The present invention relates to a means and method for providing lengths of material such as paper with zigzag or reverse folds, and more particularly relates to means and method of providing slack portions in a web to facilitate formation of folds.

Another object of the invention is to provide new and improved means and method for pulling portions of a web over edges of folder blades so as to provide slack in the web both in advance of and in retard of the folder blades.

Syll another object of the invention is to provide an improved form of a machine of relatively simple construction and operation.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention has been chosen for purposes of illustration and description and is shown in the accompanying drawings, forming a part of the specification, wherein:

FIG. 1 is a side elevational view illustrating a preferred embodiment of the present invention;

FIG. 2 is a vertical sectional view taken along line 2--2 of FIG. 1;

FIG. 3 is an enlarged fragmentary view illustrating the present invention prior to closing of clamping jaws against a folder blade;

FIG. 4 is a fragmentary sectional view generally similar to FIG. 3, but showing the relationship of parts subsequent to jaw closing to form a fold in a paper web;

FIG. 5 is an enlarged sectional view intended to illustrate in a general way the action of paper folding machines not provided with the present invention; and

FIG. 6 is a fragmentary sectional view illustrating a modified form of the present invention.

Referring more particularly to FIGS. 1 and 2 of the drawings, there is shown a paper folding machine comprising a pair of rollers 1 and 2 rotatably mounted on axles 4 and 5, the latter being carried by any suitable framework 7. These rollers may be rotatably interconnected similarly to those hereinbefore mentioned prior patent and may be driven as therein referred to. The rollers turn in opposite directions so that peripherally spaced, alternately arranged, folder blades 9 and clamping jaws 10 of the different rollers are disposed in a manner to follow adjacent an area of tangency of the rollers, and the folder blades of either roller cooperate with the clamping jaws of the other roller to effect a fold in any oppositely disposed folds in a web of paper 13 between the rollers.

The web of paper 15 may be unwound from a large reel thereof (not shown), and cooperated with the folder 14 and 15 preferably provide a slack portion 16 in the web at a location in advance of the tangent area of the rollers.

Folds formed and gripped by the clamping jaws of one roller, for example roller 1, are moved away from the generally tangent location to one release location. Folds formed and gripped by the clamping jaws of the other roller 2 are moved to another release location generally opposite to the release location of the roller 1. The resulting transversely folded paper may be accumulated as a vertical stack or may be received on a removal conveyor 18.

The construction and operation of the folder blades 9 and clamping jaws 10 may be as disclosed in my previously referred to patent.

The action of the paper when used in the machine of my prior patent is disclosed in a general way in FIG. 5 herein. As there shown, paper is gripped by one pair of clamping jaws (not shown) extending from those jaws against the periphery of a roller R' and thence over the outwardly projecting edge of a folder blade B. As the clamping jaw or jaws J of opposite roller R" close with respect to the folder blade B, a portion of the web W must slide over the outermost edge of the blade in order that the paper does not tear somewhere in the vicinity W'. That is, the portion of the web in advance of the folder blade B is pulled taut between this blade and the set of preceding clamping jaws (not shown), and in order for the jaws J to close without tearing the paper, the paper must be gripped and the jaws slide over the blade, from a slack portion such as 16 in retard of the blade. If the jaws J close slowly there is time for the web to feed over the blade edge, but if the machine is speeded up excessively the members may have time to move sufficiently over the blade and hence tear. When the paper tears it is unfit for use in business machines.

The device and method of the present invention are adapted to minimize or prevent the above difficulties by providing slack portions in a web at locations in advance of a folder blade, the slack being present both in advance and in retard of the folder blade and prior to complete closing of the jaws. This permits the jaws to close and form a fold without tearing the paper, and, as a result, a paper folding machine may be run at higher speeds than previous machines without tearing the paper.

As shown in FIGS. 1--4, slack is provided in advance of the folder blades by web deflecting members 22, which extend across the width of the rollers. These members are normally disposed in lowered position on the rollers and are movable generally laterally of the roller surfaces and of a web of paper resting thereon, so as to exert force on the web and pull a portion of it to the side in advance of the blank 9 prior to closing of the clamping jaws 10.

In FIG. 3 a deflecting member 22 is shown in raised position, the succeeding clamping jaws 10 being open. In operation the clamping jaws shown on the roller 1, at the lower part of FIG. 3, close and grip a fold so as to pull the web, 13, directly against the outer surface of the roller 1; these jaws remain closed until the fold is formed as a succeeding set of clamping jaws on the other roller 2 have moved to closed relationship about a folder blade so as to form and grip a succeeding fold.

The deflecting member 22 is moved to its outer declaf-
The modified form of device shown in Fig. 6 is generally similar to that of Figs. 1–4, the main difference from the Fig. 6 device being that it has a relatively small deflecting member 22, and the deflecting member 22 is moved quickly back to its lower or inward position and thus the previously taut web portion in advance of the blade 9, which has sufficient slack to permit the closing of the jaws without tearing the paper. Shortly thereafter the previously closed set of jaws on the roller 1 are opened. The relationship of the deflecting member 22 in its lowered position, with a succeeding set of clamping jaws on the roller 2 in closed relation, is shown in Fig. 4.

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parallel portions generally laterally of said web to thereby exert force on the web and move portions of it in advance of the moving blades, said moving means operable prior to folding and rendered inoperative subsequently just prior to folding.

5. In a device of the class described having a pair of adjacent rotatable rollers provided with peripherally spaced cooperating folder blade and clamping members for forming folds in a web of paper, a member carried by said rollers in advance of at least some of said folder blade and having at least one peripheral surface of the rollers to exert force on the web and pull portions of it to locations in advance of said blades, means for intermittently moving at least said portion of the carried means outwardly beyond said peripheral surfaces prior to folding, and yieldable means for subsequently returning said carried means to inward positions just prior to folding.

7. A device as claimed in claim 6 in which said rollers are provided with a recess in advance of each folder blade and each of said carried means is normally housed in a said recess.

8. A device as claimed in claim 5, in which said means for intermittently moving the parallel member comprises stationary cams located adjacent end portions of the rollers.

9. A device as claimed in claim 8, in which spring means is provided for returning the parallel member from raised to lowered position.

10. A device as claimed in claim 2, in which said carried means are spaced greater distances from the folder blades than from the clamping members.

12. The method of providing slack in the web in a strip of sheet material during the introduction of longitudinally spaced transverse folds in successively opposite directions therein by successively deflecting portions of the web into gripping members which comprises first forming an anterior fold by deflecting portions of the web into engagement with a first set of gripping members, moving said members to pull the web over a surface of predetermined length between said first set of gripping members and a second set of gripping members spaced from said first set along said surface while at the same time withdrawing said deflecting members from said first set along said surface while at the same time raising a deflecting member above the surface so that the web is in spanning relation with the surface, and then forming a second fold by deflecting portions of the web posterior to the first named portions into engagement with said second set of gripping members to permit deflection into said second set of gripping members.

13. The method of providing slack in the web in a strip of sheet material during the introduction of longitudinally spaced transverse folds in successively opposite directions therein by successively deflecting portions of the web into gripping members which comprises first forming an anterior fold by deflecting portions of the web into engagement with a first set of gripping members, moving said members to pull the web over a surface of predetermined length between said first set of gripping members and a second set of gripping members spaced from said first set along said surface while at the same time withdrawing said deflecting members from said first set along said surface while at the same time raising a deflecting member above the surface so that the web is in spanning relation with the surface, and then forming a second fold by deflecting portions of the web posterior to the first named portions into engagement with said second set of gripping members to permit deflection into said second set of gripping members.

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