Dec. 27, 1938. R. HAAS 2,141,432

METHOD AND APPARATUS FOR CRIMPING SHEET MATERIAL

Filed Nov. 7, 1935 2 Sheets-Sheet 1

Fig. 1

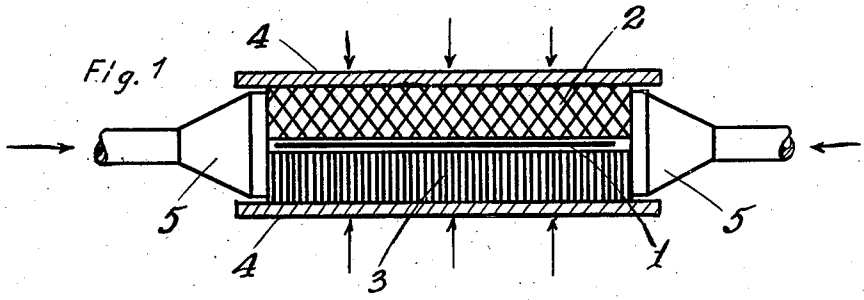


Fig. 4

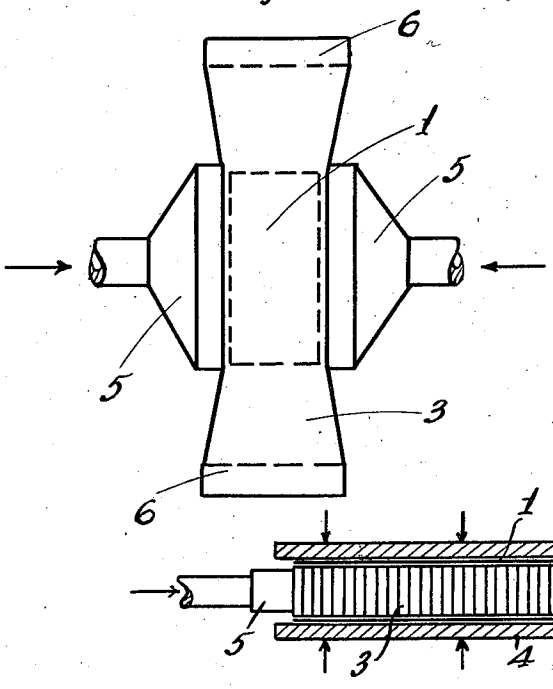


Fig. 2



Fig. 3

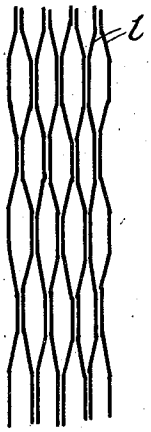


Fig. 1a

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Fig. 5

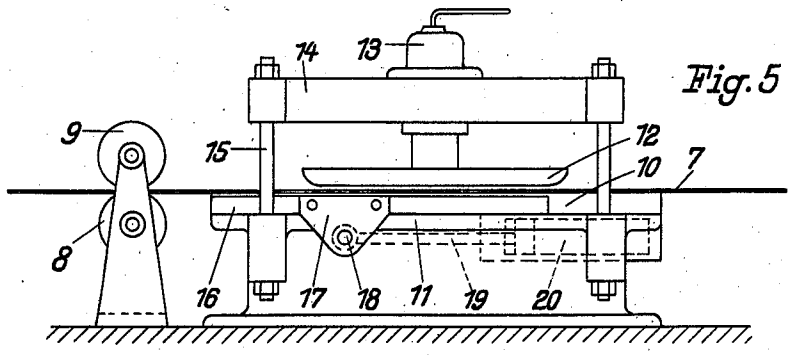


Fig. 6

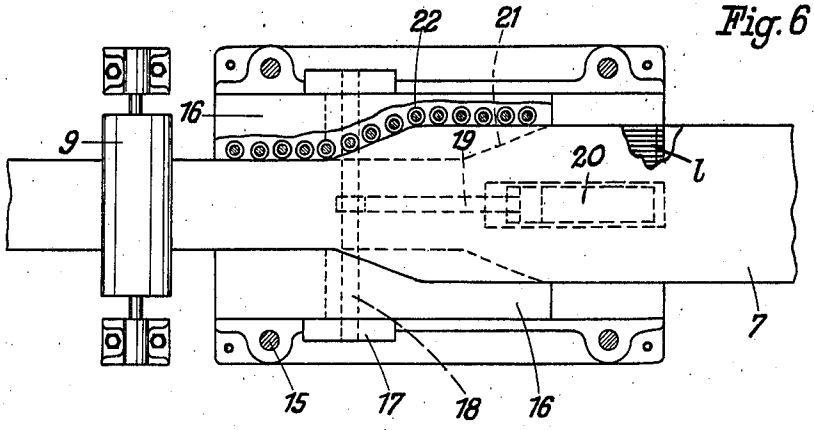
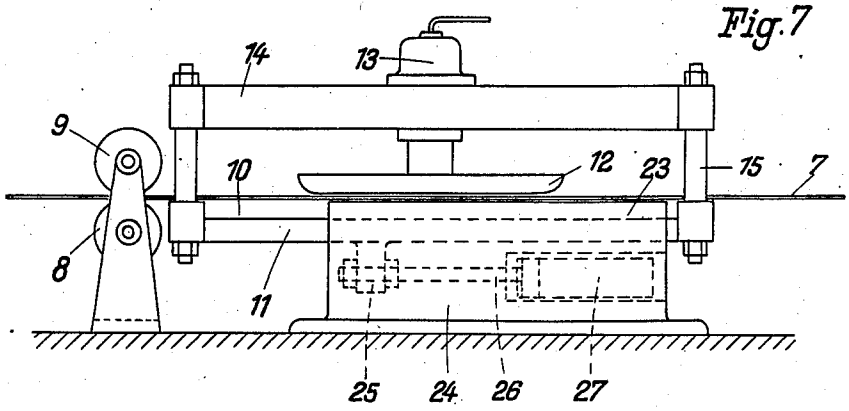


Fig. 7



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UNITED STATES PATENT OFFICE

2,141,432

METHOD AND APPARATUS FOR CRIMPING SHEET MATERIAL

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Application November 7, 1935, Serial No. 48,760
In Germany November 12, 1934

14 Claims. (Cl. 154—30)

The invention relates to apparatus and methods for crimping paper and cardboard. It may be used both for separate sheets and for continuous webs. In addition to paper and cardboard, the apparatus may be used for crimping Cellophane (registered trade-mark), fabric, foils of metal or of artificial material or the like and also any other form of material that can be crimped. For the sake of simplicity only paper will be mentioned hereinafter.

The apparatus substantially comprises a deformable body which is formed of a stack of laminations, against the edges of which the paper is pressed by mechanical, hydraulic or pneumatic pressure applying means and which, while the pressure is maintained, can be brought close together so that the surface of the deformable body and hence the paper is shortened in the desired direction. If it is a question of paper which has already been crimped, a double crimping may be effected by the process.

The paper may be treated by the apparatus according to the invention one or more times according to the degree of crimping desired, and crimping may be carried out as desired in the longitudinal direction or in the transverse direction or in both, or if desired in one or more directions obliquely thereto. Instead of a single deformable body two such bodies may be employed, the paper or the like being held between them under pressure.

The invention is illustrated by way of example in the accompanying drawings wherein—

Figure 1 shows a diagrammatical view of the apparatus; and Fig. 1*a* shows a modification thereof;

Figures 2 and 3 show by way of example constructional forms of the deformable bodies;

Figure 4 shows the crimping process diagrammatically in plan view; and

Figures 5, 6 and 7 show simple apparatus for the intermittent treatment of continuous paper webs.

Referring to Figure 1, a paper sheet, or if desired a number of paper sheets is placed, as indicated at 1, between two deformable bodies 2 and 3. These bodies are then pressed against each other in the direction of the arrows, possibly with the use of plates 4 placed thereon, so that they hold the sheet 1 fast between them with a certain force. The bodies 2 and 3 are then compressed laterally, for example by means of plungers 5 so that they are reduced in width. The sheet of paper is compelled to participate in this reduction and consequently lies in crimping folds, the size and character of which is determined by the material and the forcing action of the bodies 2 and 3 in proportion to the stiffness and thickness of the sheet 1. The bodies 2 and 3 are then separated from each other and the paper is removed.

Instead of two bodies 2 and 3 there can also be employed a single body which acts against a preferably smooth counter-body of constant shape as illustrated in Fig. 1*a*.

The deformable bodies of laminations may be made in various ways, for example in the form of stacks of metal sheets, metal bands, strips of leather, artificial materials or the like movable in relation to one another.

The metal sheets, strips, and so forth marked *l* in the drawings may be smooth or formed in any other way. For example they may be curved, corrugated, cranked, toothed and roughened or sharpened on their sides facing the paper. Figures 2 and 3 show some simple constructional examples. Preferably, the stacks are caused to project on either side beyond the length of the paper sheets to be crimped in order to enable them to be held together outside the working surfaces. This is shown by way of example in Figure 4. The stacks of metal sheets 3, the width of which is varied by the plungers 5, are held together at 6 outside the paper surface 1. This may be effected for example by simple clamping together, if desired with the introduction of intermediate layers of rigid or of more or less yielding material.

The movement of the deformable bodies may be brought about by any desired means, for example by simple external pressure, as indicated in Figures 1 and 4. Instead of this, the bodies may be stretched before the crimping movement so that they afterwards contract by means of their own elasticity. A combination of tension and compression and so forth may also be employed.

The surfaces between which the crimping is effected may be flat but they may also have any desired curvature. It is also possible to allow bodies of different constructions to cooperate.

Fixed sliding surfaces against which the paper is pressed may be advantageously employed to obtain a heating or drying effect by which the crimping is fixed in the case of crimping moist papers. Of course, stacks of sheet metal strips or the like may also be heated and for this purpose besides steam, gas or electric current may be advantageously employed.

Figures 5, 6 and 7 show constructional examples

in which the invention is not applied to the treatment of single paper sheets but to the intermittent treatment of continuous webs. 7 indicates a paper web which is introduced on the right and discharged on the left, for example by means of a pair of rollers 8 and 9. This movement takes place intermittently. Each time, a length of the web is brought into the range of the deformable body 10, for example in the form of a sheet metal stack indicated at *l* in Fig. 6, which by means of two lateral cam tracks 16 may be deformed in such a manner that its original width contracts to the degree indicated by the dotted line 21. With this contraction there occurs a corresponding crimping of the paper web, which is then drawn a length further by means of the pair of rollers 8, 9. For this purpose, after each crimping operation, the body 12 is lifted off the paper strip by any old and well-known means, for example by a common fluid cylinder 13 which is mounted in a cross-frame 14 and by means of columns 15 is connected to the base plate 11 on which the deformable body is mounted.

The reciprocatory movement is effected by any well-known mechanism for example by means of lateral plates 17 mounted on the cam tracks 16, a transverse rod 18 passing between said plates and a tension rod 19 operated by a hydraulic piston 20. 22 indicates rollers which are mounted in the body 16 and which reduce the friction occurring in the relative movement between the cam tracks 16 and the body 10.

In the machine shown in Figures 5 and 6 the deformable body 10 and the counter-body 12, which may likewise consist of a stack of laminations, effect both the actual crimping movement and also the movements of seizing and releasing the paper web, the cam tracks 16 being moved from left to right for the purpose of carrying out the crimping process. As shown in Figure 7 the arrangement may, however, be such that the cam tracks 23 are stationary, and the bodies 10, 12 are moved from right to left relatively to the cam tracks 23. In this case the feeding of the paper web occurs simultaneously with the intermittent crimping, which is particularly advantageous since then the function of the pair of rollers 8, 9, is restricted to holding the web fast during the return of the bodies 10, 12.

The reciprocatory movement of the said bodies is effected in the arrangement shown in Figure 7 by any well-known means such as an arm 25 which is provided on the plate 11 bearing the parts 10, 12, 13, 14 and 15 and is connected to the piston rod 26 of a common hydraulic cylinder 27, which in its turn is secured in the machine frame 24.

The steps of the working operation in the case of the intermittent crimping of paper webs may be greater or smaller according to whether the desired crimping action is to be effected all at once or in separate partial steps.

The intensity of the crimping depends on the limits to which the deformable bodies can be stretched. If a certain degree of crimping is not sufficient for the purpose desired, it may be increased or multiplied by repeating the crimping operation.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:—

1. Apparatus for crimping sheet material comprising a deformable body consisting of a pack of laminae spaced apart out of continuous surface contact with one another, means for pressing a substantial area of the material against the deformable surface formed by the edges of the laminae, and means for causing said laminae to approach one another while maintaining the said pressure.

2. Apparatus for crimping sheet material comprising a deformable body consisting of a pack of flexible strips held together at their ends, but spaced apart out of continuous surface contact with one another, means for pressing a substantial area of the material against the deformable surface formed by the edges of said strips, and means for causing said strips to approach one another while maintaining the said pressure.

3. Apparatus for crimping sheet material comprising a deformable body consisting of a pack of bent resilient strips disposed in such a manner that when pressed together the edges thereof form a substantially continuous surface and when released open out to form an interrupted surface of a desired pattern, means for pressing a substantial area of the material against the said interrupted surface, and means for pressing said strips together while maintaining the said pressure.

4. Apparatus for crimping a strip of sheet material comprising a deformable body composed of a plurality of flat resilient strips, means for pressing a substantial length of the strip against the surface of the said body formed by the edges of said strips, means for deforming the body while maintaining the said pressure so that beginning at the entrance side of the apparatus the body is gradually reduced up to the desired width at the other end of the length, means for then releasing the pressure and means for advancing the strip relatively to the deformable body so that the completely crimped part is moved away from the latter.

5. Apparatus for crimping a strip of sheet material comprising a deformable body composed of a plurality of flat resilient strips, means for pressing a substantial length of the strip against the surface of the said body formed by the edges of said strips, means for deforming the body while maintaining the said pressure so that beginning at the entrance side of the apparatus the body is gradually reduced up to the desired width at the other end of the length, means for simultaneously advancing the deformable body together with the material applied thereto in the lengthwise direction of the strip, means for then releasing the pressure, and means for returning the deformable body to its initial position.

6. A method for crimping a strip of sheet material comprising the continuously repeated successive steps of pressing a substantial length of the strip against the surface formed by the edges of a deformable laminated body, and while maintaining said pressure, deforming the body so that beginning at the entrance side of the apparatus the body is gradually reduced up to the desired width at the other end, releasing the pressure and effecting relative movement between the strip and the deformable body so that the completely crimped part is moved away from the latter.

7. A method for crimping a strip of sheet material comprising the continuously repeated successive steps of pressing a substantial length of the strip against the surface formed by the edges of a deformable laminated body, and while maintaining said pressure, moving the body, strip and

pressing means forward while deforming the body so that beginning at the entrance side of the apparatus the body is gradually reduced up to the desired width at the other end, and then releasing the pressure and returning the deformable body and the pressing means to their initial position.

8. Apparatus for crimping sheet material comprising a deformable body consisting of a pack of laminae spaced apart out of continuous surface contact with one another, means for pressing a substantial area of the material between the deformable surface formed by the edges of the laminae and the surface of another deformable body, and means for deforming said bodies, while maintaining the said pressure, so that the laminae of said deformable bodies are caused to approach one another.

9. Apparatus for crimping sheet material comprising a deformable body consisting of a pack of flexible strips held together at their ends, but spaced apart out of continuous surface contact with one another, means for pressing a substantial area of the material between the deformable surface formed by the edges of the strips and the surface of another deformable body, and means for deforming said bodies, while maintaining the said pressure, so that the strips of said deformable bodies are caused to approach one another.

10. Apparatus for crimping sheet material comprising a deformable body consisting of a pack of bent resilient strips disposed in such a manner that when pressed together the edges thereof form a substantially continuous surface and when released open out to form an interrupted surface of a desired pattern, means for pressing a substantial area of the material between the said interrupted surface and the surface of another deformable body, and means for deforming said bodies, while maintaining the said pressure, so that the strips of said deformable bodies are caused to approach one another.

11. Apparatus for crimping a strip of sheet material comprising two co-operating deformable laminated bodies, means for pressing a substantial length of the strip between the co-operating surfaces formed by the edges of the laminations of said bodies, means for deforming the bodies while maintaining the said pressure so that beginning at the entrance side of the apparatus the bodies are gradually reduced up to the desired width at the other end of the length, means for then releasing the pressure and means for advancing the strip relatively to the deformable bodies so that the completely crimped part is moved away from the latter.

12. Apparatus for crimping a strip of sheet material comprising two co-operating deformable laminated bodies, means for pressing a substantial length of the strip between the co-operating surfaces formed by the edges of the laminations of said bodies, means for deforming the bodies while maintaining the said pressure so that beginning at the entrance side of the apparatus the bodies are gradually reduced up to the desired width at the other end of the length, means for simultaneously advancing the deformable bodies together with the material held therebetween in the lengthwise direction of the strip, means for then releasing the pressure, and means for returning the deformable bodies to their initial position.

13. A method for crimping a strip of sheet material comprising the continuously repeated successive steps of pressing a substantial length of the strip between the surfaces formed by the edges of the laminations of co-operating deformable laminated bodies, and while maintaining said pressure, deforming the bodies so that beginning at the entrance side of the apparatus the bodies are gradually reduced up to the desired width at the other end, releasing the pressure and effecting relative movement between the strip and the deformable bodies so that the completely crimped part is moved away from the latter.

14. A method for crimping a strip of sheet material comprising the continuously repeated successive steps of pressing a substantial length of the strip between the surfaces formed by the edges of the laminations of co-operating deformable laminated bodies, and while maintaining said pressure, moving the bodies and strip forward while deforming the bodies so that beginning at the entrance side of the apparatus the bodies are gradually reduced up to the desired width at the other end, and then releasing the pressure and returning the deformable bodies to their initial position.

RUDOLF HAAS.