MANUFACTURE OF INDENTED, CORRUGATED PAPERS

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Inventor
John A. McKeage

Patent.
This invention relates to the manufacture of indented, corrugated papers that are designed more especially for wrapping or packaging purposes. A primary objective of the present invention is to improve the manufacture of a corrugated paper product whose corrugations are locally indented or recessed in such manner as to be readily flexed in all directions across the corrugations while essentially retaining their original corrugated nature and essentially affording their original cushioning action or resiliency.

In accordance with Ives Reissue Patent No. 20,034, dated July 14, 1936, a corrugated paper product flexing readily across its corrugations is produced by creating indentures or recesses in the corrugations inwardly toward the plane paper ply along lines intersecting or crossing the corrugations at closely spaced intervals. A preferred embodiment of product disclosed in said Reissue patent involves arrangement of the indentures or recesses in the corrugations along cross-crossing lines running diagonally across the corrugations, preferably running at angles of substantially 45° thereto.

In accordance with the present invention, a corrugated paper product of the desired flexibility in all directions across the corrugations is realized by locally indenting or breaking down the successive corrugations in such fashion that the lines or regions of indentation of the successive or adjacent corrugations are staggered relative to one another, with the lines of indentation in one corrugation preferably occurring substantially midway between the lines of indentation in an adjacent corrugation. In order to ensure a product possessed of the flexibility and resiliency or cushioning property desired therein, the lines of indentation in all of the successive corrugations should be appropriately spaced, namely, a distance not less than about \(\frac{3}{16}\)" and not more than about \(\frac{3}{8}\)". The indented corrugated paper product herein may be fabricated at high speeds with comparatively little, if any, tendency to distort or crush the corrugated paper portions lying in between the lines or regions of indentation or to wrinkle the plane paper ply serving as the backing or reinforcing medium. It might be remarked that the expression "corrugated paper product" is used herein to denote a product or composite sheet including not only a corrugated paper ply but also a plane or flat paper ply or equivalent flexible fabric adhesively or otherwise secured as a reinforcing medium to the corrugated paper ply.

With the foregoing and other features and ob-jects in view, the present invention will now be described in further detail with particular reference to the accompanying drawing, wherein,

Fig. 1 shows in perspective a fragment of an indented corrugated paper product embodying the present invention.

Fig. 2 is a plan view of a fragment of such product.

Fig. 3 represents an enlarged longitudinal section through one of the indented corrugations along the line 3-3 of Fig. 1.

Fig. 4 depicts in perspective part of an indenting roll such as may be used for creating the indentations in the corrugated paper product hereof.

Fig. 5 illustrates one of the toothed rings or indenting elements entering into the roll assembly of Fig. 4.

Fig. 6 is an enlarged vertical section through one of the indenting teeth of a toothed ring along the line 6-6 of Fig. 5.

Fig. 7 represents a plan view of a modified form of indenting roll.

As appears in Fig. 1, the indented, corrugated paper product herein comprises a plane paper ply 10 secured, as by suitable adhesive, to the corrugated paper ply 11. It appears unnecessary to describe in detail the manufacture of the corrugated paper product prior to indenting its corrugated paper ply. Suffice it to say that the ply 10 may be progressively withdrawn from a roll accumulation and united with the corrugated ply 11 after the latter ply has issued from the nip of a pair of corrugating rolls and has been treated with suitable adhesive on its valley zones to contact or lie next to the ply 10.

Once the two plies have been adhesively united to form the usual corrugated paper product, the successive corrugations of the corrugated ply are indented or broken down toward the plane paper ply so that the lines or regions of indentation 12 in one corrugation are arranged in staggered relationship to the lines or regions of indentation 13 in an adjacent corrugation. It is preferable, as shown, that the lines of indenture in one corrugation occur substantially midway between the lines of indenture in a preceding corrugation and that all the lines of indenture in the successive corrugations are substantially perpendicular to the longitudinal lines definitive of the crests of the successive corrugations. The lines of indenture in each of the successive corrugations are advantageously spaced apart a distance falling within a range of about \(\frac{3}{16}\)" to about \(\frac{3}{8}\)" as this makes for a product possessed of the desired con-
...of tapering cross-sectional shape, as appears in Fig. 6; and the maximum annular span of such teeth and the intervening spaces in an annular series may conform to the dimensions already indicated for the teeth and intervening spaces of a toothed ring 15. An important advantage of indenting a corrugated paper product with the rolls of Figs. 4 and 7 is that such product or composite sheet may be passed continuously at high speed into appropriate pressure-contact with such rolls while minimizing injury of either paper ply through crushing or wrinkling. This is attributable to the fact that the indenting teeth or elements of such rolls break down the corrugations of the corrugated ply along lines substantially parallel to the crest lines of the corrugations and in direct line with the tension exerted on the sheet as it is being drawn or propelled past the indenting teeth. On the other hand, when the corrugations of the corrugated ply are indented crosswise along lines deviating materially from lines running perpendicularly to the crest lines of the corrugations by the use of rolls presenting continuous helical indenting ribs on their peripheries, the tendency is to place the corrugated paper product under stresses such as may cause considerable distortion or wrinkling of either its plies, particularly when the corrugated paper product is run at high speeds into contact with such rolls. While the use of successive indenting rolls with helical ribs running in opposite directions, as disclosed in Ives application Ser. No. 173,629, filed November 9, 1937, tends to imprint neutralizing strata on the corrugated paper product, yet even in such case the tendency toward crushing or wrinkling of the plies cannot altogether be overcome while creating the desired or substantially perfect indentations in the corrugated paper ply by both the rollers. It is thus seen that the present invention makes possible worthwhile improvements as regards method, speed of manufacture, and resulting product over Ives Reissue Patent No. 20,034 and Ives application Ser. No. 172,629. It is possible to vary the construction of the roll by which the successive corrugations are indented or locally broken down so that such product is adapted to be flexed readily across its corrugations. In accordance, the roll periphery is toothed and its teeth are preferably of a maximum annular span at least substantially equal to the distance between the longitudinal crest lines of successive corrugations and are preferably spaced from one another a maximum annular distance substantially no greater than the distance between the longitudinal crest lines of successive corrugations; and such teeth occur as successive annular series with the teeth in one series staggered relative to the teeth in an adjacent series and are arranged to indent each of the successive corrugations along lines crossing each of the corrugations substantially perpendicularly at intervals of about \( \frac{1}{4} \) to \( \frac{1}{2} \) in. and with the lines of indents in one corrugation in staggered relationship to the lines of indenture in an adjacent corrugation. The indenting roll is preferably positively driven or rotated at a peripheral speed substantially equal to the linear speed of the corrugated paper product or composite sheet being progressively fed into contact therewith.
successive corrugations of said corrugated ply containing indentures along lines crossing said corrugations substantially perpendicularly at intervals in each corrugation of about \( \frac{1}{4} \) to \( \frac{1}{2} \)" and the indentures in each corrugation being arranged in staggered relationship to, and substantially midway between, the indentures in each adjacent corrugation.

2. An indented, corrugated paper wrapping and packaging material adapted to be flexed across its corrugations and comprising a corrugated paper ply reinforced by a plane paper ply, the successive corrugations of said corrugated ply containing indentures along lines crossing said corrugations substantially perpendicularly at substantially regular intervals in each corrugation of about \( \frac{1}{4} \) to \( \frac{1}{2} \)" and the indentures in each corrugation being arranged in staggered relationship to, and substantially midway between, the indentures in each adjacent corrugation.

JOHN A. MCKEAGE.