(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 000 448**
A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **78300154.8**

(22) Date of filing: **14.07.78**

(51) Int. Cl.²: **B65D81/34**

(30) Priority: **15.07.77 GB 29857/77**

(43) Date of publication of application: **24.01.79 Bulletin 79/2**

(84) Designated Contracting States: **BE DE FR GB NL**

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(54) Paper articles with crimped seals and their manufacture.

(57) Crimping of paper produces seals of low strength unless the paper contains some moisture, and it has been usual to humidify the paper. This invention provides a method of improving the strength of such seals by applying to the paper a non-volatile substance such as calcium chloride or a polyhydric alcohol. Preferred is glycerol in a ratio by weight of paper to glycerol of from 150 : 1 to 1500 : 1.

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PAPER ARTICLES WITH CRIMPED SEALS AND THEIR MANUFACTURE

This invention relates to paper articles including a crimped seal between two sheets, or two parts of the same sheet, of paper, and to methods of making such articles.

Crimping is a standard operation which comprises passing two sheets of paper, or two parts of the same sheet, between knurled rollers which corrugate the two sheets of paper and cause the fibres thereof to knit together, thereby forming a seal between the sheets. Usually, crimping is done along quite a narrow line, up to ½ cm in width and of indeterminate length, but there is no reason in principle why crimping should not be effected over any desired area. The resulting crimped seal is not very strong, but it is cheaply and easily made and involves no adhesive, so paper articles including crimped seals find very wide commercial application.

In order to get the paper fibres to knit together satisfactorily in the crimping operation, it has in the past been found necessary for the fibres to have a humidity which is higher than normal equilibrium values. There has therefore grown up the practice of

subjecting paper which is to be crimped to treatment in a humidifying atmosphere for periods of up to one week. Such pre-treatment is expensive, both in terms of time and in the provision of a humid room. It is an object of this invention to reduce or eliminate the need for pre-humidifying paper to be crimped.

In one aspect, this invention provides a paper article including a crimped seal between two sheets, or two parts of the same sheet, of paper, wherein the paper carries, at least in the area of the crimped seal, a non-volatile substance of a nature and in an amount to improve the strength of the crimped seal.

In another aspect, the invention provides a method of making a paper article by forming a crimped seal between two sheets, or two parts of the same sheet, of paper, wherein there is applied to the paper, at least in the area where the crimped seal is to be formed, a non-volatile substance of a nature and in an amount to improve the strength of the crimped seal.

Tea bag envelopes are one product to which the present invention is advantageously applied. Tea bags are normally sold loose in the United Kingdom, but for export they are generally packed in an envelope of printed paper which serves three purposes, a) it provides the descriptive matter for the tea, b) it protects the tea bag, and c) it also provides a form of tag which is part of the envelope and attached to the tea bag by cotton. Tea bag envelopes are initially supplied to the packers in reel form, and a complex machine forms the outer bag of the tea bag, inserting

the tea bag in the outer paper wrap by pre-cutting a tag and attaching the envelope to the tag by a length of cotton. Tea bag envelopes are sealed along the edges by crimping. It has for years been normal practice for the packers to place the reels of tea bag envelopes in a humid room for periods of up to one week before use.

Tea bags themselves may also be sealed by crimping. Tea bag paper is light (10 to 25 grams per square meter) and porous, wet strength being provided by the incorporation of a rubber or plastics material along with the cellulousic paper fibres. Coffee paper is similar but rather heavier. Crimp seals are valuable in such products, for they ensure that no extraneous material such as glue gets introduced into the tea cup, but it is essential that the seal should not burst open in use. Seals made using standard tea bag paper without pre-treatment have sometimes proved defective in this respect and the present invention helps to overcome the problem.

In general, crimping is useful for sealing paper containers for anything that is to be supplied dry, for example, rice, seeds, herbs etc. The present invention is of value wherever crimped seals are used.

This invention is characterised by the use of a non-volatile substance which improves the strength of the crimped seal. We are not at present sure how this improvement is achieved. It may be that the substance acts to soften the fibres of the paper, so that they may be more readily knitted with fibres of an adjacent

sheet. Alternatively or additionally, the substance may attract water to, or retain water in, the fibres, the water exerting the softening effect as in conventional practice. Deliquescent salts are believed to act by attracting water to the fibres, and we have found that calcium chloride, calcium nitrate and magnesium chloride are effective in this manner. Probably other deliquescent salts would work as well, but cost is a major factor and calcium chloride is preferred on this account.

As materials which themselves soften the paper fibres, there may be mentioned those organic liquids which extert a swelling or solvent effect on cellulouse.

Preferred are those compounds known as humectants, for example the polyhydric alcohols including sorbitol and particularly glycerol. Such materials are believed to act in both the manners mentioned above, that is to say by both softening the paper fibres themselves and by retaining water in and attracting water to the paper fibres. The substance needs to be non-volatile, since it is applied to the tea bag envelope or other paper article by the manufacturer, and not used until the crimped seal is formed by the user, frequently in a different continent and a matter of months or even years later.

The amount of non-volatile substance that is required is very small, certainly much less than the amount of glue that would be required to form an adhesive seal. The ratio by weight of paper to non-vola-

tile substance should be in the range of 50:1 to 3000:1, preferably 150:1 to 1500:1. For example, in the case of 70 grams per square meter paper, the amount of non-volatile substance applied should be in the range 0.023 to 1.4, preferably 0.05 to 0.5, grams per square meter. The lower ends of these ranges represent the minimum amount of non-volatile substance needed to achieve a useful improvement in crimp strength. At the upper ends of the ranges the extra cost of using more non-volatile substance is likely to outweigh any advantage of extra crimp strength. The amount of substance required for a particular application depends on the substance and on the paper, and can quite readily be determined by experiment.

It is believed preferable that the substance should impregnate or permeate the paper to which it is applied. Where the substance is carried on the surface of the sheet of paper, then it is essential that that surface be presented to the other sheet of paper in the crimping operation.

The remainder of this specification relates to tea bag envelopes. These are conventionally printed on Gravure machines, and are of two kinds, illustrated in Figures 1 and 2. Figure 1 shows an Ima envelope, a simple rectangle of paper, a reel of which travels through the Gravure printing machine in the direction indicated by the arrows 10. The user slits a label from the reel along lines 11, folds the label twice along lines 12 and 13, at the same time inserting the tea bag, and then forms a crimped seal along the two

lines 14.

Figure 2 shows the Constanta type of tea bag, which passes through the Gravure printing machine in the direction shown by the arrows 15. After passage through the one or more printing stations, the originally rectangular sheet passes through a slitting and punching station, at which two triangular pieces 16 are cut away and a slit formed at 17. Later, the user detaches the envelope from the roll by cutting along lines 18 and 19, folds the paper twice along lines 20 and 21, at the same time inserting the tea bag, and finally completes the envelope by forming a crimped seal along lines 22.

Tea bag envelope paper generally weighs from 50 to 100, particularly 50 to 80, grams per square meter. Paper below 50 grams per square meter is difficult to handle and tends to tear and jam the users equipment when he cuts and folds it. Increasing the weight of the paper above 80 grams per square meter increases the cost without securing a commensurate increase in the qualities of the envelope. The paper used is usually bleach kraft, but may be sulphite or sulphate, or any other low-cost paper capable of being crimped.

In our preferred process, a polyhydric alcobol such as glycerol is applied from aqueous solution at the last printing station of the Gravure machine. Aqueous solutions may suitably contain from 0.1 to 25%, preferably from 0.5 to 5% by weight of the polyhydric alcohol, more concentrated solutions being used with thicker papers and vice versa. Such aqueous solutions are not

viscous and readily impregnate the paper. It is preferred that the water should not rapidly be driven off, so as to allow time for impregnation. In cases where impregnation is not important, it may be possible to use more concentrated solutions of the polyhydric alcohol, or even neat liquid polyhydric alcohols. It is possible, but not preferred, to apply the polyhydric alcohol in solution in a volatile organic solvent. In our preferred process, glycerol is used as an aqueous solution containing from 0.5% to 5.0% by weight glycerol.

In normal printing operation, the glycerol solution is applied to the front of the paper sheet, whereas it is in fact the back surfaces of the sheet that are pressed together for crimping. It is for this reason that it is preferred that the glycerol should impregnate the entire thickness of the paper. However, as the paper is then rapidly wound-up in a roll, where the front of one sheet contacts the back of the next, impregnation may not be essential. It may be advantageous to modify the Gravure printing machine so as to apply the glycerol solution to the back of the sheet.

Referring again to the drawings, in Figure 1 the glycerol is most conveniently applied to the entire sheet. In the production of sheets according to Figure 2, the application of the glycerol solution is effected after the printing operations but before the punching operation which removes the triangular pieces 16. It has been found difficult to punch out the triangular pieces 16 from paper which has been impregnated with

glycerol solution. It is therefore preferred to apply the glycerol solution only to the areas 23, shown shaded in the drawing, where the crimped seal is to be effected.

If calcium or magnesium salts are used in place of glycerol, we have found it appropriate to use a solution containing from 2% to 30% by weight of the salt.

EXAMPLE

We have been making tea bag envelopes as illustrated in Figures 1 and 2 on a commercial scale by a Gravure printing process, using an aqueous solution of glycerol in the last printing station of the Gravure machine. We use our normal paper which is of 70 grams per square meter weight. Our aqueous solution contains 3.1% by weight of glycerol, and is applied to the paper (the whole surface according to Figure 1, part of the surface according to Figure 2) at a rate of 7.37 grams per square meter. After treatment, the paper, or those areas of it to which the solution has been applied, contain 0.23 grams per square meter of glycerol.

We can replace the glycerol by sorbitol or ethylene glycol with similar results.

We can replace the aqueous solution of glycerol by a 10% by weight aqueous solution of calcium chloride or magnesium chloride with similar results. This is applied at a rate of about 7.37 grams per square meter, resulting in a loading of $CaCl_2$ or $MgCl_2$ of 0.737 grams per square meter.

The resulting tea bag envelope rolls have a more or less indefinite shelf life. If the user should find

that the crimped seal formed is not adequate, for example because insufficient glycerol has been applied by the paper manufacturer, he can easily remedy matters by placing the roll in the humid room, and the time required to "reactivate" the roll is found to be much shorter than is the case when the roll has not been pretreated with glycerol.

CLAIMS

1. A paper article including a crimped seal between two sheets, or between two parts of the same sheet, of paper, wherein the paper carries, at least in the area of the crimped seal, a non-volatile substance of a nature and in an amount to improve the strength of the crimped seal.

2. A paper article as claimed in claim 1 which is a tea bag envelope.

3. A paper article as claimed in claim 1 or claim 2 wherein the ratio by weight of paper to non-volatile substance in the area of the crimped seal is in the range 150:1 to 1500:1.

4. A paper article as claimed in any one of claims 1 to 3, wherein the non-volatile substance is a humectant.

5. A paper article as claimed in any one of claims 1 to 4, wherein the humectant is glycerol.

6. A method of making a paper article as claimed in any one of claims 1 to 3, by forming a crimped seal between two sheets, or two parts of the same sheet, of paper, wherein there is applied to the paper, at least in the area where the crimped seal is to be formed, a non-volatile substance of a nature and in an amount to improve the strength of the crimped seal.

7. A method as claimed in claim 6, wherein the non-volatile substance in aqueous solution is applied to the paper from the last station of a Gravure printing machine.

8. A method as claimed in claim 7, wherein the aqueous solution contains 0.5% to 5% by weight of gly-

cerol.

9. A method as claimed in claim 7, wherein the aqueous solution contains 2% to 30% by weight of calcium chloride.

10. A method as claimed in any one of claims 6 to 9, wherein the non-volatile substance is applied at a rate of from 0.05 to 0.5 grams per square meter of paper.

FIG. 1

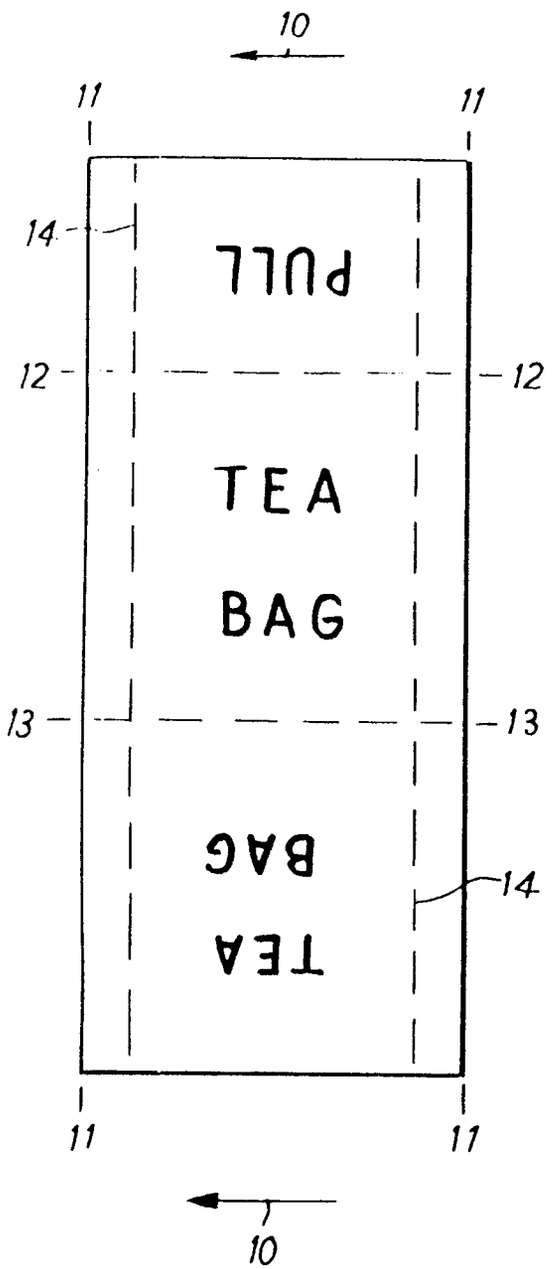
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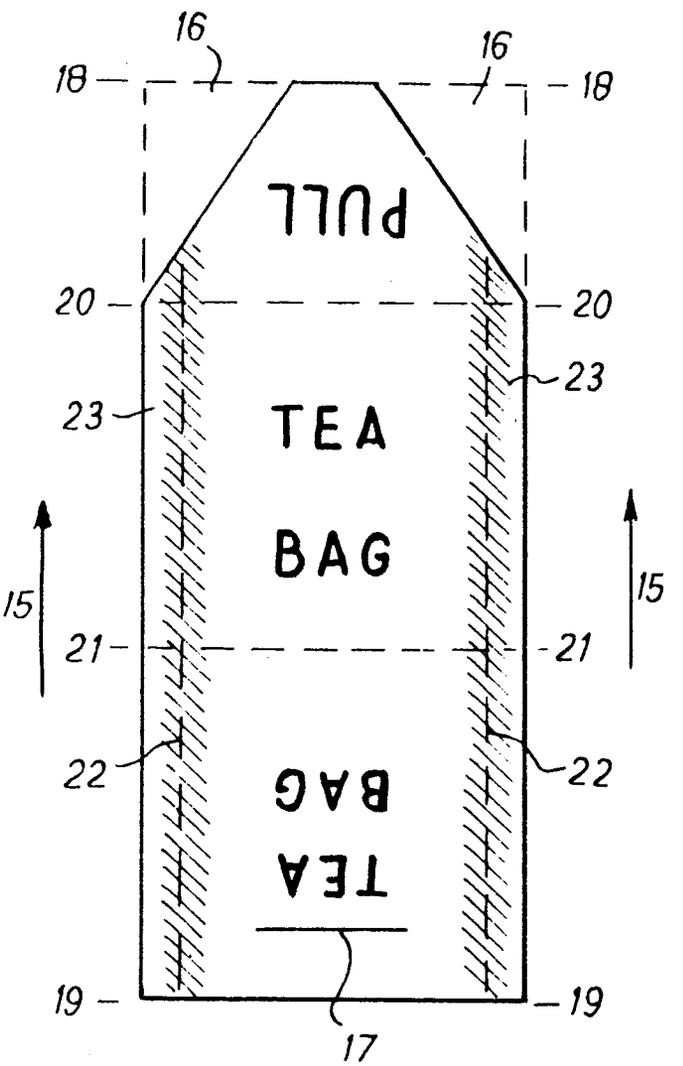
FIG. 2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EUROPEAN SEARCH REPORT

Application number
EP 78 30 0154

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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
A	US - A - 3 047 397 (IRMSCHER) * Column 1, lines 62 to 69; figure 1 *	1
A	US - A - 2 277 050 (REED) * Page 2, lefthand column, lines 7 to 72 *	1
A	US - A - 2 614 934 (TROTMAN) * Column 3, lines 9 and 10 *	1
A	US - A - 3 095 315 (MAGILL) * Column 1, lines 53 to 66 *	1

CLASSIFICATION OF THE APPLICATION (Int. Cl.²)

B 65 D 81/34

TECHNICAL FIELDS SEARCHED (Int.Cl.²)

B 65 D 65/42
B 65 D 75/20
B 65 D 81/34
B 31 F 5/02

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	11-10-1978	LORENZ