

Nov. 26, 1935.

K. HÄMMISCH  
PROCESS AND APPARATUS FOR THE FORMATION OF CHANNELS IN SHEETS  
OF CARDBOARD, CORRUGATED CARDBOARD OR THE LIKE

2,022,563

Filed Feb. 17, 1934

2 Sheets-Sheet 1

Fig. 1

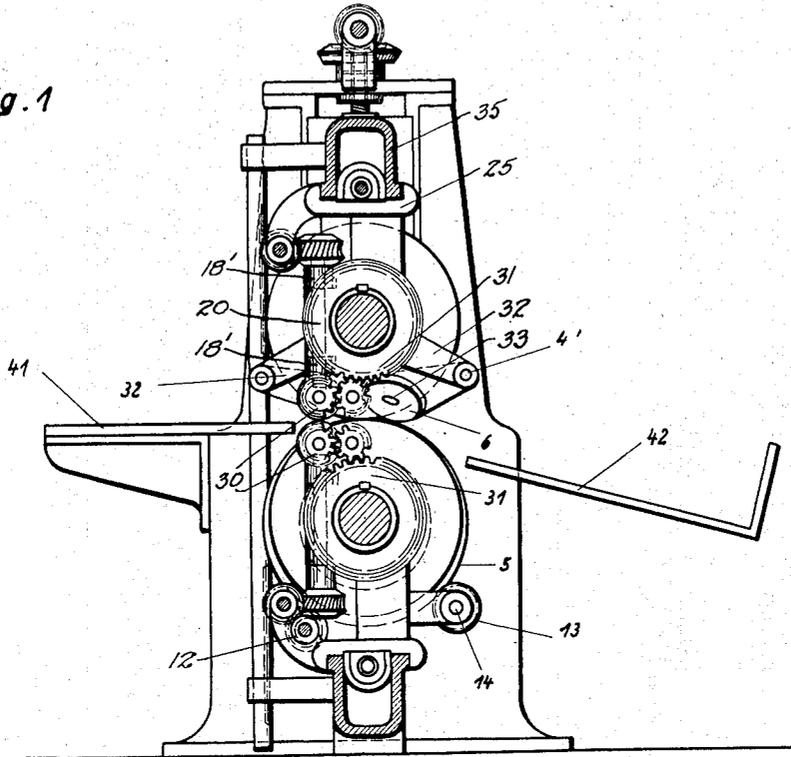


Fig. 2

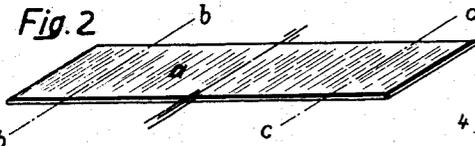


Fig. 3

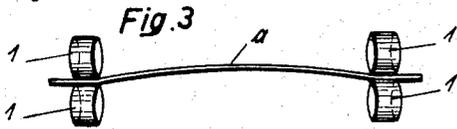


Fig. 4

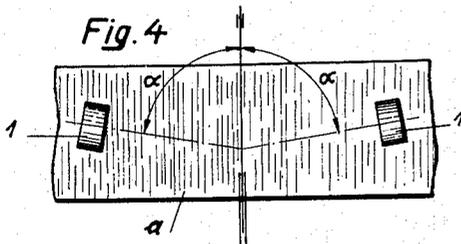


Fig. 5

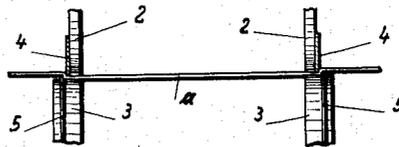


Fig. 6

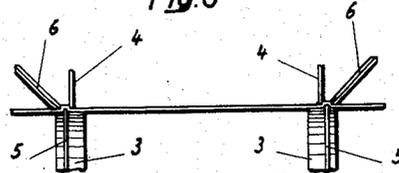
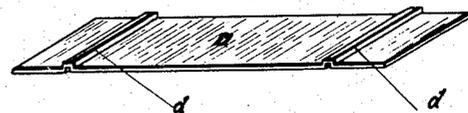


Fig. 7



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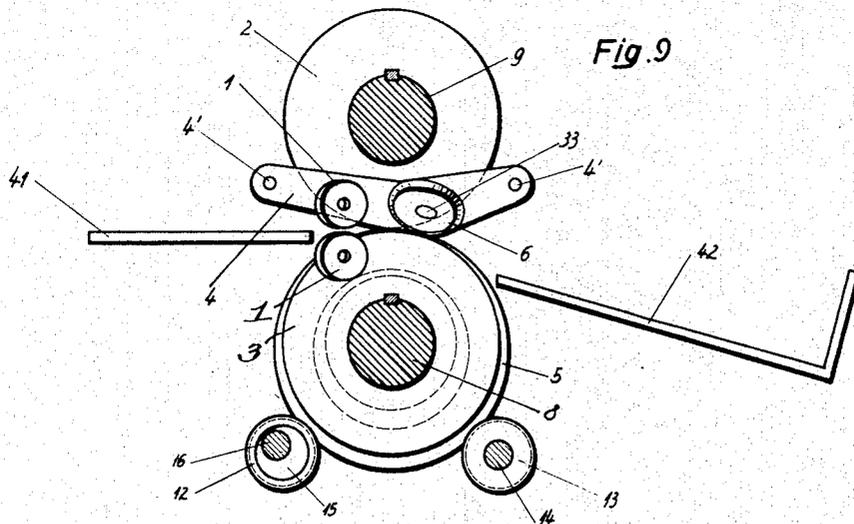
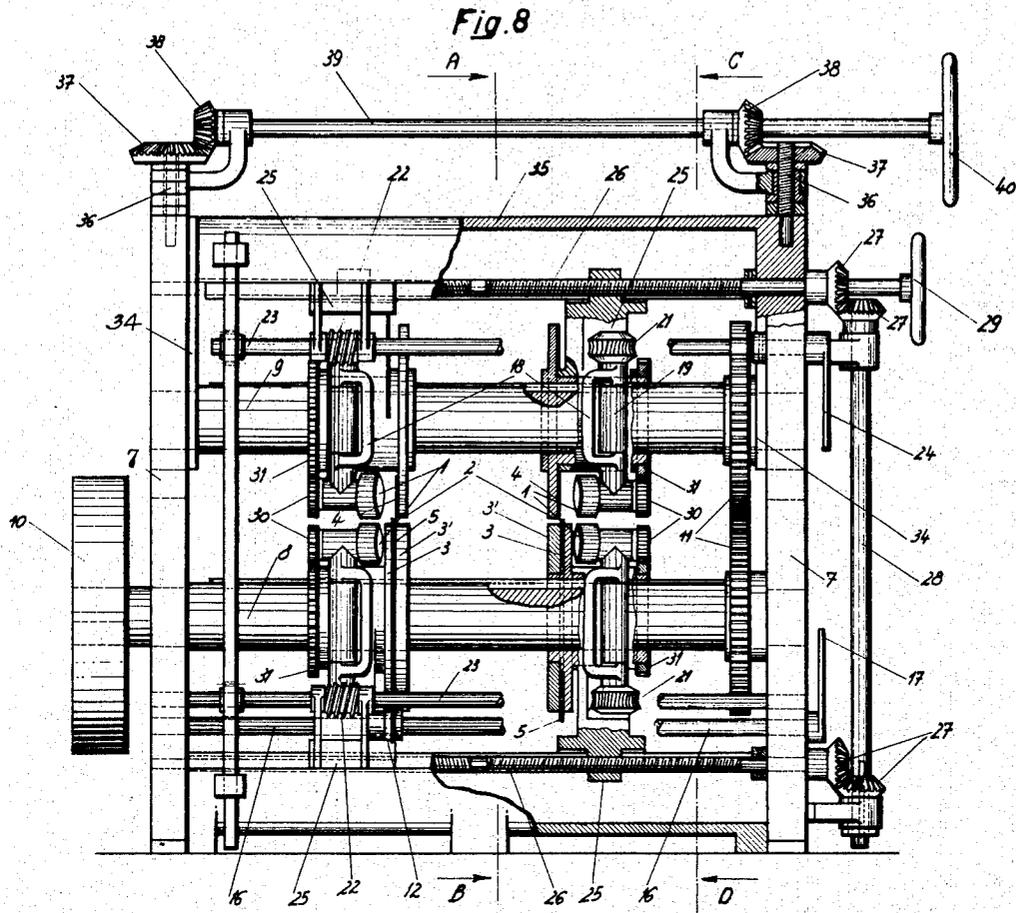
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## UNITED STATES PATENT OFFICE

2,022,563

## PROCESS AND APPARATUS FOR THE FORMATION OF CHANNELS IN SHEETS OF CARDBOARD, CORRUGATED CARDBOARD, OR THE LIKE

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32 Claims. (Cl. 93—58)

In order to prepare for the bending (generally rectangular) of parts of a sheet of cardboard, right-angled bends are produced in the sheets, which, according to the type and thickness of the material, are in some cases merely grooves which appear on the rear side of the sheet as very slight projections, and in other cases as clearly defined, rather deep and wide channels.

The present invention relates to the simultaneous formation of two such grooved parallel portions, and can be used (with thin material) for forming merely grooves, and also (with thick material) for forming pronounced channels. It is particularly valuable for the latter operation.

The object of the invention is the simultaneous formation of two parallel channelled portions without extension of the material located between them, and the formation of each of the two channelled portions without subjecting the material to injurious stress, the material being neither unduly pulled nor compressed.

In particular, in the formation of the channelled portions, stresses which would subsequently cause the work to tend to return to its original form are avoided. Thus, according to the invention, channelled portions are produced which are not hard but are stable (retain their shape).

According to the present invention, the material necessary for forming the inner halves of the channelled portions, i. e. those facing one another and the longitudinal axis of the sheet of cardboard, is, so to speak, stored between the channelled portions, in that the sheet arrives at the channelling position in a curved form, and the said material can be removed therefrom while flattening the curvature. Then first of all the inner halves of the channel are formed from this material and immediately afterwards also the outer halves of the channel by drawing the marginal parts of the sheet to the machine parts which form them.

The process is preferably carried out in a machine in which the two channelled portions are formed on passing through the machine, by means of rotating tools, partly with the co-operation of stationary tools, progressing from one transverse edge to the other. Assuming such a machine to be employed, the process will now be described by reference to Figs. 2-7 of the annexed drawings, whereas the machine itself is further illustrated by means of Figs. 1, 8 and 9, and will be described hereinafter.

Fig. 2 represents diagrammatically the yet unworked sheet of cardboard.

Figs. 3 and 4 show in elevation and plan the

curving of the sheet, in order that the material from which the inner halves, that is the halves forming the longitudinal centre of the sheet, are to be formed, may be brought between the positions between which the channels are to be formed.

Fig. 5 shows the forming of these halves.

Fig. 6 shows the forming of the outer halves of the channelled portions (those facing the longitudinal edges of the sheet).

Fig. 7 shows in elevation the sheet of cardboard with the two channelled portions.

First of all it should be noted that the process is not limited to operation with smooth sheets of cardboard. Sheets of corrugated cardboard and sheets of other material which behaves similarly to cardboard when being worked may be subjected to the operation.

A sheet of smooth cardboard *a*, shown in Figs. 2 and 7 by way of example, is to be provided in the direction indicated by the arrow, which at the same time indicates the longitudinal middle of the sheet, and in the vicinity of the lines *b-b* and *c-c*, with the strongly defined, channel-like portions as shown in Fig. 7.

For this purpose, according to Figs. 3 and 4, the sheet *a*, before its transverse edge arrives in engagement with the channelling tools, passes through the pair of delivery rollers 1-1 which engage close to their longitudinal edges, on axes which, in plan, are disposed obliquely, namely rearwardly directed, that is to say which form with the arrow, which in this case also indicates the longitudinal axis and the direction of movement, the angle  $\alpha$ . Thereby the sheet is caused to assume the curvature shown in Fig. 3. The curvature is so pronounced that it yields the material necessary for the formation of the inner halves of the channels, so that, after the formation of these halves of the channel the sheet lies flat again as shown in Figs. 5 and 6. In these two figures 2-2 are parts of two discs on a common axle, which first of all co-operate with the discs 3 likewise mounted on a common axle, for the further conveyance of the sheet *a*. Both pairs of discs 2-2 and 3-3 are positively rotated. In circumferential grooves in the discs there are disposed freely rotatable rings 5, which, at the operative position protrude slightly beyond the periphery of the discs 3, namely to an extent corresponding to the depth of the channels to be produced. By the co-operation of the discs 5 with the blades 4, according to Fig. 5, the inner halves of the channels are formed, whereby the surplus material is employed which was, so

to speak, stored in the curved state as compared with the sheet when imagined in a flat position.

Then, as shown in Fig. 6, there follows the formation of the outer halves of the channel by the co-operation of discs or rollers 6 directed obliquely in relation to the ring 5, the peripheries of the said discs or rollers being wedge-shaped. The angle of the roller profile corresponds to the angle which the outer limb of the channel forms with the plane of the sheet of cardboard, and thus will generally be an angle of 90°. As the axles of the discs 6, both in elevation and in plan, are directed obliquely to the direction of advance of the sheet *a*, they displace the marginal portions of the sheet located outside the channel positions towards the ring 5, so that also the outer halves of the channels are formed without doing violence to the material. The discs 6 do not generally need to be driven; they are rotated by the advance movement of the cardboard sheet. In the formation of the outer halves of the channels, the blades 4 support the channel in the process of formation.

Fig. 7 shows the sheet *a*, flat again, with the two channels *d-d*.

As may be seen from Figs. 5 and 6 in conjunction with what has been said, for the formation of the channels a downwardly directed pressure on the top of the channels is not necessary, that is to say it is not necessary to arrange and shape the machine members which participate in the formation of the channels in such a manner that the material is forced through a shaping device surrounding the channel on all sides.

Fig. 1 represents a suitable form of construction of the machine in vertical section along the line A—B of Fig. 8, and Fig. 8 is a front view in partial section.

Fig. 9 shows on a somewhat larger scale the members which co-operate in the formation of the channels in vertical section along the line C—D of Fig. 8, and in particular also those parts which have been omitted from Fig. 8 for the sake of clarity.

In the frame 7 there are mounted thick shafts 8 and 9. The shaft 8 is driven by a belt pulley 10 and transmits its rotation by way of a pair of gear wheels 11 to the shaft 9. On the shaft 9 are mounted the discs 2—2 which co-operate with the discs 3—3 on the shaft 8. Between the actual disc 3 and a covering disc 3', are formed circular slots in which the rings 5 are placed loosely and rotatably. The bore of these rings is considerably greater than the diameter of the shaft 8 and their external diameter is greater than that of the discs 3. These rings are supported by discs 12 and 13 (Figs. 1 and 9) in such manner that they protrude at the top beyond the periphery of the disc 3 to an extent corresponding to the depth of the channels to be produced. The disc 13 is adapted to rotate about a stationary pivot 14, and the disc 12—which may also be called a ring—is adapted to rotate on an eccentric 15 which is fixed on its axle 16 and adapted to be adjusted by turning the axle by means of a lever 17 (Fig. 8), whereby the extent to which the ring protrudes in relation to the disc 3 can be changed.

In front of the vertical plane in which are located the shafts 8 and 9, is arranged a pair of delivery discs 1—1. Their axles which are obliquely directed as shown in Fig. 4, are mounted in rotating frames 18 which, as may be seen in Fig. 8, have the form of a loop with two bearing

members 18'. The latter, with the intermediately disposed members 19 and an axle 20 passing through the members 18' and 19 (Fig. 1), form a hinge-joint about which the axles of the disc 1 can be swung in an horizontal plane. For this purpose there are provided worm wheels 21 which co-operate with worms 22 on an axle 23, which can be turned by a hand lever 24. The members 19 form parts of supports 25 which, by means of spindles 26 with right-hand and left-hand threads can be brought towards one another or moved apart from one another in order to determine the distance of the two channels. Each rotating frame 18 is provided with a support. The spindles 26 are interconnected by a pair of 15 cogwheels 27 and a shaft 28 (adapted to be displaced in the lower cogwheel), so that when a hand wheel 29 is turned, all four supports can be moved simultaneously and uniformly in an appropriate manner. The delivery disc 1 is 20 driven by cogwheels 30 which mesh with cogwheels 31 on the shafts 8 and 9. The discs 2 or 3 also participate in the displacement of the supports 25.

The outwardly directed surfaces of the disc 2 bear against the flat plates or blades 4, which are shaped as illustrated in Fig. 9. By means of their eyes 4' they are fixed to arms 32 which form parts of the support 25.

Outside the blades 4 and behind the vertical plane of the shafts 8, 9 are disposed the obliquely directed, bevelled edge discs 6 on correspondingly oblique pivots 33, which are connected with the support in any suitable manner.

If it is desired to work cardboard or the like of different thicknesses, the distance between the shafts 8 and 9 must be variable. With this object in view the upper shaft 9 is mounted in sliding bearings 34 which are connected by cross pieces 35 of U-shaped cross section, and by which 40 spindles 36 fixed therein can be raised and lowered. For this purpose, in the frame 7 are mounted bevel pinions 37 provided with internal threads, which pinions mesh with bevel pinions 38 on a shaft 39 provided with a hand wheel 40. In the vertically-adjustable system 34—35—36, the upper spindle 26 is also mounted so that also the two top supports 25 with the rotating frames 18, the blades 4 and the discs 6 take part in the vertical adjustment of the shaft 9.

The sheets *a* are passed over a table 41 to the pair of discs 1—1, and after passing through the machine parts which produce the channels are received by a table 42.

Having thus described the nature of the said invention and the best means I know of carrying the same into practical effect, I claim:—

1. A process for forming creases in sheets of cardboard and the like comprising first forming one side of the crease and thereafter forming the other side of said crease whereby the folding lines in the making of cartons and the like are produced.

2. A process for forming creases in sheets of cardboard and the like comprising forming a slack in the sheet of cardboard adjacent where the crease is to be formed, then forming one side of the crease and thereafter forming the other side of said crease whereby the folding lines in the making of cartons and the like are produced.

3. A process for forming parallel creases in sheets of cardboard and the like comprising forming a slack in the sheet of cardboard between the places where the creases are to be formed, then forming the inner side of said creases

utilizing said slack and then forming the outer sides of said creases.

4. A process for forming two parallel creases in sheets of cardboard and the like comprising forming a curvature in the central portion of a sheet of cardboard, then forming the inner sides of said parallel creases while using the slackness in said curvature thereby flattening out the curvature in said sheet and thereafter forming the outer sides of said creases while displacing the longitudinal edges of the sheet towards the creases.

5. A machine for forming creases in sheets of cardboard and the like comprising means for forming the inner side of a crease and means operative after the formation of said inner side for forming the outer side of said crease whereby the folding lines in the making of cartons and the like are produced.

6. A machine for forming creases in sheets of cardboard and the like comprising means for forming a slack in a sheet of cardboard, means for forming one side of a crease while utilizing said slack and means for thereafter forming the other side of said crease.

7. A machine for forming creases in sheets of cardboard and the like comprising means for forming a curvature in a sheet of cardboard, means for forming the inner side of a crease while utilizing the slack caused by said curvature and means for thereafter forming the other side of said crease.

8. A machine for forming creases in sheets of cardboard and the like comprising a frame, means associated with said frame for cooperating with a sheet of cardboard for developing a slackness therein along the longitudinal center thereof, means upon said frame for forming the inner side of a crease while utilizing said slackness in order to prevent tearing of the fibers and means operative subsequently to said first two mentioned means for forming the outer side of said crease and displacing the outer side of said sheet so as to provide the necessary slackness in said sheet for forming the outer side of said crease without tearing the fibers of said sheet.

9. A machine for forming creases in sheets of cardboard and the like comprising a frame, a pair of shafts carried by said frame, means associated with said shafts for feeding a sheet of cardboard and at the same time forming a curvature therein at substantially the longitudinal center thereof, means carried by said shafts for forming one side of a crease in said cardboard and means also associated with said shafts for thereafter forming the other side of said crease.

10. A machine for forming creases in sheets of cardboard and the like comprising a frame, a pair of shafts mounted in said frame, angularly disposed feeding means for curving a sheet of cardboard, means for varying the angularity of said feeding means and means for forming creases in said cardboard.

11. A machine for forming creases in sheets of cardboard and the like comprising a frame, a pair of shafts mounted in said frame, feeding rollers angularly disposed to the axes of said shafts so as to curve a sheet of cardboard at approximately the longitudinal center thereof, creasing disks carried by said shafts and means associated with certain of said disks for adjusting the amount of crease.

12. A machine for forming creases in sheets of cardboard and the like comprising a frame, angularly disposed feeding rollers carried by said

frame, means for varying the angularity of said rollers, a shaft, a pair of disks mounted upon said shaft, a second shaft located below said first mentioned shaft, a pair of disks mounted upon said second shaft and loosely mounted creasing disks carried by said last mentioned disks cooperating with said first mentioned disks for forming one side of the creases and means for thereafter forming the other sides of said creases.

13. A machine for forming creases in sheets of cardboard and the like comprising a frame, angularly disposed feeding rollers carried by said frame, means for varying the angularity of said rollers, a shaft, a pair of disks mounted upon said shaft, a second shaft located below said first mentioned shaft, a pair of disks mounted upon said second shaft and loosely mounted creasing disks carried by said last mentioned disks cooperating with said first mentioned disks for forming one side of the creases, means for adjusting said loosely mounted disk so as to control the amount of crease and means for thereafter forming the other sides of said creases.

14. A machine for forming creases in sheets of cardboard and the like comprising means for curving a sheet of cardboard, a pair of superposed shafts, cooperating disks carried by said shafts, the disks upon the lower shaft being provided with circumferential grooves, loosely mounted creasing rings located in said grooves and means for adjusting said rings to control the amount of crease.

15. A machine for forming creases in sheets of cardboard and the like comprising means for curving a sheet of cardboard, a pair of superposed shafts, cooperating disks carried by said shafts, the disks upon the lower shaft being provided with circumferential grooves, loosely mounted rings located in said grooves, supporting rollers for said rings, means for varying the position of said supporting rollers to thereby vary the amount of crease and blades coacting with the outer sides of the disks upon the upper shaft and with said rings for forming in said cardboard one side of a crease.

16. A machine for forming creases in sheets of cardboard and the like comprising means for curving and feeding a sheet of cardboard, a pair of superposed shafts, cooperating disks carried by said shafts, means cooperating with said disks for forming one side of a crease and means disposed obliquely to said disks cooperating with said disks upon said lower shaft for forming the outer side of said crease.

17. A machine for forming creases in sheets of cardboard and the like comprising a frame, a pair of superposed shafts carried by said frame, vertically disposed driven feeding disks for feeding a sheet of cardboard and at the same time curving said sheet along its longitudinal center, means for forming one side of a crease in said cardboard utilizing the slack caused by the curve in said sheet and means cooperating with said last named means for forming the outer side of said crease.

18. A machine for forming creases in sheets of cardboard and the like comprising a frame, means associated with said frame for feeding a sheet of cardboard and at the same time curving said sheet at approximately its longitudinal center, a pair of superposed shafts in said frame, creasing means mounted upon said shafts and means for adjusting the distance between said shafts and thereby between said creasing means

to accommodate sheets of cardboard of various thicknesses.

19. A machine for forming creases in sheets of cardboard and the like comprising a frame, a pair of superposed shafts in said frame, means carried by said shafts for feeding and at the same time curving a sheet of cardboard, means carried by said shafts for forming one side of a crease utilizing the slackness caused by said curving, means also carried by said shafts for forming the other side of said crease and means for varying the distance between said shafts and thereby between said means for forming the sides of the crease to adapt the machine to various thicknesses of cardboard.

20. A machine for forming creases in sheets of cardboard and the like comprising a frame, a shaft mounted in said frame, a pair of supports slidably mounted upon said shaft, means for moving said supports towards and away from each other, a disk in each support carried by said shaft and mounted upon said shaft non-rotatably but free for axial movement along said shaft, a feeding roller mounted upon said support and means for varying the angularity of said roller with respect to the axis of said shaft.

21. A machine for forming creases in sheets of cardboard and the like comprising a frame, a pair of shafts mounted in said frame, a pair of supports associated with each shaft capable of movement along the longitudinal axis of each shaft, means for moving said supports in unison towards and away from one another, a disk mounted in each support and upon said shafts, said disks being non-rotatably mounted upon said shafts and freely movable along the longitudinal axis of said shafts, a blade cooperating with each disk mounted upon one of said shafts a loosely mounted ring cooperating with the disks upon the other of said shafts in order to form one side of a crease and means for varying the relation between said rings and the disks upon which they are mounted.

22. A machine for forming creases in sheets of cardboard and the like comprising a frame, a pair of superposed shafts mounted upon said frame, a pair of supports mounted upon each shaft, means for moving said supports in unison towards and away from one another, a disk associated with each support and movable along the longitudinal axis of the shaft upon which it is mounted with its cooperating support, blades cooperating with the disks mounted upon one shaft, loosely mounted rings cooperating with the disks mounted upon the other shaft, means for varying the relation between said loosely mounted rings and the disks upon which they are mounted, a feeding and curving roller mounted upon each support and a bevelled edge disk carried by each support.

23. A machine for forming creases in sheets of cardboard and the like comprising a frame, a pair of superposed shafts mounted upon said frame, a pair of supports mounted upon each shaft, means for moving said supports in unison towards and away from one another, a disk associated with each support and movable along the longitudinal axis of the shaft upon which it is mounted with its cooperating support, blades cooperating with the disks mounted upon one shaft, loosely mounted rings cooperating with the disks mounted upon the other shaft, means for varying the relation between said loosely mounted rings and the disks upon which they are mounted, a feeding and curving roller

mounted upon each support and a bevelled edge disk obliquely mounted upon each support.

24. A machine for forming creases in sheets of cardboard and the like comprising a frame, a pair of superposed shafts carried by said frame, a pair of disks mounted upon each shaft, a loosely mounted ring located in each disk upon one of said shafts and adjustable rollers supporting said loosely mounted rings in order to vary the extent which said rings protrude beyond the upper periphery of said disks.

25. A machine for forming creases in sheets of cardboard and the like comprising a frame, a pair of shafts mounted in said frame, a pair of disks mounted upon each shaft, loosely mounted rings located in the disks upon one of said shafts, a fixed roller associated with each of said rings for supporting the same and a second movable roller for supporting said rings and varying the position of said rings with respect to said disks.

26. A machine for forming creases in sheets of cardboard and the like comprising a frame, a pair of shafts mounted in said frame, a pair of disks mounted upon each shaft, loosely mounted rings located in the disks upon one of said shafts, a fixed roller associated with each of said rings for supporting the same, a second roller also supporting said loosely mounted rings and an eccentric upon which said second roller is mounted whereby said second roller may have its position adjusted and thereby vary the positioning of said loosely mounted rings with relation to said disks.

27. A machine for forming creases in sheets of cardboard and the like comprising a frame, a pair of shafts mounted in said frame, a pair of supports associated with each shaft, means for driving said shafts in unison, gears carried by said supports and driven by said shafts and a feed roller angularly adjustable upon each support and driven by the gear provided in each support.

28. A machine for forming creases in sheets of cardboard and the like comprising a frame, a pair of shafts mounted in said frame, a pair of supports mounted upon each shaft, means for moving said supports towards and away from each other in unison, a feeding roller carried by each support, means for varying the angularity of said roller with respect to the longitudinal axes of said shafts and means whereby all of said feeding rollers may have their angularity with respect to the longitudinal axes of said shafts adjusted in unison.

29. A machine for forming creases in sheets of cardboard and the like comprising a frame, a pair of shafts mounted in said frame, a pair of supports mounted upon each shaft, means for creasing a sheet of cardboard mounted in said supports, means for moving said supports towards and away from one another in unison and means for varying the distance between said shafts to accommodate different thicknesses of cardboard and thereby also varying the distance between said supports and the means for creasing said cardboard.

30. A process for forming creases in sheets of cardboard and the like comprising continuously forming one side of the crease and thereafter continuously forming the other side of said crease whereby the folding lines in the making of cartons and the like are produced.

31. A process for continuously forming creases in sheets of cardboard and the like comprising continuously forming a slack in the sheet of

5 cardboard adjacent where the crease is to be formed, then continuously forming one side of the crease and thereafter continuously forming the other side of said crease whereby the folding lines in the making of cartons and the like are produced.

32. A machine for continuously forming creases in sheets of cardboard and the like comprising

means for continuously forming the inner side of a crease and means operative after the formation of said inner side for continuously forming the outer side of said crease whereby the folding lines in the making of cartons and the like are produced. 5

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