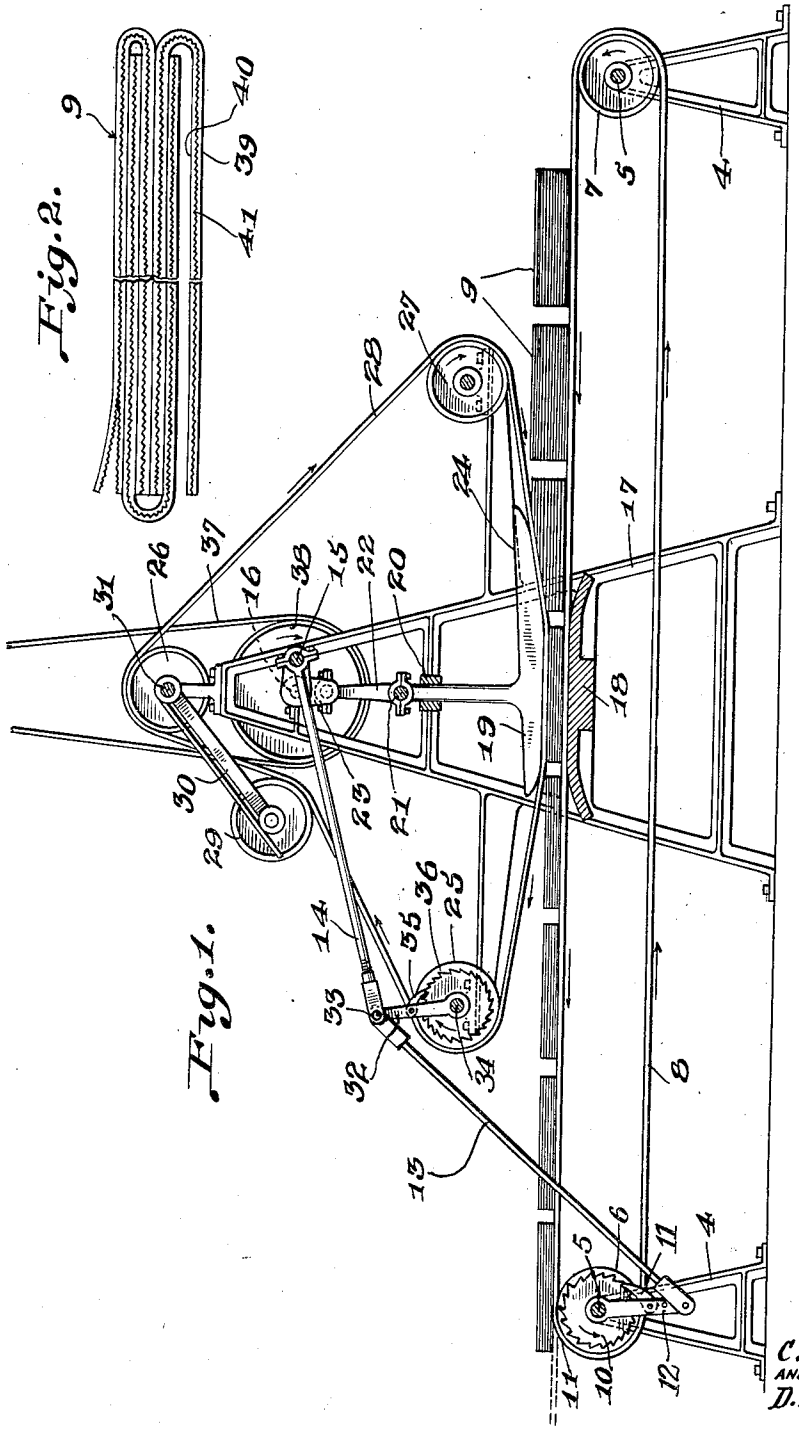
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METHOD AND APPARATUS FOR REDUCING THE BULK OF STACKS OF PAPER SHEETS AND SOFTENING SAID SHEETS

Filed May 25, 1934 2 Sheets-Sheet 1



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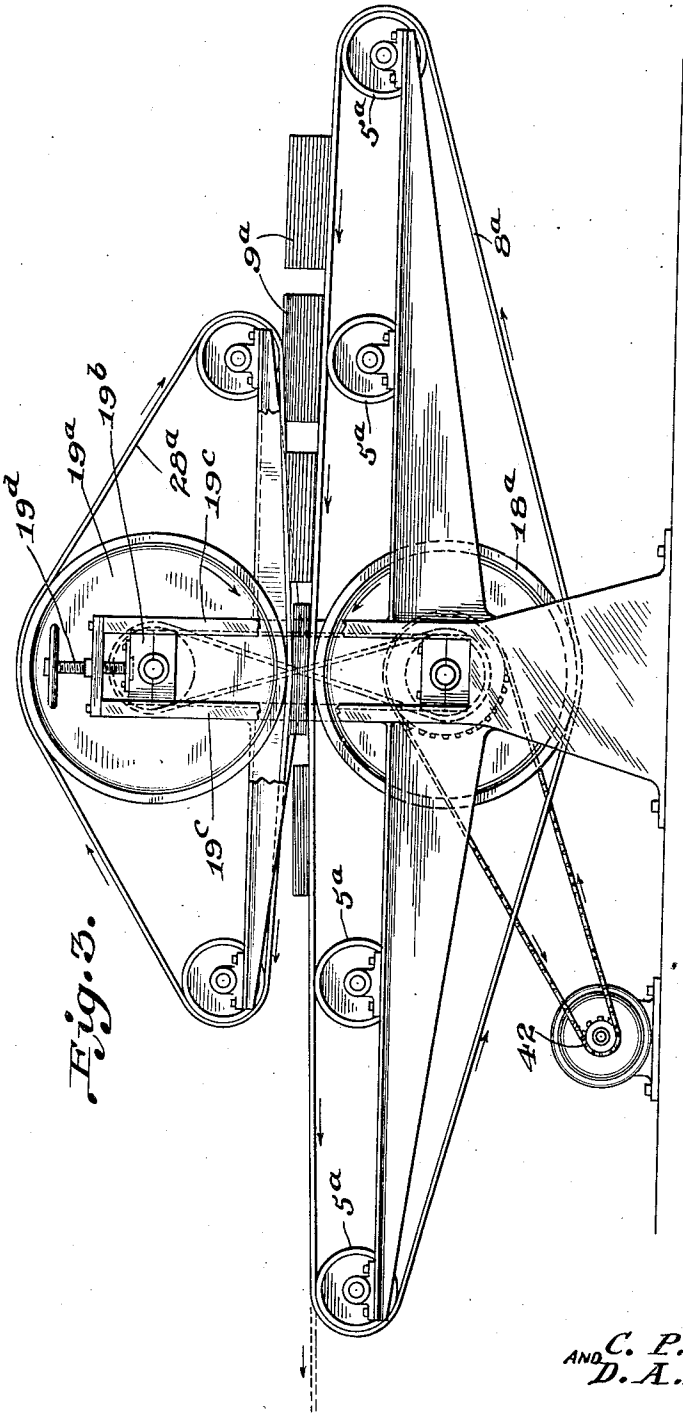


Fig. 3.

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METHOD AND APPARATUS FOR REDUCING THE BULK OF STACKS OF PAPER SHEETS AND SOFTENING SAID SHEETS

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This invention relates to the treatment of paper sheets, and more especially to a novel method and apparatus for reducing the bulk of stacks of paper towels, toilet paper, paper napkins, and other paper products, and for simultaneously softening such products.

One of the objects of the invention is to produce extreme softness or velvety texture of the paper sheets, and at the same time reduce the bulk of piles of these products to the point where the storage space required is materially less and the cost of shipping containers is correspondingly reduced.

Heretofore, it has been customary to effect softness by means of embossing rollers, in which case the paper in single thickness is fed through the embossing rollers in a continuous web. However, the embossing process does not reduce the thickness of the paper, but in many cases increases the same. In accordance with our invention, the paper sheets are first organized into a suitable pile or stack, and the entire stack is then subjected to a number of blows of gradually increasing pressure until the maximum pressure is reached. During the hammering, the stack is held in such a manner as to prevent distortion.

It has been found that ram pressures ranging from about 1000 pounds upwardly, are suitable for our purposes, but the softening effect is increased in proportion to the pressure. In practice, approximately 1500 pounds ram pressure has given very satisfactory results on certain kinds of paper without excessive power requirements, but in actual practice, it is best to use ram pressures of approximately 40,000 pounds up to 100,000 pounds for piles of folded towels, napkins, etc. made of creped paper.

Certain types of paper products, particularly creped towels and creped toilet paper can be made into long stacks or packages before they are subjected to the compression operation, and after compression, they can be banded and cut into lengths of merchandisable size.

Another object of the invention is to furnish a suitable method and apparatus for simultaneously reducing the bulk of a stack of paper sheets and softening the texture of the sheets.

With the foregoing objects outlined and with other objects in view which will appear as the description proceeds, the invention consists in the novel features hereinafter described in detail, illustrated in the accompanying drawings, and more particularly pointed out in the appended claims.

In the drawings,

Fig. 1 is a side elevation, partly in vertical longitudinal section, of one form of apparatus suitable for practicing our method.

Fig. 2 is an enlarged side edge view of a few of the sheets of a paper stack for the purpose of illustrating another novel feature of the invention.

Fig. 3 is a side elevation of a modification of the machine.

Referring to the embodiment of the invention illustrated in Fig. 1, 4 designates suitable supports carrying horizontal shafts 5 on which are mounted pulleys or rollers 6 and 7. The pulley 6 is fixed to its shaft. A belt 8 is mounted on the pulleys and is adapted to feed stacks 9 of the paper articles through the compressing mechanism. Any suitable means is provided for advancing the belt step by step. For example, a ratchet wheel 10 can be fixed to the roller 6 and will be actuated by a pawl 11 pivotally carried by a lever 12 loosely mounted on the shaft 5. Pivotally connected links 13 and 14 connect lever 12 to a crank 15 on the main shaft 16 of the machine.

Supports 17 at the medial portion of the machine carry an anvil 18 across which the upper bight of the belt travels in order to bring the stacks successively beneath the hammer 19. The latter is vertically guided by a guide 20 fixed to the supports 17, and the upper end of the hammer is pivotally connected at 21 to a link 22 suspended from a crank 23 fixed to the main shaft 16.

The upper face of the anvil has a flat surface intermediate its ends, and the hammer has a lower flat surface corresponding thereto, but a long horn or projecting shoe 24 extends forwardly from the hammer toward the roller 5 for a purpose hereinafter described.

Guide pulleys 25, 26 and 27 are rotatably carried by the supports 17, and a belt 28 passes about these pulleys and beneath the hammer 19. A belt tightening pulley 29 is supported by arms 30 pivotally suspended from the shaft 31 of the pulley 26, and the pulley 29 rests upon the belt and causes the same to press upon the lower surface of the hammer 19.

Any suitable means may be provided for advancing the belt 28 in timed relation with the belt 8. For example, a lever 32 may have one of its ends pivotally connected to the links 13, 14, as shown at 33, and the other end of the lever may be pivotally mounted on the shaft 34 of the pulley 25. A pawl 35 on the lever can engage a ratchet wheel 36 on the pulley 25.

The main shaft may be driven by any appro-

priate prime mover, for instance, through the instrumentality of a belt 37 which drives a pulley 38 fixed to the main shaft.

While the above described mechanism may be used with stacked paper sheets of various kinds, it is particularly applicable for the treatment of creped paper towels or napkins. We have found it especially suitable for towels and napkins of the kind diagrammatically illustrated in Fig. 2. In that figure, it will be noted that two sheets 39 and 40 of creped paper are used for each towel, and the inner or juxtaposed surfaces of the two sheets are rougher than the external surfaces, as indicated at 41. Consequently, when towels of this character are interfolded as shown in Fig. 2, to form a stack, the pressing operation not only reduces the bulk and softens the texture of the sheets, but causes the roughened surfaces 41 to more firmly adhere to one another. Consequently, when a towel is in use, the two sheets forming the same will stick together and will not accidentally separate from one another.

In operation, it will be understood that when the main shaft 16 is turned in a clock-wise direction, the hammer 19 will be reciprocated, and while the hammer is moving upwardly, the belt 28 will be moved in a clock-wise direction, and the belt 8 in a counter-clock-wise direction. Of course, the belts will be stationary when the hammer is in its lowermost position. In accordance with out method, the stacks or packages 9 are placed on the belt 8 at the right end of the machine, and the belt is advanced between strokes of the hammer. In practice, the belt advances about five inches for each stroke of the hammer, and the projecting horn 24 acts to gradually reduce the thickness of the package or stack step by step with gradually increasing pressure until the package reaches the flat part of the hammer. Then the maximum pressure is brought to bear on the stack for the purpose of materially reducing its bulk. During such operation, the upper belt cooperates with the lower belt to prevent distortion of the package or stack and distribute the pressure uniformly over the entire area of the sheets.

As we use extremely high pressures in our method, a stack of paper towels or napkins of the customary thickness can not only be reduced to about one-half such thickness, but the paper is given a velvety texture so that a towel out of a package treated in this manner can be used on the face as well as on the hands.

If the method is used on creped paper towels and the like, the greater pressure which we use apparently causes the ridges and valleys of each sheet to be compressed to such an extent that they overlap. In other words, the ridges will be flattened and there will be fold lines at the sides of each ridge which overlie adjacent valleys.

Instead of employing hammer action mechanism for our purposes, we may use heavy rollers, as illustrated in Fig. 3. In that embodiment, the feed belt 8*a* can pass around guide rollers 5*a* and an anvil roller 18*a*, the latter being driven by a suitable prime mover 42 through any suitable power transmitting means.

Another upper or superposed roller 19*a* cooperates with the roller 18*a* to effect the desired compression, and a suitably guided belt 28*a* cooperates with the roller 19*a* for gradually reducing the thickness of the stacks 9*a* as they move forwardly through the machine.

The bearings 19*b* of the upper roller are preferably guided by vertical guideways 19*c*, and hand screws 19*d* may be employed to force the roller 19*a* toward the roller 18*a*.

In view of the description of the operation of the machine shown in Fig. 1, it is believed unnecessary to describe the operation of the modification shown in Fig. 3.

Prior to this invention, it has been customary in packaging paper towels and the like, to compress the stack to a slight extent for the purpose of placing a retaining band around the same, but this compression is of such a minor degree as to in no way change the characteristics of the paper sheets. We have found that by using relatively high ram pressures ranging between about 1000 and 100,000 pounds, we can not only reduce the customary stack to about half the conventional size, but each towel or the like in the stack is so changed that its outer surfaces have extreme softness and a velvety texture.

While we have disclosed our method in the above description, and have also explained some preferred embodiments of the apparatus, we are aware that various changes may be made in the method and apparatus without departing from the spirit of the invention, as expressed in the claims.

What we claim and desire to secure by Letters Patent is:

1. In a method of the character described, subjecting a stack of sheets of creped paper progressively to sufficient pressure uniformly over substantially the entire area of the sheets to simultaneously reduce the thickness of the stack and soften the texture of the sheets.

2. In a method of the character described, subjecting a stack of inter-folded sheets of creped paper progressively to sufficient pressure to simultaneously reduce the thickness of the stack and to soften the texture of the paper.

3. In a method of the character described, placing a plurality of sheets of creped paper having roughened inner surfaces into juxtaposed relation with the roughened surfaces abutting one another and thereby forming a paper towel, organizing a multiplicity of such towels into a stack of inter-folded towels, then subjecting said stack to sufficient mechanical compression to simultaneously reduce the thickness of the stack and to soften the texture of said sheets.

4. In a method of the character described, subjecting a stack of sheets of creped paper progressively to a mechanical pressure ranging between 1000 and 100,000 pounds, and thereby reducing the thickness of the stack to about one-half its original thickness while simultaneously softening the texture of each sheet of the stack.

5. In a method of the character described, subjecting a stack of sheets of creped paper to mechanical hammer blows of gradually increasing pressure, and thereby reducing the thickness of the stack to about one-half its original thickness while simultaneously softening the texture of each sheet of the stack.

6. In a method of the character described, subjecting a stack of sheets of creped paper to a mechanical pressure ranging between 1000 and 100,000 pounds by delivering hammer blows to the stack with gradually increasing pressure, and thereby reducing the thickness of the stack to about one-half its original thickness while simultaneously softening the texture of each sheet of the stack.

7. A machine for reducing the bulk of stacks of paper articles and for softening such articles, comprising a feed belt for supporting and moving

stacks of paper articles, an anvil over which a bight of the belt travels while supporting said stacks, a hammer movable toward and away from said anvil, a second belt cooperating with the first belt and passing between the hammer and anvil, means for reciprocating said hammer, and means for intermittently moving the belts in timed relation to the movements of the hammer, said hammer having a projecting horn provided with an inclined under surface adapted to compress each stack step by step as the latter is moved by the first belt into a position over said anvil.

8. In a machine of the character described, rotatable pulleys, an anvil arranged between said pulleys, a first belt mounted on said pulleys and having a bight passing over said anvil and adapted to feed stacks of paper articles over the anvil, a hammer cooperating with the anvil for compressing the stacks as they move between the hammer and anvil, means for moving said hammer, other guide pulleys, a second belt passing about the last mentioned guide pulleys and having a bight passing between the hammer and anvil, and means for moving the belts in timed relation with the movements of the hammer, said hammer having a substantially flat under surface and a horn projecting in the direction opposed to the direction of movement of the stacks, and said horn having an inclined under surface slanting downwardly toward said substantially flat surface.

9. A method of treating a stack of superposed sheets of creped paper comprising subjecting the stack to sufficient pressure to simultaneously reduce the thickness thereof and soften the texture of the sheets, by gradually and uniformly moving successive portions of the top and bottom sheets of the pile toward one another and thereby progressively compressing all of the sheets over areas, each extending substantially from one end to the opposite end of the stack.

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