This invention relates to apparatus for forming creases in webs of blank material of the type from which box portions are to be produced. The invention is herein illustrated as embodied in web-creasing mechanism suitable for use in blank-making apparatus of the type illustrated and described in Letters Patent of the United States No. 1,988,451, granted January 22, 1935, on an application of C. D. Knowlton, although it will be understood that the invention is not limited in its application to machines of the type described therein.

The apparatus of the Knowlton patent operates progressively on a continuous web of blank material to perform various operations thereon leading to the formation of box blanks. Included in the apparatus are mechanisms which operate intermittently to produce a succession of lengthwise creases in the web, the ends of which overlap to form a pair of parallel continuous creases. The crease-forming instrumentalities are formed on carrier bars which are reciprocated toward and from the web. The other blank-forming instrumentalities are carried by members which have movements of rotation only and the speed at which the machine may operate is limited by the speed at which the carrier bars may be reciprocated to form the lengthwise creases. The creasing mechanisms are so formed that the material is gathered in and pinched at the crease in a manner to separate the laminae of the material of the web along the crease lines thus facilitating subsequent folding of the material along the crease lines without materially weakening the stock.

It is an object of the present invention to provide improved mechanism for progressively and continuously creasing a web of blank material and simultaneously pinching the crease thus formed to render stable the material along the crease line, the mechanism being constructed and arranged to permit feeding of the web therethrough at a very high rate of speed. To this end and in accordance with a feature of the invention the creasing mechanism is formed of a pair of rolls arranged with their axes converging and providing between them a notch into which the material of the web is forced by a ribbed creasing roll mounted for free rotation at the side of the web opposite the first-mentioned rolls. The first-mentioned rolls are arranged so that their web-facing surfaces diverge slightly from the notch between them from the plane of the web supported by the rolls so that the web is engaged by the rolls only along the edges between the top faces and edge faces of the rolls at the location where the creasing operation takes place. By so arranging these rolls drag on the web is minimized as it passes through the creasing mechanism.

In order to form the creases so that the material may be bent easily along the crease lines without danger of rupturing the surface of the material it is desirable to separate the laminae of the material of the web during the creasing operation. To this end and in accordance with a further feature of the invention the creasing rolls, between which the crease is formed by the ribbed creasing roll are beveled in such a manner that their edge faces at their contiguous portions, which portions define the notch into which the material is forced in the creasing operation, diverge slightly in a direction away from the web-facing surfaces. By thus forming the rolls and properly spacing them they exert a pinching action on the material along the sides of the crease at its base. This is done without exerting undue force on the remainder of the crease, the result being that the material is easily turned about the crease thus formed through an angle of 180° without rupturing the surfaces of the material.

In the formation of the creases the material of which the web is formed is drawn from opposite sides of the crease so that if two laterally spaced creases are formed simultaneously at the same points lengthwise of the web, undesirable lateral strains may be imposed on the web between the creases. To obviate this and in accordance with a further feature of the invention the creasing mechanisms are spaced lengthwise of the web so that neither of the mechanisms sets up stresses in the web due to the action of the other creasing member.

The above and other features of the invention, including various novel details of construction and combinations of parts will now be described by reference to the drawings and pointed out in the claims.

In the drawings,
Fig. 1 is a front elevation, partly in section, of one form of mechanism embodying the invention;
Fig. 2 is a plan view of the mechanism shown in Fig. 1;
Fig. 3 is a side elevation of the mechanism;
and
Fig. 4 is an enlarged fragmentary view of the creasing rolls illustrating their action on the web of material in the creasing operation.
The invention is illustrated herein as embodied in a creasing mechanism suitable as a replacement for the creasing mechanism Y of the Knowlton patent referred to above, although it is to be understood that the use of the creasing mechanism described herein is not limited to machines of this particular type. As shown in that patent the machine includes supporting bars 10 on which the various blank-forming mechanisms of the machine are supported. Carried by the bars is a cross frame member 12 providing a pair of transverse supporting rails 14 (Fig. 2) in which are formed slots 16. Interposed between the frame member 12 and the supporting bars 10 are keys 18 for locating the frame 12 transversely with respect to the bars 10. For securing the frame member 12 to the bars 10 after it has been correctly positioned lengthwise of the bars, clamps 28 are provided. These clamps are U-shaped, one of the legs of each clamp terminating in a hemispherical projection 22 arranged to seat in a similarly formed recess in the top of the frame member, the other leg 23 of the clamp having threaded therethrough a screw 24 (Fig. 3) engageable with the underside of the associated bar 10.

Carried by each of the rails 14 is a creasing mechanism 26, the creasing mechanisms being spaced lengthwise of the machine in accordance with the spacing of the rails 14 as indicated in Fig. 2 so that their zones of operation are spaced lengthwise of the web W as it passes therethrough. By this arrangement of the creasing mechanisms, each of which is designed progressively to form one longitudinal crease in the web, the gathering of the material of the web into a crease does not impose undesirable lateral strains upon the web as would be the case were the creasing mechanisms aligned transversely of the machine.

Each of the creasing mechanisms includes an upper creasing roll 28 having a peripherally extending rib 30 by which the material passing beneath the roll is pressed downwardly between a pair of lower creasing rolls 32. These lower rolls are mounted on axes inclined slightly from the vertical and converging downwardly toward each other as shown in Fig. 1 so that the upper web-facing surfaces of the rolls incline downwardly and outwardly from the rib 30. By this arrangement the only portions of the lower rolls 32 which engage the web are the edges between the top faces and the edge faces at the location where the creasing takes place, thus minimizing drag on the web as it passes between the upper and lower creasing rolls.

The lower rolls 32 are carried by downwardly extending shafts 34 formed in bearings 36 located in recesses 38 formed in supporting blocks 40. Between each block and its creasing roll 32 are anti-friction-bearing bushes 42 so that even though excessive pressure is exerted on the rolls 32 they will rotate freely about the axes of the shafts 34.

The blocks 40 have depending tongues 44 (Fig. 3) which extend downwardly through the slots 16 in the respective rails 14, and the blocks of each pair are interconnected by side strap members 46 (Fig. 1) and bottom strap members 48. To permit relative adjustment of the blocks and creasing rolls 32 of each creasing mechanism with respect to each other, screw and slot connections 52 and 54 interconnect the straps 46, 48 with the outermost block of each pair. Threaded into one only of the blocks of each pair is a screw 56 having a shank portion 58 which extends outwardly beyond the end of the supporting frame 12 to receive a handle 60 by which the screw is rotated. Endwise movement of the screws relatively to the frame member 12 is prevented by collars 52 pinned to the shank portions 58 of the screws and engaging the frame member at the end of the slot 16. It will be apparent that by turning the screws 56 the creasing mechanisms are adjusted lengthwise of the rails 14 and by loosening the screws 52, 54 and interchanging the screws 58 and one of the supporting blocks 40 may be adjusted with respect to the other to adjust the space between the creasing rolls 32 of each creasing mechanism.

Secured to the outer surface of the outermost block of each pair is an upwardly extending supporting arm 64 having an outwardly offset portion 66 to accommodate those portions of the web extending outwardly from the creases to be formed therein. Secured to the upper end of each supporting arm 64 is a supporting bracket 68 having spaced depending arms 71 in which is journaled a shaft 72 having an eccentric portion 73 providing a journal for an upper creasing roll 28. The brackets 68 are secured to the supporting arms 64 for upward yielding movement to eliminate the possibility of breakage of the parts of the mechanism in the event that an extra thickness of blank material should pass between the upper and lower creasing rolls. For this purpose screws 74 are threaded into the upper ends of the supporting arms 64, the brackets 68 being adjustable on unthreaded portions 75 of the screws. Interposed between the heads of the screws and the top surfaces of the brackets 68 are heavy compression springs 81 which normally maintain the brackets seated upon the upper ends of the supporting arms but which will yield to permit upward movement of the creasing rolls 28 during the passage of an excessive thickness of material between the upper and lower creasing rolls.

The rolls 28 are mounted on the eccentric portions 73 of the shafts 72 so that by turning the shafts the upper rolls 28 may be moved heightwise with respect to the rolls 32 to accommodate webs of blank material of different thicknesses. Also, by separating the upper and lower rolls upon turning the shafts 72, initial feeding of the web therebetween is facilitated. Each shaft 72 projects beyond the inner arm 70 of its bracket 68 to receive a handle 60 by which the shaft may be turned. Locking screws 62 are provided for locking the shafts 72 against turning after the upper creasing rolls have been moved into the proper positions for the creasing operation. By mounting the upper creasing rolls on the brackets 68 secured to the supporting arms 64 which are in turn secured to the blocks 40 it will be apparent that the three creasing rolls of each unit may be adjusted simultaneously by rotation of the respective screw 56 thus facilitating adjustment of the machine for the desired lateral positions of the creases C.

As shown in Fig. 4, the face edges 84 of the lower creasing rolls 32 are beveled in such a manner that they form between them at the location where the creasing takes place a crease-receiving notch having walls which diverge slightly in a direction away from the upper creasing roll 28. By thus forming the lower creasing rolls, the pressure exerted thereby on the crease formed therebetween by the rib 30 on the upper creasing roll is concentrated along
the sides of the crease at its base. This has the effect of separating the laminae of which the web is formed without unduly compressing the outermost portion of the crease, thus rendering the material flaccid and facilitating subsequent bending of the material about the crease line.

In the operation of the machine the web is drawn through the creasing mechanisms in any suitable manner and by its engagement with the rolls which are all mounted for free rotation it will cause them to turn so that the material is progressively displaced by the rib 30 on the upper creasing roll 28 downwardly between the lower creasing rolls 32. The base of the crease thus formed is pinched by the top edges of the lower creasing rolls but the rest of the crease receives only slight pressure from the edge faces of the lower creasing rolls by reason of the beveling thereof. The laminae of the material along the crease are separated by this action of the creasing rolls so that subsequent folding of the material about the creases is facilitated.

Having thus described our invention what we claim as new and desire to secure by Letters Patent of the United States is:

1. Web-creasing mechanism comprising a pair of frusto-conical web-supporting rolls, each of said rolls having a large web-supporting end face and a smaller end face, means supporting said rolls for rotation about axes so inclined to each other that a crease-receiving notch having walls diverging from that side of the web engaged by the rolls is formed between the peripheries of the rolls and that the large web-engaging end faces of the rolls are nearly parallel with but diverge slightly from the plane of the web engaged by the rolls in directions away from said notch, and means cooperating with said rolls for forming a crease in the web.

2. Web-creasing mechanism comprising a pair of frusto-conical web-supporting rolls, each of said rolls having a large web-supporting end face and a smaller end face, means mounting said rolls for free rotation about axes so inclined to each other that a flared crease-receiving notch having downwardly diverging side walls is formed between the peripheries of the rolls and that the large web-supporting faces of the rolls are nearly parallel with but diverge slightly from the plane of a web supported by the rolls in directions away from said notch, a roll engageable with the top face of the web, said roll being mounted for free rotation about a horizontal axis parallel to the plane of the web, and a peripheral rib carried by said roll and arranged to press the web into the narrowest portion of the notch formed between the first-named rolls.

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