

March 31, 1936.

J. E. KIEFFER
INDENTED SHOCK ABSORBING CUSHIONING OR PACKING PAPER
AND METHOD AND APPARATUS FOR MAKING SAME
Filed April 7, 1934

2,036,051

3 Sheets-Sheet 1

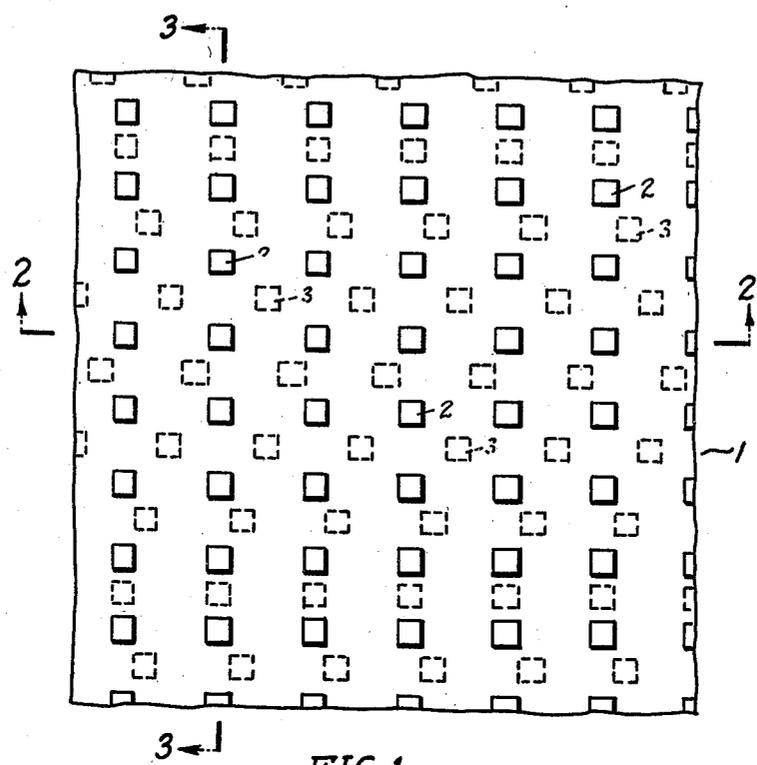


FIG. 1

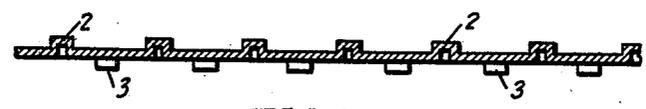


FIG. 2

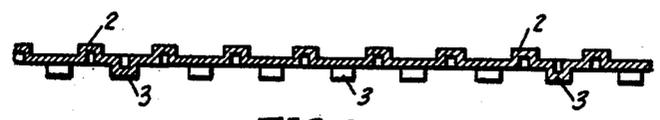


FIG. 3

INVENTOR.
JOHN E. KIEFFER

BY
A. D. Caesar
Charles W. Rivise
ATTORNEYS

March 31, 1936.

J. E. KIEFFER
INDENTED SHOCK ABSORBING CUSHIONING OR PACKING PAPER
AND METHOD AND APPARATUS FOR MAKING SAME

2,036,051

Filed April 7, 1934

3 Sheets-Sheet 2

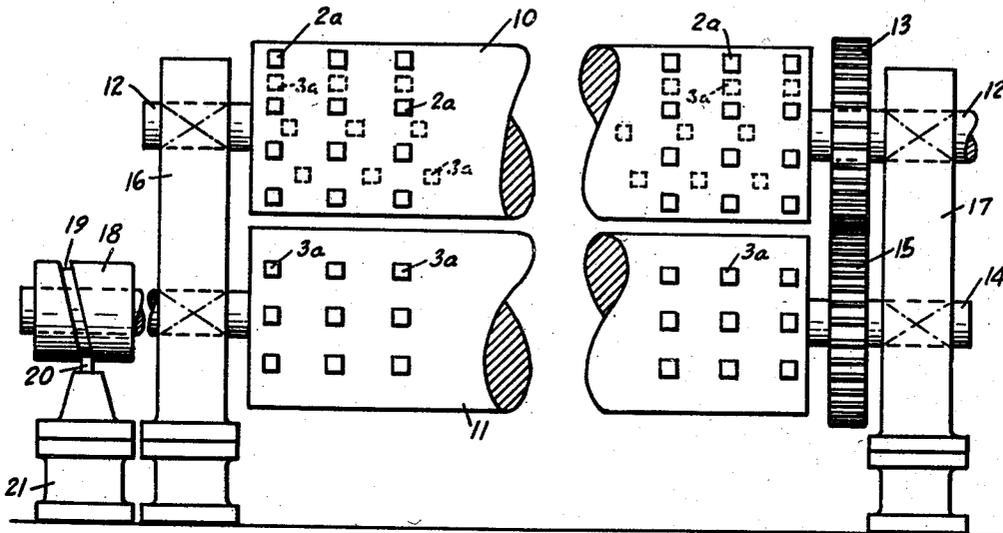


FIG. 4

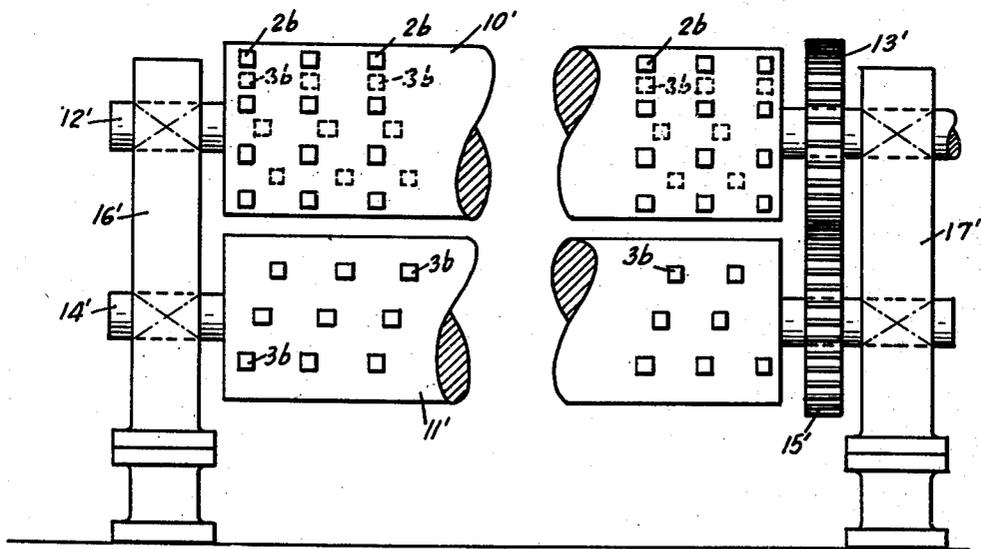


FIG. 5

INVENTOR.

JOHN E. KIEFFER

BY

A. B. Caesar
Charles W. Rivise
ATTORNEYS

March 31, 1936.

J. E. KIEFFER
INDENTED SHOCK ABSORBING CUSHIONING OR PACKING PAPER
AND METHOD AND APPARATUS FOR MAKING SAME

2,036,051

Filed April 7, 1934

3 Sheets-Sheet 3

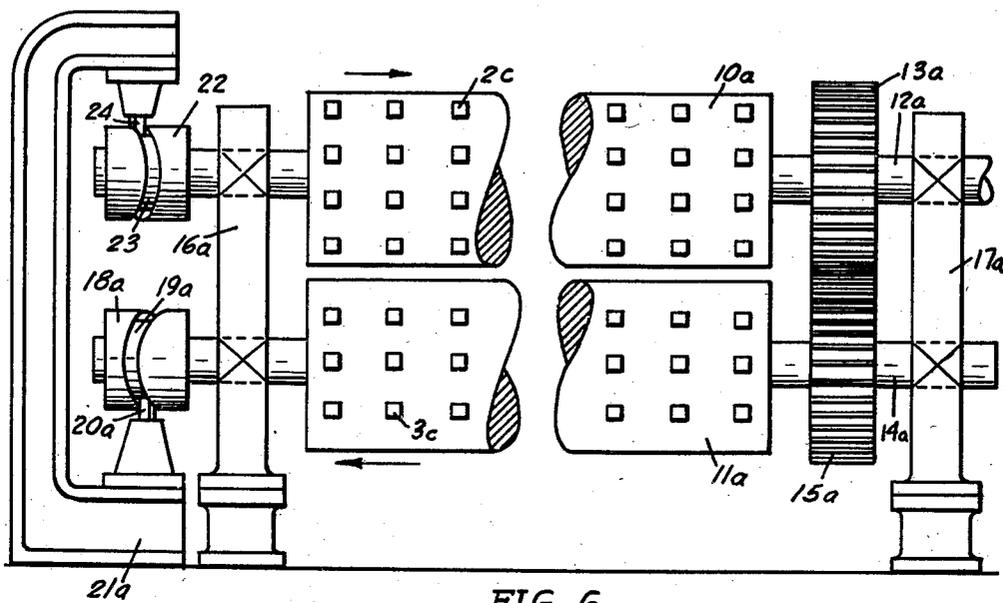


FIG. 6

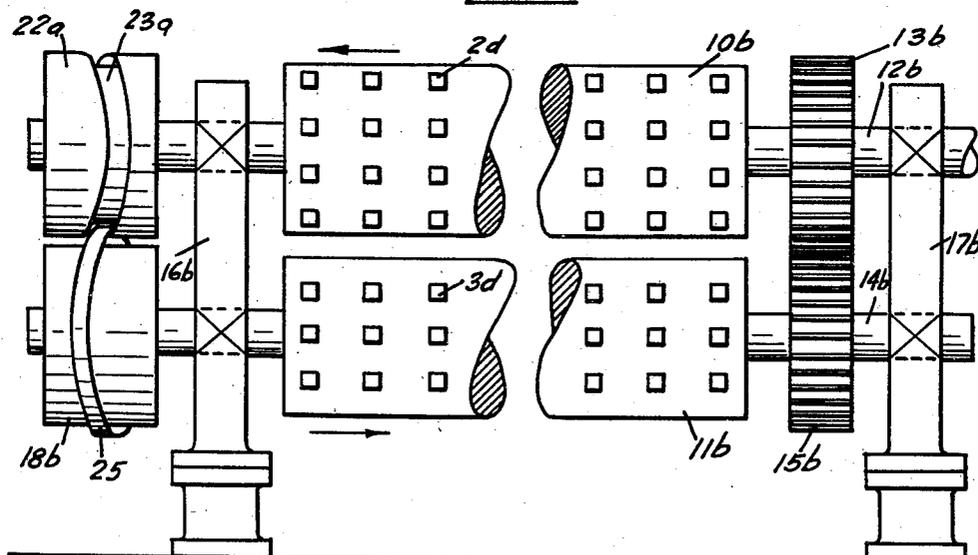


FIG. 7

INVENTOR.
JOHN E. KIEFFER

BY

A. D. Caesar
Charles W. Rivise
ATTORNEYS

UNITED STATES PATENT OFFICE

2,036,051

INDENTED SHOCK ABSORBING CUSHIONING OR PACKING PAPER AND METHOD AND APPARATUS FOR MAKING SAME

John E. Kieffer, Ewing, Ind.

Application April 7, 1934, Serial No. 719,492

10 Claims. (Cl. 154--33)

The present invention relates to shock absorbing cushioning or packing paper of the type which is provided on one or both of its surfaces with a multiplicity of more or less closely spaced hollow protuberances or indentations as distinguished from corrugations. Such paper is particularly well adapted for wrapping and protecting fragile articles such as glassware, and may also be used as a pipe covering and for covering floors or stairs under carpets.

In my prior patent (Patent No. 1,780,526 dated November 4, 1930), I have disclosed a material of this type in which the protuberances have been molded into the paper after it has been completely formed and after a substantial portion of its water content had been removed without materially decreasing its plasticity or causing the fibers to set in their usual substantially flat condition, and prior to the final conditioning and setting of the fibers of the paper. By molding the protuberances in this manner I have found it possible to produce deeper indentations than had been made by prior processes and to impart to the product a previously unequalled rubber-like resiliency normal to its surface.

Indented paper as made prior to the present invention has one shortcoming; namely, if the material is laminated as by winding a web in a roll or by stacking a number of sheets, the indentations or protuberances of the different layers tend to register and to nest in each other. For certain uses and applications of indented paper, this is a serious disadvantage, for nesting of the indentations cuts down the amount of air space between the layers, thus lessening to a considerable extent the shock absorbing and heat insulating properties of a laminated sheet. Furthermore, nesting of the indentations makes it impossible to wind a web so as to produce a roll having a uniform circular cross-section. Moreover, it is exceedingly difficult to separate nested sheets by hand, an operation which must be performed very rapidly in the placing of sheets between the articles being wrapped.

The principal object of the present invention is to provide an indented shock absorbing cushioning or packing paper in which the registration or nesting of the indentations or protuberances is reduced to a minimum.

In its very essence, the phase of the invention rendering the foregoing object possible of accomplishment consists in arranging the indentations or protuberances on at least one side of the sheet so that they are out of line in a plurality of directions on the sheet. In the embodiment

selected to illustrate the invention, the indentations on one side of the sheet are shown to be in line in the breadth and length of the sheet as well as diagonally of the sheet while the indentations on the other side of the sheet are shown to be in line only in the breadth of the sheet. However, I am not to be limited to this particular arrangement of the indentations, for there are many other possible arrangements falling within the essence of the invention.

Another object is to provide a method for making an indented shock absorbing cushioning or packing paper in which the registration or nesting of the indentations or protuberances is reduced to a minimum.

Still another object is to provide an apparatus for making an indented shock absorbing cushioning or packing paper in which the registration or nesting of the indentations or protuberances is reduced to a minimum.

Referring briefly to the drawings, Figure 1 is an enlarged plan view of a small portion of material made according to the teachings of the present invention, the arrangement of protuberances on the upper surface of the sheet being indicated diagrammatically by solid squares, while the protuberances on the bottom of the sheet are indicated diagrammatically by squares in dotted lines;

Figure 2 is a cross-section taken along line 2-2 of Figure 1;

Figure 3 is a cross-section taken along line 3-3 of Figure 1;

Figure 4 is a front elevation of a pair of indenting rolls and associated mechanism for producing the product of Figure 1; the arrangement of protuberances on each of the rolls being shown diagrammatically by solid squares and the projection of the protuberances of the bottom roll onto the top roll being indicated diagrammatically by means of squares in dotted lines;

Figure 5 is a view similar to Figure 4 of an alternative embodiment of a pair of indenting rolls and associated mechanism;

Figure 6 is a view similar to Figure 5 of another embodiment of indenting apparatus suitable for the purposes of the present invention; and

Figure 7 is a view similar to Figure 6 of still another embodiment of indenting apparatus.

Referring in greater detail to the drawings and particularly to Figures 1, 2 and 3 thereof, the sheet of paper per se is denoted generally by the numeral 1. The upper surface of the sheet is provided with a series of protuberances 2 in-

dictated rather diagrammatically by means of solid squares. The lower surface of the sheet is provided with a series of protuberances 3 indicated rather diagrammatically by means of squares in dotted lines. The protuberances may take any polyhedral shape, such as for example, cubes or hemispheres, without sacrificing any of the advantages of the invention. Obviously the protuberances of one side of the sheet form indentations for the reverse side of the sheet, so that in the embodiment illustrated both sides are provided with protuberances and indentations. The spaces between the protuberances and indentations are substantially in the plane of the original sheet of papers.

It is to be noted that the protuberances 2 are in line, not only longitudinally and transversely of the sheet but also diagonally of the sheet. The indentations 3 are illustrated as being in line transversely of the sheet but out of line in every other direction. Taking the first transverse row of protuberances 2 as a reference line, it will be seen that the first transverse row of indentations 3 is in longitudinal alinement therewith, but that each succeeding transverse row of indentations 3 is shifted over slightly to the right until the fourth transverse row of indentations 3. With the fifth transverse row, the indentations 3 start shifting back to the left until in the seventh transverse row they are again in longitudinal alinement with the protuberances 2. This particular arrangement is repeated for the entire length of the material. It is to be noted that the amount of shift of the transverse rows of indentations 3 back and forth transversely of the sheet is equal to the distance between two contiguous longitudinal rows of protuberances 2.

In Figures 4 and 5 are illustrated two alternative forms of indenting rolls for producing the material of Figure 1. As illustrated in Figure 4, the two rolls are indicated by the reference numerals 10 and 11. The top roll 10 is fixed on a shaft 12, to which shaft is also fixed the gear 13. The bottom roll 11 is fixed to a shaft 14 to which shaft is also fixed the gear 15. These two gears mesh as indicated in order to transmit the rotation of one of the gears to the other. Sufficient space is left between the two rolls for the purposes of the invention.

Each shaft is rotatively supported near its ends in the standards or frames 16 and 17 which are provided with the proper bearings. One of the rolls is also provided with means to shift it back and forth axially. In the illustrated embodiment, it is the lower roll 11 which is shown so mounted, but clearly either or both rolls may be mounted for axial movement. In Figure 4, the shaft 14 of the lower roll has fixed to one of its ends the cam wheel 18 having a circumferentially disposed cam groove or slot 19. This slot receives the lug 20 carried by the stationary stand 21. The design of the cam is such as to shift the lower roll back and forth axially a small distance, which may well be equal to the distance between two circumferentially contiguous rows of protuberances on the rolls.

The protuberances on the upper roll are denoted by the numerals 2a, while those on the lower roll are denoted by the numerals 3a. Both sets of protuberances are arranged in rows both circumferentially and axially of the rolls. As the rolls rotate the cam causes the lower roll to shift back and forth axially. Hence as the paper web is drawn between the rolls, the rows of indenta-

tions made by the lower roll will be shifted back and forth transversely of the sheet.

The same result may be produced by spacing the protuberances on one of the rolls so that they are arranged in rows axially of the roll but are out of line circumferentially of the roll. Referring to Figure 5, the two rolls are denoted by 10' and 11', their shafts by 12' and 14', their gears by 13' and 15', and the protuberances by 2b and 3b. The ends of the shafts 12' and 14' are shown as being rotatively supported in the standards 16' and 17'.

The protuberances 2b on the upper roll 10' are arranged as in the first embodiment of the apparatus, i. e. in line both axially and circumferentially of the roll. The protuberances 3b on the lower roll 11' are arranged so that they are in line only axially of the roll. Circumferentially of the roll 11' the corresponding protuberances of adjacent axial rows are out of line. Preferably each axial row of protuberances 3b shifts over slightly in one axial direction and then back in the other axial direction.

In both embodiments of the invention, the axial rows of protuberances of the lower roll when projected onto the upper roll fall in between the axial rows of protuberances of the upper roll (see Figures 4 and 5) and shift first in one axial direction relative to the axial rows of protuberances on the upper roll and then in the opposite direction.

In Figures 6 and 7, I have illustrated two alternative forms of apparatus in which both of the indenting rolls shift endwise as they rotate. Referring to Figure 6 the two indenting rolls are indicated by the numerals 10a and 11a. The top roll 10a is provided with the protuberances 2c and the bottom roll 11a is likewise provided with the protuberances 3c. Both of these sets of protuberances are arranged similarly to those of Figure 4; namely, in rows both circumferentially and axially of the rolls.

The two rolls 10a and 11a are fixed to the shafts 12a and 14a, the upper shaft 12a carrying the gear 13a and the lower shaft 14a carrying the gear 15a. The gears mesh to transmit the rotation of one roll to the other. The ends of the shafts 12a and 14a are journaled in the vertical standards 16a and 17a. The ends of the shafts which are journaled at 16a extend beyond the standard and are provided with the cam wheels 18a and 22. The lower cam wheel 18a is provided with a cam slot 19a. This slot receives the lug 20a carried by the stationary stand 21a. The design of the cam is such as to shift the lower roll back and forth axially a short distance, which may be equal to half the distance between two circumferentially contiguous rows of protuberances, or to any small multiple of such distance.

The upper cam wheel 22 is provided with a cam slot 23 which receives a lug 24, which may be carried as shown in Figure 6 by the standard 21a. The design of the cam is preferably such as to cause the upper roll to shift back and forth axially a short distance in opposite directions to the shift of the bottom roll. The shift of the upper roll may be equal in length to that of the bottom roll. Conceivably the shift of both rolls may be in the same direction, but of such relative lengths as to produce a relative shift of the corresponding protuberances.

In Figure 7, an arrangement is shown wherein the relative shift of the two rolls is produced by meshing cam wheels. The two rolls are designated as 10b and 11b and the two sets of protuberances as 2d and 3d. The protuberances

on both rolls are arranged as in Figure 6; i. e. in rows both circumferentially and axially of the rolls. The shafts are denoted by 12b and 14b and the meshing gears by 13b and 15b. One end of each shaft is journalled in the standard 16b while the other end is journalled in the standard 17b.

The ends of the shafts which are journalled in the standard 16b are provided with meshing cam wheels 18b and 22a. One of the cam wheels; e. g. the upper one which is designated by the numeral 22a, is provided with a slot 23a while the other cam wheel 18b is provided with a circumferential rib 25 which is received in the slot 23a.

The design of the groove 23a and of the rib 25 are such as to cause the two rolls 10b and 11b to shift relatively to each other as they are rotated. The design may be such as to produce a shift similar to that produced by any of the preceding embodiments of the invention.

To obtain the best results I prefer to mold the protuberances and indentations into the semi-plastic sheet according to the teachings of my prior patent. However, I am not precluded from performing the method of the present invention upon a moistened web or sheet of paper.

The term "paper" in this specification is used in its ordinary sense in the art; namely, as a sheet material formed by papermaking methods from an aqueous suspension of fibrous materials such as cellulose and/or asbestos which may be admixed with other vegetable, animal or mineral fibers to impart to the product other desirable properties.

The foregoing constitutes the essential thought of my invention, but it is to be understood that its details may be modified in various ways, replaced by other details or combined with other concepts without departing from the spirit and scope of the following claims, in which I am endeavoring to cover all novelty inherent in the foregoing disclosure.

I claim:

1. As an article of manufacture, a shock absorbing cushioning or packing paper provided on one of its sides with a multiplicity of indentations, said indentations being arranged in rows, said rows of indentations being progressively offset relative to each other, whereby the tendency of the indentations to nest when the paper is rolled is reduced to a minimum.

2. As an article of manufacture, a shock absorbing cushioning or packing paper provided on one of its sides with a multiplicity of hollow protuberances and with a multiplicity of indentations, said protuberances being arranged in rows and columns and said indentations being arranged in rows, said rows of indentations being progressively offset relative to each other, whereby the tendency of the protuberances and indentations to nest when the paper is rolled is reduced to a minimum.

3. The article defined by claim 1, wherein the rows of indentations are equally spaced.

4. The article defined by claim 2, wherein the rows of protuberances are equally spaced.

5. A method for producing an indented shock absorbing cushioning or packing paper, the indentations of which will not nest when the paper is wound in a roll, said method consisting in passing a web of paper through the gap between two indenting rolls and simultaneously shifting one of said rolls back and forth transversely to the web.

6. An apparatus for producing an indented shock absorbing cushioning or packing paper, the indentations of which will not nest when the paper is wound in a roll, said apparatus consisting of a pair of rotatable indenting rolls spaced to permit the drawing of a web of paper therebetween and means for shifting one of said indenting rolls back and forth transversely of the web of paper.

7. An apparatus for producing an indented shock absorbing cushioning or packing paper, the indentations of which will not nest when the paper is wound in a roll, said apparatus consisting of a pair of rotatable indenting rolls spaced to permit the drawing of a web of paper therebetween, each of said rolls being provided on its surface with a multiplicity of protuberances arranged in rows both circumferentially and longitudinally of the rolls and means for shifting one of said indenting rolls back and forth transversely of the web of paper.

8. An apparatus for producing an indented shock absorbing cushioning or packing paper, the indentations of which will not nest when the paper is wound in a roll, said apparatus consisting of a pair of rotatable indenting rolls spaced to permit the drawing of a web of paper therebetween and means for shifting said indenting rolls back and forth transversely of the web of paper relatively to each other.

9. An apparatus for producing an indented shock absorbing cushioning or packing paper, the indentations of which will not nest when the paper is wound in a roll, said apparatus consisting of a pair of rotatable indenting rolls spaced to permit the drawing of a web of paper therebetween, each of said rolls being provided on its surface with a multiplicity of protuberances arranged in rows both circumferentially and longitudinally of the rolls and means for shifting said indenting rolls back and forth transversely of the web of paper relatively to each other.

10. An apparatus for producing an indented shock absorbing cushioning or packing paper, the indentations of which will not nest when the paper is wound in a roll, said apparatus consisting of a pair of rotatable indenting rolls spaced to permit the drawing of a web of paper therebetween and means for shifting said indenting rolls in opposite directions back and forth transversely of the web of paper.

JOHN E. KIEFFER.