Oct. 14, 1958 A. R. STOBB 2,856,184

FLEXIBLE SHEET FOLDING MACHINE AND METHOD

Filed Dec. 20, 1954 2 Sheets-Sheet 1

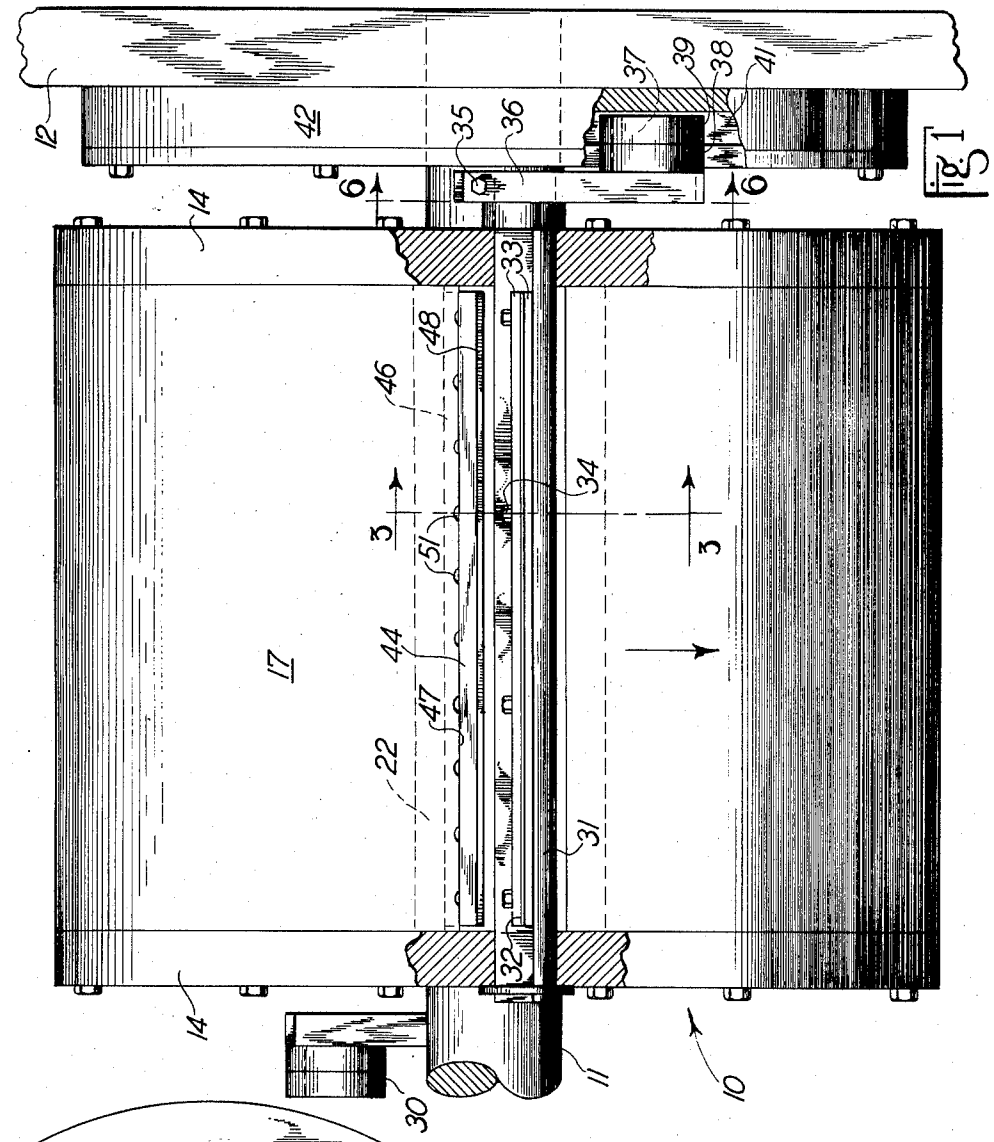


Fig. 1

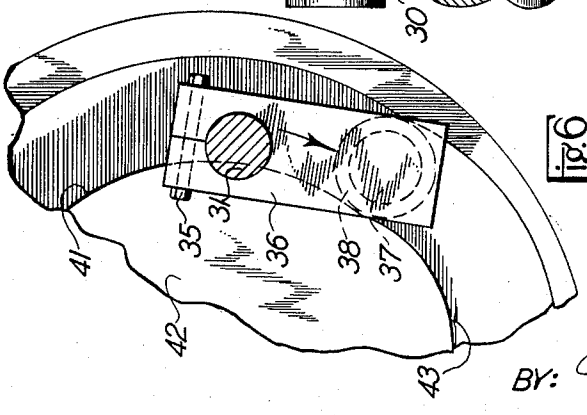


Fig. 2

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FLEXIBLE SHEET FOLDING MACHINE AND METHOD

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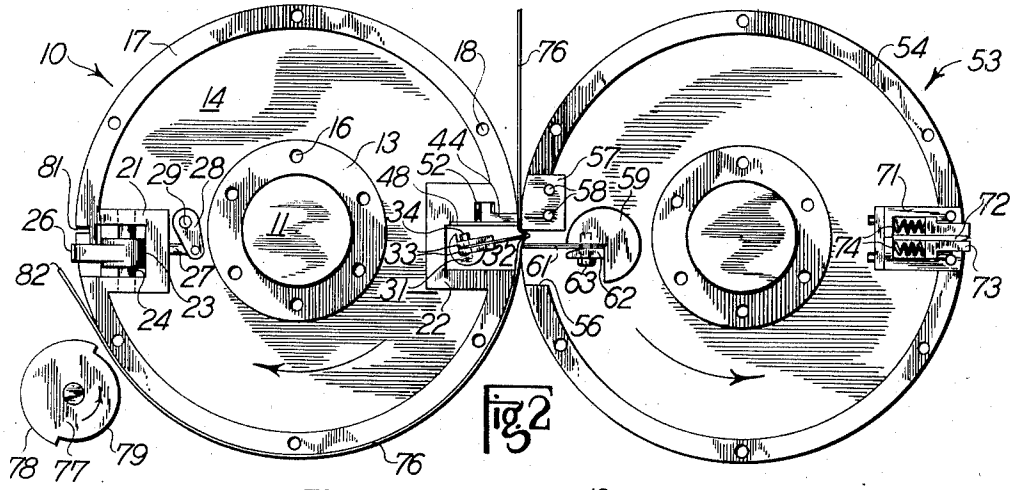


Fig 2

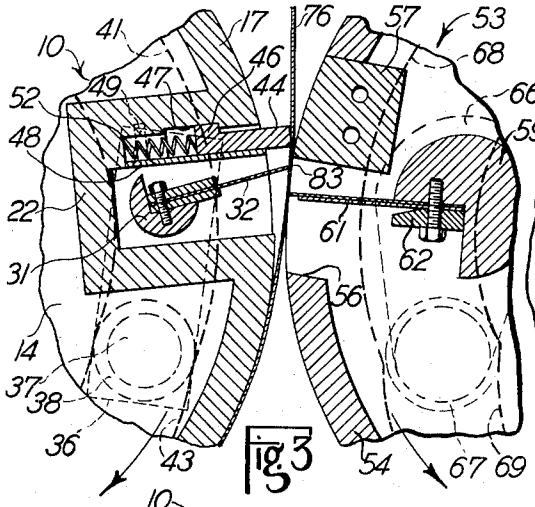


Fig 3

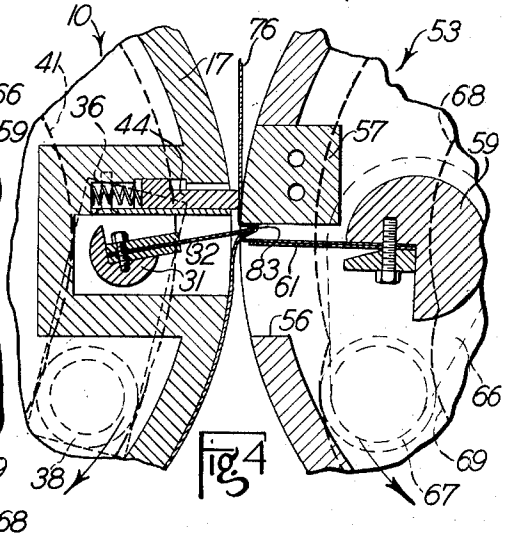


Fig 4

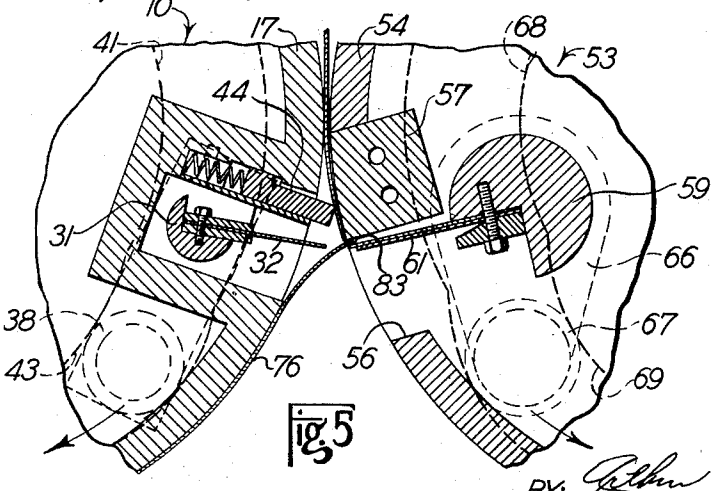


Fig 5

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FLEXIBLE SHEET FOLDING MACHINE AND METHOD

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Application December 20, 1954, Serial No. 476,476

9 Claims. (Cl. 270—73)

This invention relates to a method of folding paper and to flexible sheet folding machines and, more specifically, it relates to the tucker and folder members of a machine for folding paper or the like.

It is an object of this invention to provide an improved tucker for flexible sheets. Particularly, the object is to provide a paper tucker which will fold paper uniformly for forming the pages of a book, or magazine, newspaper, or the like. In achieving this object, the undesirable result of irregularity in manifolding paper is eliminated as the pages are aligned at their edges.

Another object is to provide a paper tucker and folder which will not tear the paper during the folding process.

Still another object is to provide a paper tucker and folder which can be operated at speeds higher than those heretofore achieved.

Other objects and advantages will become apparent upon reading the following description in conjunction with the accompanying drawings, wherein,

Fig. 1 is a side elevational view of a cylinder containing a preferred embodiment of this invention with parts thereof slightly rotated out of their normal position for clarity.

Fig. 2 is a reduced end view of the cylinder shown in Fig. 1 with the end plate removed and with a cooperating cylinder and a sheet guide also shown in end elevation in their respective operating positions.

Fig. 3 is an enlarged fragmentary sectional view taken on the line 3—3 of Fig. 1 with a fragment of the cooperating cylinder also shown.

Fig. 4 is a view similar to Fig. 3 but with the operating parts in a different and advanced position.

Fig. 5 is a view similar to Fig. 4 but with the operating parts in a different and still further advanced position.

Fig. 6 is a fragmentary sectional view taken on the line 6—6 of Fig. 1.

Similar reference numerals refer to similar parts throughout all the views.

As mentioned, this invention is related to the folding of flexible sheets including material like plastics, cloth, paper, etc. Since the invention has particular application to the folding of paper, the following description will refer to that application.

Fig. 1 shows a side view of a sheet tucker cylinder 10 which is suitably mounted on an axial shaft 11. The latter is rotatably disposed at opposite ends in suitable supports, such as a support 12, so that the cylinder is rotatable. As shown in Figs. 1 and 2, the cylinder 10 can be composed of a member 13, fitted onto the shaft 11 to rotate therewith, with a circular end plate 14 bolted to each end of the member 13 through bolt holes 16. A hollow cylindrical member 17 is attached between the plates 14 through bolt holes 18. Thus, the exterior of the member 17 is circular and conveys paper thereon in a manner described later.

The interior of the member 17 can be formed with integral channels 21 and 22 to be on opposite sides of the cylinder 10 and extend the length thereof. A paper

gripper 23 is shown pivotally mounted in the channel 21 on a pivot pin 24 to rock toward and away from the circumference at the end of the cylinder 10. A finger 26 of the gripper 23 thus alternately presses on the cylinder circumference to hold paper on the cylinder. A link 27 is attached between the gripper 23 and another link 28. The latter is mounted on a rock shaft 29 to rotate with the rock shaft which is attached to a cam follower 30, shown in Fig. 1, to be rocked to impart the pivotal motion to the gripper 23. The cam follower arrangement is similar to that described later with regard to other rock shafts. More details of the gripper arrangements are shown in a co-pending patent application Serial No. 496,125, and now Patent No. 2,797,097. Also, this invention is not limited to the gripper construction described but, alternatively, the well-known pin type of paper holders could be employed.

The channel 22 encloses a rock shaft 31 which extends the length of the cylinder 10 and therebeyond to be rotatably mounted in the end plates 14. The shaft is cut out as shown to receive a tucker finger or blade 32 supported by a block 33 along the top and bottom of the inner portion thereof and bolted to the shaft by a plurality of bolts 34 passing through the blocks 33 and the blade 32 and into the shaft 31. The radially outer edge of the blade 32 then projects slightly beyond the circumference of the cylinder 10, as shown.

As shown in Figs. 1 and 6, the shaft 31 projects beyond the end plate 14 and is clamped by a bolt 35 to an arm 36. The latter includes a pin 37 upon which is rotatably secured two rollers 38 and 39. A cam groove 41 is formed in a stationary member 42 to be approximately concentric with the shaft 11 and receive the rollers 38 and 39 to positively guide them during the rotation of the cylinder 10. The groove 41 is provided with a concentric portion 43 and thus the shaft 31 is rocked or rotated slightly in the cylinder 10 when the rollers engage the portion 43 of the groove. The groove is a cam and the rollers are the cam follower. Also, with this arrangement, the shaft 31 is rocked at a predetermined phase of rotation of the cylinder 10. Disposed within the channel 22, adjacent the shaft 31, is a pressure bar or finger 44 containing an angled end 46 received in a slot 47 inside the channel 22. A backing plate 48 is shown attached through the length of the channel by a screw 49 to maintain the bar 44 within the confines of the slot 47. Fig. 1 shows a plurality of radial holes 51 in the cylinder 10 with the holes extended into the channel 22 to be aligned with the pressure bar end 46. A coil spring 52 is disposed within each of the holes 51 to yieldingly urge the bar 44 radially outwardly of the cylinder 10. Thus, Fig. 3 shows the bar extended beyond the circumference of the cylinder and the bar is, of course, radially slidable to be retracted as shown in Fig. 2.

Fig. 2 also shows a cooperating sheet folding cylinder 53 constructed generally similar to the cylinder 10 with the same diameter and the same length although it should be understood that different relative sizes could prevail. The cylinder 53 contains a hollow cylindrical member 54 provided with an opening 56 wherein a block 57 is preferably disposed by bolting to the end plates of the cylinder through holes 58 to partly occupy the opening 56. A grooved rock shaft 59 is rotatably mounted in the end plates of the cylinder 53 to extend the length thereof and be rocked in a manner and by means which may be similar to that described with regard to the shaft 31. A paper folding blade or finger 61 is disposed in the shaft recess and is supported by a block 62, and both are attached by bolts, like a bolt 63, to the shaft 59. The latter is attached to an arm 66, shown dotted in Fig. 3, which connects to an offset cam roller 67. The latter is received in a cam groove 68, also shown dotted, to be guided

therewithin. The groove **68** includes an eccentric portion **69** and, here also, the shaft **59** is rocked as the cylinder **53** rotates and the cam follower **67** rides in the portion **69**. This construction is conventional and similar to that shown and described in regard to the shaft **31**. However, the folder blade **61** does not project beyond the circumference of the cylinder **53**.

A channel **71** is located in the cylinder **53** diametrically opposite the shaft **59** to extend the length of the cylinder in the usual manner. The usual paper knife **72** is radially supported in the channel to extend a slight distance beyond the circumference of the cylinder **53**. A pressure bar **73** is slidably disposed on each side of the knife to be confined by limits of the channel **71** and to be yieldingly urged by springs **74** to project with the knife beyond the circumference of the cylinder **53**.

The cylinders **10** and **53** are rotated in the direction of the arrows shown in Fig. 2. In this rotation, the gripper **23** is actuated to grip paper **76**, fed from a source not shown, and convey the paper half way around the cylinder. At the position shown in Fig. 2, the gripper **23** has released the paper as the tucker **32** has commenced the folding of the paper. A paper guide cylinder **77** is rotatably mounted adjacent the cylinder **10** to be synchronized therewith and rotate in the direction shown. The guide **77** includes a large circular portion **78** and a smaller portion **79** and the guide rotation is timed to have the portion **78** maintain contact with the paper until it is desired to loosen the paper on the cylinder shortly after the gripper **23** has released the paper. Thus, the paper is released by the cylinder **77** at the desired time of folding the sheet.

Also, the cylinder **10** contains a knife slot **81** positioned along the length of the cylinder to receive the knife **72** when the two cylinders are rotated. The knife then cuts the leading edge **82** of the paper **76** and the trailing gripper **23** holds the paper during the subsequent one-half turn of the shaft to the Fig. 2 position.

Figs. 3, 4, and 5 show the sequence of a tucking and folding operation. In Fig. 3, the operation commences as the pressure bar **44** secures the paper against the cylinder **53** to prevent the pulling of paper from the source above. At that time, the tucker **32** engages the paper at a point **83** which later becomes the creased line of the paper. As the cylinders rotate to the Fig. 4 position, the tucker continues to contact the paper at the crease line **83**. It will be seen in Fig. 4 that the lower left-hand cornor of the block **57** provides a stationary corner over which the paper is wrapped, as the corner does not move with respect to the cylinder **53**. The cylinder **10** rotates clockwise as the tucker shaft **31** rotates slightly counterclockwise since the cam followers **38** and **39** ride on the cam portion **43**. At this time, the tucker **32** is extended into the slot **56** and the paper is folded as indicated. Also, the pressure bar is urged radially inwardly on the cylinder **10**, and, therefore, more securely retains the paper from pulling from its source.

As shown between Figs. 3 and 4, the folder shaft **59** has rotated clockwise as its cylinder **53** rotates counterclockwise. Again, the cam follower **67** has traveled on the cam portion **69** to effect the rotation of the shaft **59**. The folder blade has then made the fold of the crease in the paper.

Fig. 5 shows the advanced position of the parts after the tucker **32** is withdrawn from the fold in the paper and as the folder completes the creasing of the paper along the line **83**. From the Fig. 4 to the Fig. 5 position, the tucker is again rotated slightly counter-clockwise with respect to the cylinder **10**. Such motion of the tucker permits it to be withdrawn without interfering with the folder or the paper. The folder then pulls the paper partly around the cylinder **53** as the pressure bar **44** has released the paper so that it can be pulled from its source above to where the knife **12** again cuts it.

While a specific embodiment of this invention has been shown and described, it will be obvious that certain changes can be made therein and the scope of the invention should, therefore, be limited only by the appended claims.

I claim:

1. In a tucker for flexible sheets such as paper, the combination comprising a rotatable sheet tucker cylinder, a sheet holder mounted on said cylinder to extend therefrom to hold a flexible sheet to the circumference of said cylinder during predetermined rotation of the latter, a sheet tucker finger rockably mounted on said cylinder rotationally behind said holder to project beyond the circumference of said cylinder and engage said flexible sheet to form a fold therein, means for rotating said tucker finger in a direction opposite to the rotation of said cylinder during folding of said flexible sheet, a rotatable sheet folder cylinder adjacent said tucker cylinder, a sheet folder finger on said folder cylinder to be rotatable in a direction opposite to that of said tucker finger for folding of said flexible sheets, and a block stationarily mounted on said folder cylinder adjacent said folder finger and presenting a stationary portion over which said sheet is laid by said tucker finger and against which said folder finger creases said sheet.

2. In a folding machine for flexible sheet material such as paper, the combination comprising a pair of oppositely rotatable cylinders in approximate rolling contact whereby a paper can be passed therebetween, a rock shaft rotatably mounted on each of said cylinders eccentric and parallel to the axis of said shaft to be adjacent each other at one phase of rotation of said cylinders, a paper tucker attached to one said shaft, a paper folder attached to the other said shaft, a block stationarily mounted on one of said cylinders to be adjacent said folder, said tucker and said folder arranged to project from their respective cylinders and overlap to engage said paper, means operative between said cylinders for holding said paper at a point between its source and the engagement thereof by said tucker, a cam attached to each said shaft to rotate each said shaft in an opposite direction with respect to said cylinders during said one phase of rotation of said cylinders, said cam for actuating said tucker being formed to cause said tucker to contact said paper at the line of fold and to lay said paper over said block while maintaining the contact at said line of fold.

3. In a machine for folding flexible sheets such as paper, the combination comprising a rotatable first cylinder, a sheet tucker on said first cylinder, a rotatable second cylinder, a sheet folder on said second cylinder, said tucker and said folder being oppositely disposed and rotatable with their respective said cylinders to receive a flexible sheet therebetween when the latter is fed from a source, means operable between said source and said tucker for holding said flexible sheet to prevent feeding thereof from said source to said tucker, means for actuating said folder to crease said sheet, means for actuating said tucker with respect to said first cylinder toward and away from said folder while the latter is creasing said sheet.

4. A paper tucking and folding machine comprising in combination a pair of oppositely rotatable cylinders spaced to receive a sheet of paper therebetween, a paper holder on a first of said cylinders for conveying said paper around the circumference of said first cylinder upon predetermined rotation of said cylinders, a paper tucker on said first cylinder to extend adjacent the circumference thereof, a paper folder on a second of said cylinders, a pressure bar on said first cylinder immediately rotationally behind said tucker to press said paper against said second cylinder, means for actuating said holder to release said paper after said pressure bar has pressed said paper against said second cylinder, means for actuating said tucker for feeding said paper into said folder in response to the rotation of said first cylinder and with respect thereto and when said holder is actuated to

release said paper, means for actuating said folder to crease the paper.

5. In a machine for folding flexible sheets such as paper, the combination comprising a first rotatable cylinder, a sheet tucker on said first cylinder, a second rotatable cylinder, a sheet folder on said second cylinder, said tucker and said folder being oppositely disposed and rotatable with their respective cylinders to receive a flexible sheet therebetween from a source, means for holding said flexible sheet with respect to said tucker to prevent movement of said sheet with respect to said first cylinder and between said source and said tucker while folding said flexible sheet, means for actuating said tucker with respect to said first cylinder during folding of said flexible sheet to continuously engage the crease line of the fold of said flexible sheet, means for actuating said folder to crease said flexible sheet.

6. In a machine for folding flexible sheets such as paper, the combination comprising a pair of oppositely rotatable cylinders spaced to receive a sheet of paper therebetween, a paper holder on a first of said cylinders to convey said paper around said first cylinder, a paper tucker on said first cylinder, a paper guide disposed to be operative between said holder and said tucker for engagement of said paper until said tucker commences operation, a paper folder mounted on the second of said cylinders to meet with said tucker upon rotation of said cylinders, a block stationarily mounted on said second of said cylinders adjacent said folder, means for actuating said tucker to feed said paper toward said folder at a predetermined phase of rotation of said cylinders and lay said paper over said block, means associated with said guide for releasing said paper at commencement of said phase of rotation of said cylinders, means for actuating said folder to crease said paper against said block.

7. In a machine for folding flexible sheets such as paper, the combination comprising a pair of oppositely rotatable cylinders disposed to receive paper therebetween, a paper holder on one of said cylinders for gripping said paper during a certain part of the rotation of said one of said cylinders, a paper tucker on said one of said cylinders, a paper folder on the other of said cylinders, the diameters of said cylinders and the speeds of rotation of said cylinders and the respective positions of said tucker and said folder on said cylinders being such that said tucker and said folder are both located adjacent the line of fold of said paper on each rotation of said cylinders, means for actuating said tucker for feeding said paper toward said folder when said folder and said tucker are

adjacent said line of fold of said paper, means for actuating said folder for creasing said paper, a paper guide roller disposed in rolling contact with said one of said cylinders and said paper for maintaining the latter on said one of said cylinders until commencement of folding of said paper after said certain part of the rotation of said one of said cylinders, said roller having a circumferentially relieved portion spaced clear of said paper and synchronized with the rotation of said one of said cylinders to be faced toward but clear of said paper at commencement of and during the folding of said paper.

8. In a method of folding paper, the steps comprising gripping the paper at one end and advancing it forward away from its source at a given speed, securing the paper at a location immediately behind the line where said paper is to be folded to continue to advance it at said speed, releasing said paper at said one end, engaging said paper on said line, and retracting said paper from said one end and creasing said paper along said line with the slack from said one end only.

9. In a method of folding paper, the steps comprising gripping the paper at one end and advancing it forward away from its source at a given speed, securing the paper between two rotating cylinders at a location immediately behind the line where said paper is to be folded to continue to advance it at said speed, releasing said paper at said one end while advancing it at said location, engaging said paper on said line and laying the length of it from said location to said line over a corner on one of said cylinders, and retracting said paper from said one end and creasing said paper along said line with the slack from said one end only.

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