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ART OF MANUFACTURING EMBOSSED PAPER PRODUCTS

Original Filed Feb. 17, 1964

Fig. 1

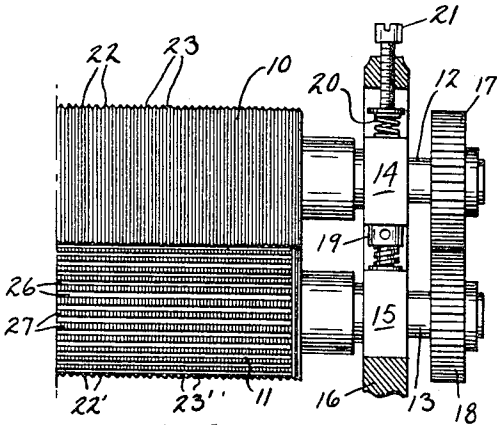


Fig. 2

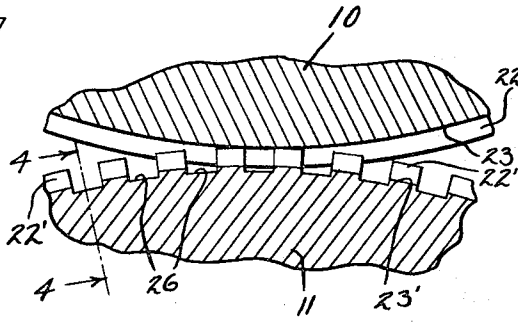


Fig. 3

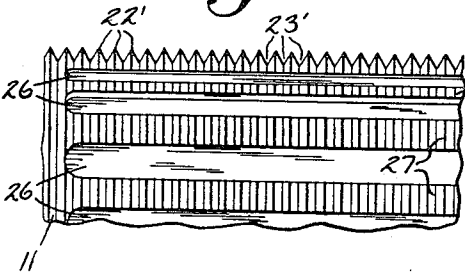


Fig. 4

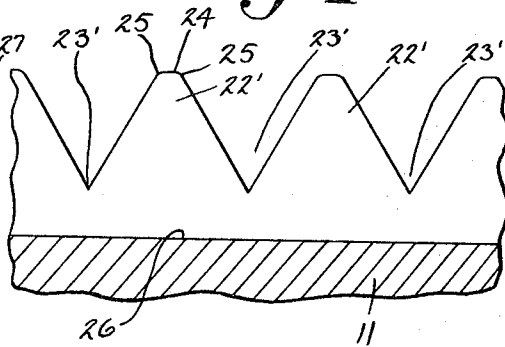


Fig. 5

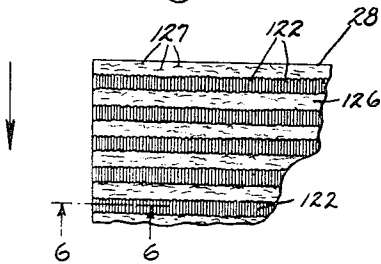


Fig. 6

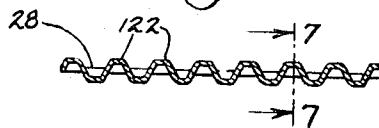
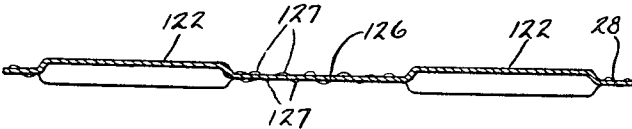


Fig. 7



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3,418,925

ART OF MANUFACTURING EMBOSSED PAPER PRODUCTS

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Divided and this application Mar. 14, 1967, Ser. No. 622,993

4 Claims. (Cl. 101—23)

ABSTRACT OF THE DISCLOSURE

An embossing machine having a pair of cooperating embossing rolls, each with alternating circumferential ridges and valleys, with the ridges of one roll engaging in the valleys of the other roll, in which one of the rolls has circumferentially-spaced axially-extending relief grooves intersecting the ridges to provide alternating axial grooves and ridged strips, and in which there is yielding means normally urging the rolls toward one another. The grooves of the one roll are of sufficient width that a pattern-setting hammering action occurs when the rolls are operated.

This application is a division of application, Ser. No. 345,411, filed Feb. 17, 1964.

Background of the invention

Field of the invention.—The invention pertains to the embossing of paper products and is particularly useful in embossing products which are used for sanitary purposes, such as toweling.

Description of the prior art.—In the manufacture of paper products such as towels it is desirable to perform an embossing operation for the purpose of increasing bulk and softness, and to improve the appearance. It is also desirable that this be accomplished without sacrificing any appreciable amount of strength. Heretofore it has not been possible to successfully emboss with fine pattern lines on relatively heavy toweling stock such as 30-lb. kraft and get a well-set design, particularly while using a small diameter roll.

Summary of the invention

The invention provides apparatus wherein a complete pattern of circumferential ribs is embossed in one of the rolls, such as the top roll, the other roll having mating circumferential ridges which are intersected by axially extending relief grooves which are deeper than the circumferential grooves between the circumferential ridges whereby, in operation, the two rolls are pushed slightly farther apart against spring tension, when an axial groove is not at the nip, said upper roll jumping toward the other roll whenever one of the axial grooves arrives at the nip. Thus, due to the multitude of the axial grooves, there is in effect, a fast hammering action between the rolls which serves to set the design into the material.

Brief description of the drawing

In the accompanying drawing, illustrating the improved product and one form of apparatus for producing the same:

FIG. 1 is an elevational view showing one end of the novel set of embossing rolls;

FIG. 2 is a fragmentary transverse sectional view through the rolls, on an enlarged scale as compared with FIG. 1;

FIG. 3 is a fragmentary plan view showing a portion of the lower roll;

FIG. 4 is a fragmentary sectional view on an enlarged scale taken on the line 4—4 of FIG. 2;

FIG. 5 is a plan view of a portion of a finished product, such as a paper towel, bearing the improved embossed design;

FIG. 6 is a fragmentary sectional view on an enlarged scale taken on the line 6—6 of FIG. 5; and

FIG. 7 is a fragmentary sectional view taken on the line 7—7 of FIG. 6.

Description of the preferred embodiments

Referring more particularly to the drawing, the numeral 10 designates a top embossing roll and the numeral 11 a cooperating bottom embossing roll, both formed of metal. These rolls are suitably mounted on shafts 12 and 13 which are journaled in the conventional way in bearing blocks 14 and 15 at each end, which bearing blocks are suitably supported in spaced upright standards 16, one at each end, forming a part of a conventional embossing frame (not shown). It is to be understood that only a fragment of the length of the rolls 10 and 11 is illustrated in FIG. 1, said rolls being of substantially greater length than is illustrated. One of the shafts is driven from a suitable source and, through the constant mesh gears 17 and 18, which are rigidly mounted on the shafts 12 and 13, the two shafts are driven at the same speed. Projecting upwardly from each bearing block 15 is an adjustable jack 19 of conventional form which can be manipulated to adjust the minimum clearance between rolls. Engaging the top of each bearing block 14 is a pressure loading spring 20 which may be adjusted by means of a screw 21 in the top of the standard 16. It is to be understood that there is an identical frame member 16 at the opposite end, also having an adjustment jack 19 and an adjustable pressure loading spring 20.

One of the rolls, preferably the top roll 10 as illustrated, has a multiplicity of circumferential ridges 22 separated by circumferential valleys 23. While the ridges may be of varying cross-sectional shape, the ridges on both rolls are preferably of the shape illustrated in FIG. 4—that is, generally inverted V-shape—and the separating valleys 23 on one roll and 23' on the other roll are V-shaped. It is preferred to have the sides of the ridges of both rolls at a 60° angle from the horizontal, as is best shown in the sectional view of the lower roller presented in FIG. 4. In the preferred form of the invention the base of each ridge is .0625 of an inch in width, and the tops of the ridges on both rolls are preferably flattened somewhat for a distance of approximately .010 of an inch, as is also best illustrated at 24 in FIG. 4, the cross-section of the ridges in the top roll being the same as is illustrated in FIG. 4 for the bottom roll. Where the flattened tops 24 join the sloping sides of the ridges there is preferably a slight radius such as .010 of an inch as at 25.

There are on the rolls 10 and 11 between sixteen and twenty-four ridges per inch and preferably approximately eighteen. The depth of the valleys 23 and 23' is preferably 0.046 of an inch.

The bottom roll 11 has mating circumferential ridges 22' separated by grooves 23', the ridges 22' of the lower roll fitting in the grooves 23 of the top roll.

An important feature of novelty of the present invention resides in the formation of one of the rolls, preferably the lower roll as illustrated, with axial relief grooves 26. These relief grooves preferably terminate just short of the ends of the roll. These relief grooves are preferably one-eighth of an inch wide and they intersect the circumferential ridges so that there are alternating axial relief spaces 26 on the roll 11 where there are no circumferential ridges. Each ridged roll portion 27, between a pair of axial grooves 26, is preferably 3/32 of an inch wide (in a circumferential direction) or of slightly less width than a groove 26. On a 12 1/2 inch diameter roll, there are preferably 180 equally-spaced relief grooves. The dimensions

and spacings referred to herein are those which have been found to produce the best results on 30-lb. kraft stock.

The purpose of the above construction is to make it possible to emboss a relatively fine pattern on paper products, such as paper towels, for the purpose of increasing the bulk, softness and appearance. Normally, it would not be possible to get enough pressure, with the fine pattern illustrated and described herein, using small diameter rolls and a relatively wide web of relatively heavyweight toweling stock such as 30-lb. kraft. If this were attempted without the features of the present invention the pattern would not become set. In addition, the present invention provides a well-set pattern without sacrificing strength in the cross direction, which direction is normally less strong in an embossed paper.

In operation, when a continuous web of toweling stock, or other paper material, of a width no greater than coextensive with the length of the grooves 26, is run between the rolls, it will be embossed with a pattern such as is illustrated in FIGS. 5, 6 and 7. In these figures the numeral 28 designates the toweling or other paper product and it will be noted that there are rows of ribs or bars 122 extending in the cross direction of the sheet or web, which rows are separated by relatively narrow unembossed areas or spaces 126 also extending crosswise of the sheet. The ribs 122 project from both sides of the sheet as shown in FIGURE 6 to produce a two-way emboss. In the case of toweling, this material may be 30-lb. kraft. It is to be understood, however, that the process will work on a variety of paper stock but that, normally, there would be a problem in obtaining a well-set pattern when using a stock as heavy as 30-lb. kraft, which problem is solved by the present invention.

During the embossing of the web of paper, when a row of ridges 27 of the bottom roll are at the nip between the two rolls, the two rolls 10 and 11 are pushed slightly apart against the tension of the springs 20 to permit such engagement. This is due to the fact that the depth of the valleys 23' and 23 is less than the depth of the axial grooves 26, the former being preferably 0.046 of an inch as against 0.056 of an inch for the depth of the axial grooves 26. As soon as one of the axial relief spaces 26 of the bottom roll 11 is at the nip between the rolls the spring tension on the rolls causes the top roll to jump toward the bottom roll. Due to the multitude of the axial grooves 26, there being preferably 180 on a 12½ inch diameter roll, when the rolls are rotating at production speed, there is in effect a fast hammering action between the rolls the material passing between the rolls absorbs at least some of the impact of the hammering action to set the desired pattern in the material. While this hammering movement is slight in amount, it is, nevertheless, quite definite and serves the purpose of hammering the design into the material, this hammering being due to the alternate relief of pressure whenever an axial groove 26 arrives at the nip between the rolls.

The fine ridges 22 of the top roll enter the valleys 23' of the bottom roll a distance substantially less than the depth of the axial grooves 26. The exact amount of the difference in depth between the valleys 23' and grooves 26 depends upon conditions, and particularly upon the depth of the emboss which is desired and the caliper of the paper. As a result of the novel process it is possible to emboss a wide web of relatively heavyweight stock, such as a 30-lb. kraft, without using a large diameter roll while still leaving a well-set design.

A fragment of the improved paper product, usually toweling, produced by the present invention is illustrated in FIG. 5. It is understood, however, that this is just a corner of a piece of toweling and that the same design appears uniformly throughout the paper product.

Embossed paper products are usually weaker in the cross direction as distinguished from the machine direction. With the present invention, by having the unembossed spaces 126 which extend in the cross direction there is

added strength in this direction which makes it possible for embossing to be done without seriously impairing the strength in either direction. While the single or multiple paper stock to be embossed may be either plain or creped, the present invention has particular utility in connection with stock having transverse lines of light creping 127. With such stock the creping 127 extends in the same direction as the unembossed spaces or strips 126, giving added strength in the cross-machine direction (the machine direction being indicated by an arrow in FIG. 5). Also, the bars 122 on the product of FIG. 5 intersect the crepe lines 127 at right angles producing an extra softening action, the cross-machine strength of the sheet, however, being preserved because of the unembossed transverse spaces or strips 126. When paper materials are being embossed which are of lighter weight than the 30-lb. kraft stock described herein, it may not be necessary to obtain the definite hammering action featured herein. For such lighter papers, the roller design of FIG. 3 may have utility regardless of the relative depth of the axial grooves 26 with respect to the depth of the valleys 23'.

It is also to be noted that, in the case of toweling or other item which is to be dispensed by a withdrawal movement, the embossed bars 122 of FIG. 5, which extend in the dispensing direction shown by the arrow, create a situation where the contact between two superimposed towel surfaces is usually only along the crests of the bars. Thus, during withdrawal movement, there is substantially less friction and easier dispensing.

Various changes and modifications may be made without departing from the spirit of the invention, and all of such changes are contemplated as may come within the scope of the claims.

What I claim is:

1. A machine for embossing paper stock of a given width and having a pair of rotatably mounted cooperating embossing rollers having a nip therebetween and having their axes in substantial parallel alignment, the improvement comprising interengaging embossing patterns in each of said rolls, said embossing patterns each comprising alternating ridges and valleys, the ridges of one roll engaging in the valleys of the other roll, one roll of said rolls having circumferentially spaced axially-extending relief grooves intersecting the said embossing pattern on said one roll to provide circumferentially alternating axial grooves and embossing strips, the said grooves having a depth greater than the depth of the said valleys, the axial length of said relief grooves being at least coextensive with the width of the said paper passing therebetween, and yielding means normally urging the said rolls toward one another so that as each of said relief grooves moves to a position at the nip between said rolls, the said other roll jumps toward said one roll to hammer the paper between said rolls and thereby form an embossment therein.

2. The machine of claim 1 wherein said ridges and valleys in said rolls are axially alternating.

3. The machine of claim 1 wherein the said relief grooves have a greater width than the said strips.

4. The machine of claim 1 wherein the said relief grooves have a depth at least as deep as the said valleys and a width greater than the said strips.

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U.S. Cl. X.R.

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