May 27, 1952 F. W. HUMPHNER 2,598,173

CALENDERED CRINKLED PAPER AND PROCESS OF MANUFACTURE

Filed June 28, 1947 2 SHEETS—SHEET 1

Fig. 1

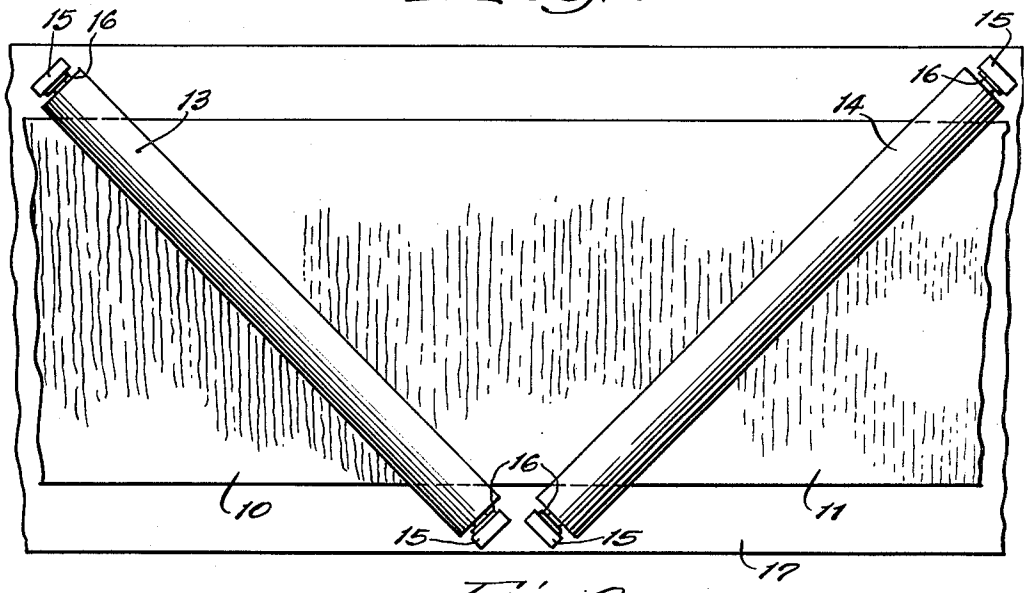


Fig. 2

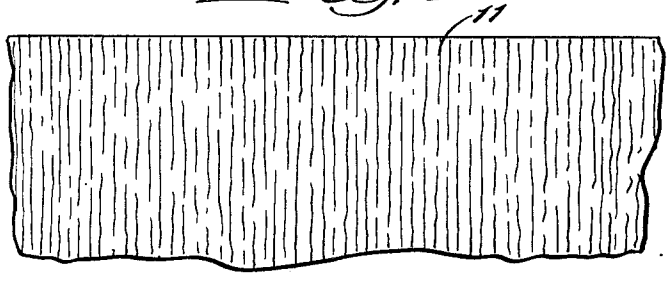


Fig. 3



Fig. 4



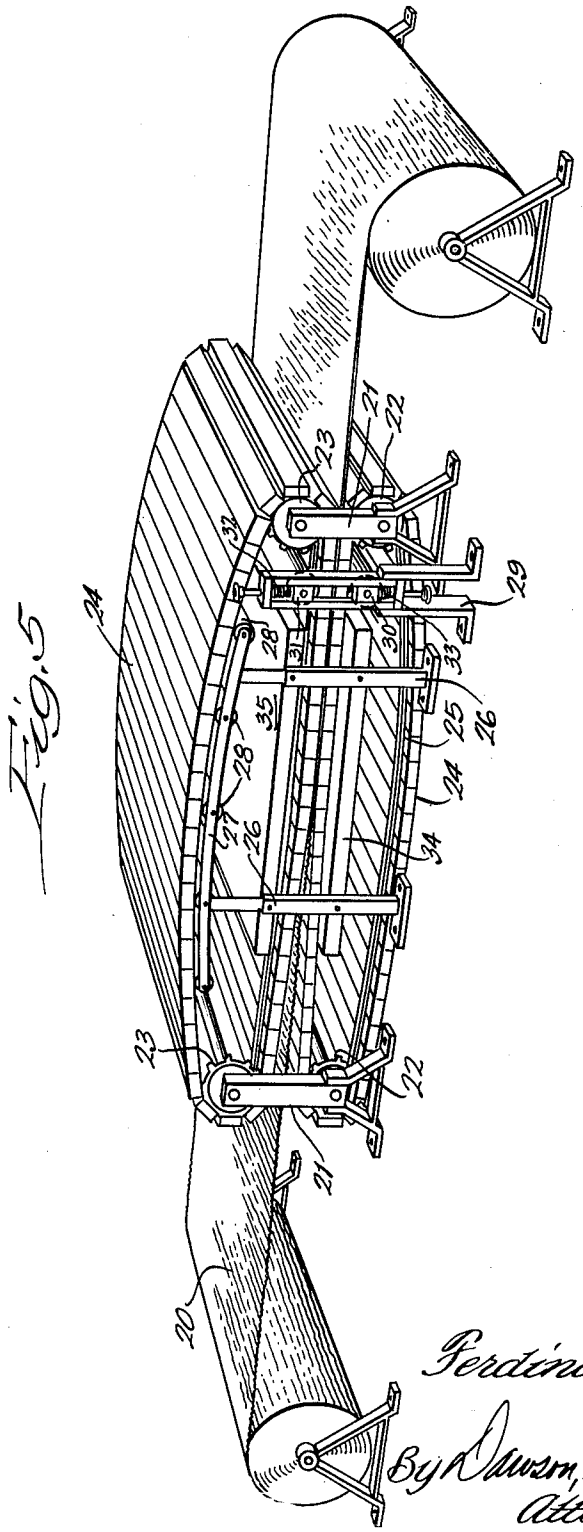
Inventor:
Ferdinand W. Humphner,
By Dawson, Booth & Strauchberg,
Attorneys.

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CALENDERED CRINKLED PAPER AND PROCESS OF MANUFACTURE

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Fig. 5



Inventor:
Ferdinand W. Humphner,
By Dawson, Boothby, Strauch & Strauch,
Attorneys.

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2,598,173

CALENDERED CRINKLED PAPER AND PROCESS OF MANUFACTURE

Ferdinand W. Humphner, River Forest, Ill.

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10 Claims. (Cl. 154—33.05)

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This invention relates to a calendered crinkled paper. The invention is particularly useful in connection with crinkled or creped paper in which it is desired to have a controlled stretch in the paper.

A sheet of paper subject to creping or crinkling operations has been on the market for many years and has served industry in many ways. The paper has been of considerable value in the construction of bags and numerous other items. The use of this product, however, has been limited by reason of the ridged or mounded structure which prevents the application of adhesive effectively upon the paper and which does not permit printing thereon. Further, the stretch of the product cannot be effectively controlled to meet the requirements of certain products.

After such a crinkled or creped paper is passed through calender rolls to flatten the sheet, the crinkling is substantially removed and the product no longer has a satisfactory stretch.

An object of the present invention is to provide a creped or crinkled paper which has been calendered in such a manner as to retain the folds or crinkles therein, while still providing a relatively smooth surfaced paper. Yet, another object is to provide a paper sheet having folds therein which are flattened or creased, such folds providing a control of the stretch of the paper and resisting stretch up to a predetermined point. Yet, another object is to provide with a calendered crinkled paper, materials in the paper or upon the surface of the paper which cooperate in bonding the folds of the paper to the main paper body, such materials of various types providing a predetermined resistance to stretch but yielding to provide a stretch under predetermined conditions. Yet, another object is to provide a paper structure adapted to receive printing and other materials and which will yield under predetermined conditions to provide a tell-tale indication of the stretching of the paper. A further object is to provide new and improved mechanism for pressing folds of crinkled paper tightly against the body of the sheet. Other specific objects and advantages will appear as the specification proceeds.

The invention is illustrated, in a preferred embodiment, by the accompanying drawing, in which:

Figure 1 is a plan view of calender roll mechanism which may be employed for creasing the folds of crinkled or creped paper; Fig. 2, a top plan view of a portion of the paper after being calendered; Fig. 3, longitudinal sectional view

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of the structure shown in Fig. 2; Fig. 4, a view similar to Fig. 3 but showing a modified form of structure in which a bond is provided between the folds and the paper body; and Fig. 5, a perspective view of a modified form of apparatus for creasing the folds of the crinkled paper.

I have discovered that a sheet of crinkled or creped paper can be effectively calendered without removal of the folds by directing the paper into or between two calender rolls placed at such an angle that the transverse folds of the paper approach the squeeze rolls with the points of the crinkling entering sideways. When the points of the folds enter the rolls sideways, the said creasing of the fold occurs while the original shape of the sheet is held and the fold is held against removal. For example, by directing the paper into or between the two calender or squeeze rolls placed at about a 45 degree angle or less, the ridges or mounds which run generally in a transverse direction upon the sheet, bring their points into the rolls from a sideways direction, and at this point there is no tendency for the fold to squeeze out. Instead, the creasing of the points holds the fold in position and requires that the entire fold be creased. The result is the forming of a structure such as illustrated in Figs. 3 and 4, the folds no longer forming hills or ridges, but now lying in compact and creased folds upon the paper body. Any type of creped paper of coarse or fine folds may be used.

In the illustration given, in Figs. 1 to 4 inclusive, 10 designates the original creped paper prior to the calendering operation, and 11 designates the paper after it has been calendered as above described. The calendered product 10 has creased folds 12 lying upon the paper body, as shown more clearly in Figs. 3 and 4.

Any suitable apparatus may be employed. The simplest sort of apparatus, which is very effective, is to simply place two calender rolls or squeeze rolls opposite each other and arranged at an angle across the path of the creped paper. The creped paper 10 may then be passed through the angularly supported rolls, as shown more clearly in Fig. 1. If desired, one pair of rollers may be extended across the path of the paper in one direction, and thereafter a second pair of rollers may be extended across the path of the paper in the opposite direction, so that the paper, in passing through the two sets of rolls, is calendered twice and the calendering may be less close in the first rolls and the more severe squeezing brought about by the second pair of rollers.

In the illustration given in Fig. 1, a pair of

superposed squeeze rolls 13 are shown supported and extending inwardly in one direction and a pair of squeeze rolls 14 are shown supported for rotation in superposed relation and extending inwardly from another direction. Each of the rollers may be provided with a drive wheel driven by a belt 15.

In the specific illustration, each of the rollers 13 and 14 are rotatively supported at their ends by brackets 16 carried by the frame bed 17. It will be understood that any suitable calendering apparatus may be provided so long as the paper is caused to enter between the rolls at an angle thereto.

It will be understood that the angle may vary widely, depending upon the character of the creping of the paper and upon the desired quality of the finished product. I have found that for ordinary crepe paper, best results are obtained when the angle is in the neighborhood of 45 degrees, but good results may be obtained at lesser angles, and for certain purposes at greater angles. The important requirement is that the point of the fold or crinkle enter between the squeeze rolls from a sidewise direction so that the fold will be caught and creased before there is any tendency for it to be squeezed out of the paper.

The control of the calendered crinkled paper so as to resist stretch to a predetermined extent may be brought about through many variations in the method. For example, a greater resistance to stretch is brought about through subjecting the paper to a steam bath just as it enters the nip of the two rolls. The steam causes the paper to soften slightly, and under the pressure of the rolls, the finely dispersed water particles tend to form a cohesive bond between the creased folds and the paper body.

Increased resistance to stretch may be provided by the use of adhesives, which may be either added to the surface of the paper or may be incorporated in the paper body when the paper is originally formed. For example, a dry powder, consisting of irregularly spaced particles of adhesive material, such as raw starch, dextrine, corn starch or glue, may be applied to the surface of the paper just before the calendering operation. Further, the sizing of the content of the paper when it is being formed, may be modified so as to produce the desired bonding effect.

For example, when the sheet is being formed, there may be incorporated in the sheet, raw starch, modified starch, dextrine, glue, etc. so that a predetermined resistance to stretch will be thus formed in the final calendered sheet.

In the illustration given in Fig. 4, the numeral 18 indicates a bonding material between the folds 12 and the body 11 of the paper sheet. By varying the kind or character of the bond, a varying degree of resistance to stretch can be formed in the creased or crinkled paper. For example, an extreme resistance would be produced through the use of glue or such tenacious types of adhesive, while a lesser degree of resistance would be provided through the use of starch bond. Finally, a mild form of resistance is produced through the use of water. With the water or other bonding material, a fair degree of resistance to stretch is provided by the creased character of the folds 12. Further, the folds may be lightly creased or sharply creased to control the degree of resistance to stretch.

The new product, consisting of creped paper having the ridges or folds therein creased so as to lie flat upon the body of the paper, can be readily printed and will support an even layer of glue, thus multiplying the uses to which the product can be put. The product can be used as an insulation sheet, providing stretch of a desired degree of resistance. It may carry a printed design on an ungummed side, and thus serve as a gummed tape product, which would indicate whether a carton was subjected to unusual handling in transit and whether any attempt to open the sealed joint had been made. The creased and folded character of the paper renders it highly effective as a sound-proofing web. It carries wax and other weather-proofing materials effectively so that it may be used as insulation, etc., while at the same time providing the quality of stretchability. The other vastly increased number of uses to which the product may be put will be obvious.

In the modification illustrated in Fig. 5, the crinkled paper 20 is fed between two belts equipped with pivotally-connected shoes. The frame 21 pivotally supports the sprocket wheels 22 and 23. Upon the aligned sprocket wheels 22 is mounted a belt formed of caterpillar shoes 24 connected by a flexible strap 25 and operated by the driven sprocket wheels 22. An upper belt formed of the shoes 24 is carried by the sprocket wheels 23. Frame members 26 support the arcuate bars 27 upon which are mounted rollers 28 for supporting the upper portion of the upper belt. Also, a pair of frame members 29 slidably support the rollers 30 and 31, and spring members 32 and 33 urge the rollers against the adjacent shoes or blocks 24.

Heating means is provided for heating the shoes. In the illustration given, infrared units 34 and 35 are provided, as shown, for heating the blocks or shoes at the point where they are about to come together into engagement with the creped paper.

In the operation of the modification shown in Fig. 5, the creped paper is fed forwardly between the innermost portions of the belts and are engaged by the caterpillar shoes 24. The shoes 24 at the point where they come together are brought downwardly rather abruptly upon the folds, and this action results in creasing the folds effectively. Whereas, in most ironing operations, the creped paper loses its folds, the action of the hinged shoes in moving together abruptly catches the fold and creases it without permitting the fold to be lost. The spring-urged rollers 30 and 31 cause the shoes to press tightly against the engaged folds and to sharply crease the same before they are released from the device. The effectiveness of the shoes further is increased by the application of heat to the shoes, and the effect of the heat in the shoes is to firmly set the ingredients of the paper so that the folds remain tightly creased and lying flat against the body of the paper after the paper leaves the machine. The heated shoes are also effective in the presence of moisture for giving a set to the folds so that they remain intact and in flat relation against the body of the paper after the fold-forming step.

With the structure shown in Fig. 5, it will be noted that the crepe paper 20 does not have to be fed at a specific angle with respect to the machine, but may be fed in the direction illustrated in Fig. 5. Here, the action of the hingedly-connected shoes is effective in creasing the folds, and the angular feeding of the paper is unnecessary.

The hingedly-connected shoes are highly ef-

fective in creasing the folds of the paper because of the absence of stress. Such shoes produce substantially no distortion in the creasing operation. The shoes are highly effective for creasing crepe paper, both of light and heavy stock.

While in the foregoing specification, I have set forth certain specific steps in detail for the purpose of illustrating the invention, it will be understood that such details may be varied widely by those skilled in the art without departing from the spirit of my invention.

I claim:

1. A crinkled paper having interrupted folds flattened against the body of the paper to provide a smooth surfaced crinkled paper, said folds having their ends merging with flat, unfolded portions of the sheet.

2. A crinkled paper having the relatively transverse interrupted folds thereof creased so as to lie substantially in the plane of the paper body and to provide a relatively flat paper sheet said folds having their ends merging with flat, unfolded portions of the sheet.

3. A crinkled paper sheet having a controlled stretch, comprising a sheet crinkled to provide transverse interrupted folds, the folds being creased at their outer folded edges and merging with flat, unfolded portions of the sheet, the main folded portion lying flat against the face of the sheet.

4. A crinkled paper sheet having a controlled stretch, comprising a sheet crinkled to provide transverse interrupted folds, the folds being creased at their outer folded edges and merging with flat, unfolded portions of the sheet, the main body of the folds lying flat against the face of the sheet, and bonding material uniting said folds to the body of the sheet.

5. A process of the character set forth, comprising passing a crinkled paper sheet having short folds interrupted by unfolded, flat sheet portions between compression members at an angle away from a line perpendicular to the longitudinal axes of the compression members whereby the interrupted crinkles of said paper enter between said compression members from a sideways direction.

6. A process of the character set forth, comprising passing a creped paper sheet having its crepe folds interrupted by unfolded flat portions between compression rollers at an angle away from a line perpendicular to the longitudinal axes of the rollers to cause the interrupted transverse folds of said paper to enter the space between said rollers from a sideways direction.

7. In a process for forming a crinkled paper sheet, the steps of forming a creped paper sheet with folds interrupted by unfolded, flat sheet portions and passing the sheet thus formed between calender rolls at about an angle of 45 degrees from a line perpendicular to the longitudinal axis of the rolls.

8. In a process for forming a crinkled paper sheet, the steps of creping the paper sheet to form therein interrupted folds, the ends of the folds merging with the flat, unfolded portions of the sheet and passing the sheet so formed between calender rolls at an angle away from a line perpendicular to the longitudinal axes of the rolls while subjecting the sheet to moisture.

9. In a process for forming a crinkled paper sheet, the steps of creping the paper sheet to form therein interrupted folds, the ends of the folds merging with the flat, unfolded portions of the sheet, and passing the sheet so formed between calender rolls at an angle away from a line perpendicular to the longitudinal axes of the rolls while applying a bonding material to the sheet for uniting the folds of said paper sheet to the body of the sheet.

10. In a process for forming a crinkled paper sheet, the steps of creping the paper to form interrupted irregular folds therein terminating short of the sides of the paper and with the ends of the folds merging with flat unfolded portions of the sheet, passing the crinkled sheet between compression members at an angle away from a line perpendicular to the longitudinal axes of the compression members, and heating the said compression members.

FERDINAND W. HUMPHNER.

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