United States Patent

[11] **3,547,430**

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[21] Appl. No. **703,652**
[22] Filed **Feb. 7, 1968**
[45] Patented **Dec. 15, 1970**
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[54] **FOLDER BEATER BRUSH FOR COLLATOR FOR ZIG-ZAG FOLDER**
6 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **270/79**
[51] **Int. Cl.** **B65h 45/107**
[50] **Field of Search** 270/39, 79

[56] **References Cited**

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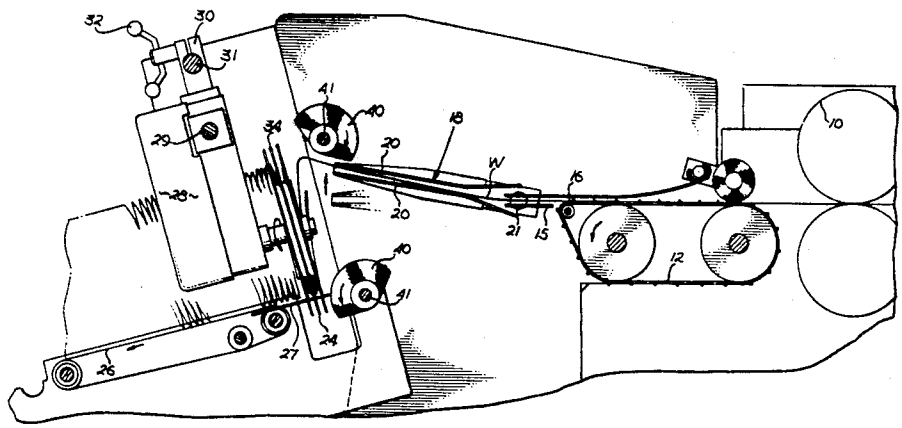
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ABSTRACT: In a collator for zigzag folding of multiple set business forms, folds in a long strip or web of paper are made at regular intervals by a plurality of rotating spiral folders assisted by a plurality of rotating brushes that are intermittently in contact with the paper. The brushes are soft, flexible members that have a wiping contact with the paper and because of their flexible nature, eliminate problems of critical timing of the brushes with respect to other moving members of the collator.



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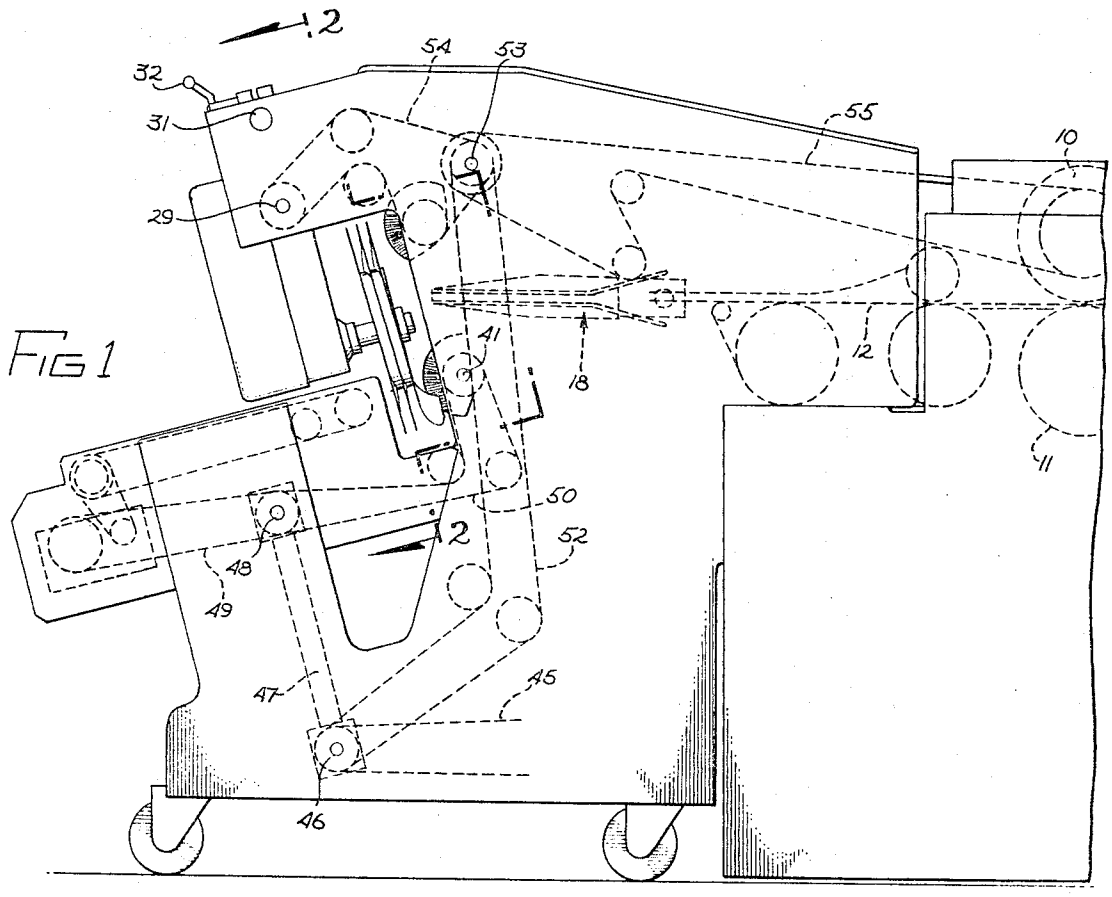


FIG 1

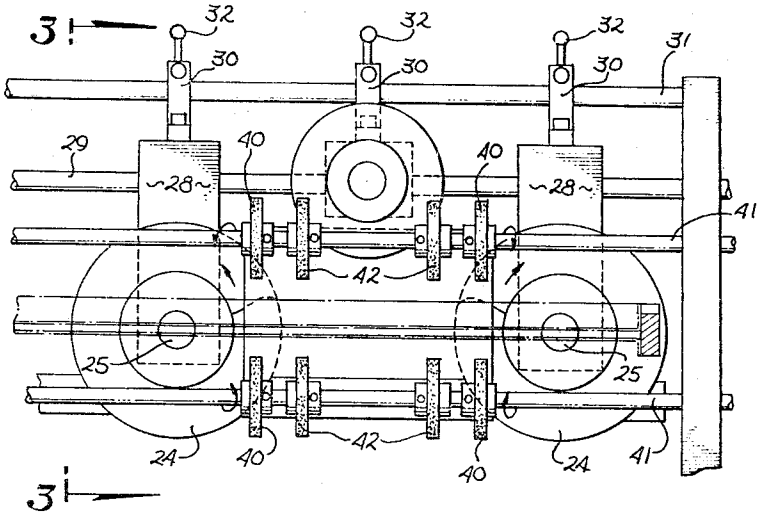


FIG. 2

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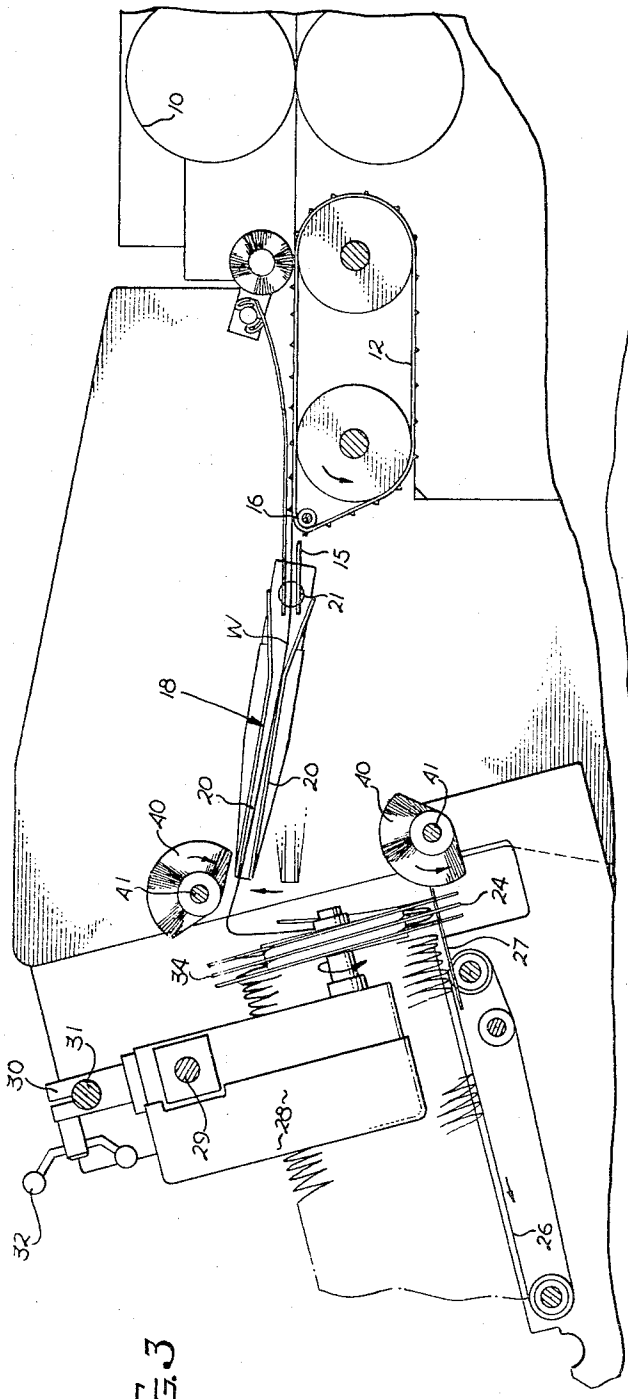


FIG. 3

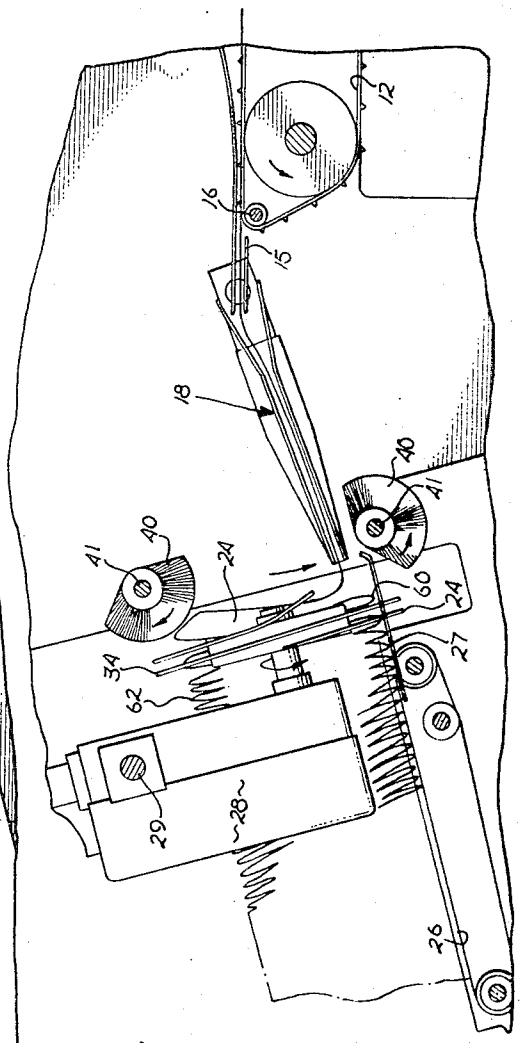


FIG. 4

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FOLDER BEATER BRUSH FOR COLLATOR FOR ZIG-ZAG FOLDER

BACKGROUND OF THE INVENTION

The present invention relates generally to a collator which interleaves a plurality of sheets of paper in long strips, perforates the strips transversely, and then folds the strip in a zig-zag configuration; but more particularly, the invention is concerned with means for assisting in the folding of the long strip or web of paper into a condition ready for final use.

A machine of this type handles preprinted rolls of paper and rolls of carbon paper and interleaves the several sheets of paper into multiple set business forms which have a wide variety of sizes and shapes, but which are typified by the forms which are used on high-speed data processing equipment to print out the results of the data processing operations. Since the forms are in a long continuous strip, referred to herein as a web, they are folded in a zigzag formation; and the collator folds the forms as a final step in its operation. The folding operation is performed primarily by a plurality of spiral members, each comprising two or more complete turns of a helix. Since the folding operation is necessarily performed rapidly and must be accurate, it is necessary to assist the spiral members by guiding and holding the paper at the proper positions. The paper web is engaged just ahead of the spirals in order to push the paper at the right point to assist in positioning the paper web at the right point for the fold and also to hold the paper in a manner to facilitate its feed up to the point of folding.

If the paper web is engaged by rigid members to do this, the members either must be timed very closely in order to avoid interferences with other movements of the machine, or they must be made in such a way that they can be retracted during certain steps of the folding operation. It is obvious that a rigid member, if it engages parts of the machine, causes the machine to hang up with the result that parts are broken, the paper web jams and valuable time is lost in clearing the machine and starting the operation again. On the other hand, retractable members which may be used to assist in the folding are necessarily complex and costly.

Hence, it is a general object of the present invention to provide a simply constructed member which engages the paper at the time of folding to cooperate with the spiral folders, and which is of such a character as to eliminate problems of critical timing and problems of constructing a complex, retractable member for this purpose.

SUMMARY OF THE INVENTION

Objects of the present invention are achieved in a collator having a pair of rotatably mounted, laterally spaced spiral folders adapted to receive and make spaced folds in a web or strip of paper, and a wigwag chute oscillating about a generally horizontal axis to feed the web to the folders, by providing a plurality of rotatably mounted brushes engaging the paper web beyond the discharge end of the chute to assist in forming said folds and by contact with the paper to facilitate its discharge from the feed chute. These rotatably mounted brushes are turned in timed relation with the spiral folders. Each brush preferably comprises a plurality of soft, flexible filaments, such as natural bristles, which bend in any direction and which accordingly yield upon contact with spiral folders or any other machine member in a manner to avoid engagement which would cause the machine to cease operating. These brushes are intermittently in contact with the paper and, for this reason, the filaments terminate in a circular arc of approximately 180°, thereby bringing the brushes into contact with the paper for only about one-half of each revolution of the brushes.

DESCRIPTION OF THE DRAWING

How, the above, as well as other, objects and advantages of the present invention are achieved will be more readily understood by reference to the following description and to the annexed drawing, in which:

FIG. 1 is a fragmentary side elevation of the discharge end of a collator in diagrammatic format;

FIG. 2 is a fragmentary transverse section on line 2–2 of FIG. 1 illustrating the folding spirals and the beater brushes;

FIG. 3 is a fragmentary vertical section comparable in extent to FIG. 1, taken on line 3–3 of FIG. 2 with the web being folded; and

FIG. 4 is a fragmentary section similar to FIG. 3 showing the spirals and beater brushes in alternate positions to form the upper folds in the web.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing, there is shown the portion of a collator which includes the elements folding the paper web. The paper web W, shown in FIGS. 3 and 4, is formed from a plurality of sheets of paper taken from supply rolls, not shown in the drawing. Alternate sheets of preprinted paper and carbon paper are interleaved and fed from right to left in the drawings, the interleaved plurality of sheets or strips of paper and carbon forming collectively the web which is advanced to the folding means.

This web passes between a pair of perforating rolls **10** and **11** which perforate the web transversely at spaced intervals as the web passes between the rolls. The folds in the paper formed as described later are at successive transverse perforations.

The paper web is advanced beyond rolls **10** and **11** by a pair of tractor belts **12** located one at each of the two opposite margins of the web. These belts are provided with a plurality of outwardly projecting pins **14** which extend upwardly through correspondingly spaced holes along the margins of the web. The tractor belts **12** each have an upper horizontal run on which the web lies so that it is drawn toward the left in the drawings, by movement of the tractor belts. As the web leaves the tractor belts, it passes between a pair of vertically spaced stationary guide plates **15** and **16** which direct the web into the wigwag chute indicated generally at **18**. This chute comprises a pair of vertically spaced guide plates **20** between which web W passes. The chute is adapted to oscillate in a short vertical arc about a generally horizontal axis **21** at the rear or entry end of the chute. The chute delivers the web to the folding means which are shown in greater detail in FIGS. **2** and **3**.

The folding means comprises a pair of laterally spaced spiral folders **24**, each of which is mounted on a short shaft **25** which may be considered to be generally horizontal, although the shaft is usually inclined slightly to correspond with the slope of discharge belt **26** and hook rail **27**. Each of the spiral folders comprises slightly more than two complete turns of a helical plate, the turns being spaced apart sufficiently that the web **20** passes freely between them. The rotating shaft upon which each spiral folder is mounted projects from one side of gear housing **28**, the two housings **28** each containing a train of gears, not shown, which rotate the spiral folders in opposite directions and in synchronism. Power for this purpose is derived from drive shaft **29** along which gear housings **28** can slide in order to vary the horizontal spacing between folders **24**. This adjustment in spacing between the folders is desired in order to accommodate the folders to webs of different widths. Any suitable type of connection between the gear train in the housing and shaft **29**, as for example a splined connection, may be used to permit this movement and still transmit power. Means are provided for locking the gear housings and the folders in adjusted positions, as for example split collars **30** which slide along the stationary rod **31** and which may be clamped in place by hand clamps **32** adapted to tighten the collars on bar **31**.

A third spiral folder **34** is often used when the web becomes very flexible, either because it is composed of a relatively small number of sheets or because it is comparatively wide. The spiral **34** is mounted between the pair of folders **24** at such a position that it engages the top folds in the web rather than the marginal areas. Spiral folder **34** is mounted on a

rotating shaft **35** which projects from one side of gear housing **36** which is slidably mounted on power shaft **29** to be driven thereby. Housing **36** is also provided with a split collar **30** which may be tightened by a handle **32** to lock the folder in adjusted position by frictional engagement with stationary bar **31**.

To assist in folding the web as will be further described, a plurality of beater brushes **40** are provided. A minimum of four such brushes are employed arranged in assemblies of at least two brushes on each of two shafts **41** which are vertically spaced apart. The brushes **40** are located near each of the upper and lower folds in the paper web, the brushes on each shaft **41** being spaced far enough apart laterally that they are located close to the edge of the web and in the vicinity of the periphery of spirals **24**.

In addition, it is preferable to also provide a plurality of similar beater brushes **42**, likewise arranged in pairs on each of the two shafts **41**. The beater brushes **42** are located inwardly of the margins of the web and are particularly useful with wide webs since it is then not necessary to carry the folding effect of the brushes **40** as far across the web. The upper two brushes **42** are preferably positioned in the vicinity of the periphery of spiral folder **34**.

All of the folding elements so far described are driven in timed relation with each other and with perforating rolls **10** and **11**. While a synchronous drive of the elements may be attained in any suitable manner, a typical means is illustrated in FIG. **1**. Herein, the drive comprises chain **45** from a prime mover, not shown, which drives a sprocket on the primary transverse drive shaft **46**. By means of bevel gears, power is transmitted from shaft **46** to an upwardly extending shaft **47** which is drivingly engaged by gear means which drive a second horizontal shaft **48**. Shaft **48** is movable up and down along shaft **47** in order to secure adjustment in the position of discharge belt **26** and other elements with respect to the spiral folders to accommodate different spacings between successive folds in the web.

From shaft **48**, sprockets thereon drive chains **49** and **50**. Chain **50** passes over suitably located idlers and a sprocket on lower beater shaft **41** carrying the lower assembly of brushes **40** and **42**.

From a sprocket on the main power shaft **46**, chain **52** is driven. This chain passes over suitably located idlers and supplies power to the upper transverse power shaft **53** which carries a plurality of drive sprockets. Around one of these sprockets passes chain **54** which drives a sprocket on shaft **29** supplying power to the plurality of spiral folders. Chain **55**, driven by another sprocket on shaft **53**, supplies power to drive the transverse perforating rolls **10** and **11** and also the mechanism which oscillates wigwag chute **18** and advances tractor belt **12**. Since drive mechanism of this character is well known in the art and only incidental to the present invention, it need not be shown in detail.

Returning to brushes **40** and **42**, they are shown in side elevation in FIG. **3**. Each of these brushes is composed of a number of soft, flexible filaments. Natural bristles are highly satisfactory for this purpose, but synthetic materials, such as nylon or any other suitable one of the plastics, can be used. Wire is not generally practical since it is difficult to secure the proper degree of resiliency without being too stiff and a stiff wire presses against the paper with sufficient pressure that objectionable marks are made on the sheets underlying the carbon sheets in the web.

Generally speaking, these brushes are rotary brushes but do not occupy a full circle. Typically, the bristles or filaments of each brush terminate in a circular arc of approximately 180° extent so that the brushes are in engagement with the paper web over approximately one-half of each revolution. This arcuate extent of the brushes has been found to be satisfactory and close to an optimum. If the bristles extend over materially more than 180°, problems of timing begin to arise; while if the bristles are much less than 180° in extent, the period of engagement with the paper web is shorter and becomes less effective.

The width of the brushes, that is their axial extent, may be varied within a wide range. A brush in the range of one-half to one inch is entirely satisfactory, but a wider brush may be employed if desired.

Having described the construction of the folding means including the beater brushes, their operation will now be described. Upon leaving perforating rolls **10** and **11**, web W is engaged and advanced by pins on tractor belt **12**. These pins not only advance the web but serve the purpose of registering the several sheets composing the web.

Belt **12** feeds the web into the wigwag chute **18** which oscillates about a horizontal axis at **21** between the two extreme positions shown in FIGS. **3** and **4**.

with the wigwag chute at the lower position of FIG. **4** and starting to move upwardly to the upper position of FIG. **5**, the web is deposited onto hook rail **27** at a transverse perforation in the web. Chute **18** now swings upwardly to clear the brushes **40** and **42** of the lower beater assembly, and brushes **40** and **42** rotating counterclockwise bring the filaments of the brushes into contact with the underside of the web. The brushes push on the web in the direction of web travel, moving the web forward to the point where the flared lips on the two spiral folders **24** move in behind the web and engage it. The counterrotating spiral folders **24**, as will be seen clearly in FIG. **2**, now engage the web along opposite margins and the flared lips move upwardly from the lower position of first engagement, moving the web forwardly and into an upright position. As this movement takes place, the lower beater assembly is pushing on the web and causes it to fold at the transverse perforation, thus creating the bottom fold in the web indicated at **60** in FIG. **4**.

Although the web is advanced by tractor belts, it is advantageous to assist the advance of the web by other means. This is accomplished by engagement of the lower beater brushes **40** and **42** with the web which press the web against the spiral folders and thereby restrains the web from rising upwardly with the chute as it moves from the lower position of FIG. **4** to the upper position of FIG. **3**. The effect of the engagement by the beater brushes is to hold the fold **60** in the web stationary so that in effect the web is drawn out of the chute as the chute moves upwardly, thus disposing the web in a generally vertical position.

By the time chute **18** has reached the uppermost end of its oscillation, the position of FIG. **3**, spiral folders **24** have rotated one-half revolution and are in maximum engagement with the web. The chute now starts its downward movement returning to the position of FIG. **4**. The web is still being lifted and held forward by the first turn of the spiral folders and the downward movement of the chute causes the web to break at a transverse perforation, thus creating another fold in the upper series at **62**. The chute moves downwardly, clearing the upper beater brush assembly which, rotating clockwise, brings the leading face of the mass of brushes into engagement with the face of the web. The filaments of the brushes bend as they press the web against the face of the spiral folder to complete formation of the fold at **62** in the web at a transverse perforation. Engagement of the web by the upper beater assembly presses the web against the first turn of the spiral folder, thereby not only assisting in forming the folds but holding the web against dropping down as the chute moves downwardly. Holding the web stationary has the effect of withdrawing the web from the chute as the chute moves down to the position of FIG. **4** to repeat the cycle of operations just described.

By repeating this cycle of folding, the web is folded in a zigzag fashion and is pushed by the spiral folders onto belt **26** which conveys the folded web to a position in which the web is stacked and boxed.

By repeating this cycle of folding, the web is folded in a zigzag fashion and is pushed by the spiral folders onto belt **26** which conveys the folded web to a position in which the web is stacked and boxed.

From the foregoing, it will be apparent that various changes can be made in the detailed construction and arrangement of the elements of the beater assembly constituting the present invention without departing from the spirit and scope thereof.

Accordingly, it is to be understood that the foregoing description is considered as being illustrative of, rather than limitative upon, the invention as defined by the appended claims.

I claim:

1. In a collator having a pair of rotatably mounted, laterally spaced spiral folders adapted to receive and make spaced folds in a continuous web of paper, and a wigwag chute oscillating about a horizontal axis to feed the web of paper to the folders, the combination with said folders of a plurality of rotatably mounted brushes engaging the web beyond the discharge end of the chute to assist in forming said folds, each brush having a plurality of soft flexible filaments bendable in any direction, and means to rotate the brushes and spiral folders in timed relation.

2. The combination as claimed in claim 1 in which each brush is in continuous contact with the paper web during about 180° of rotation of the brush.

3. The combination as in claim 1 in which each brush has a plurality of flexible filaments terminating in a substantially circular arc of approximately 180° extent.

4. In a collator having a pair of rotatably mounted, laterally spaced spiral folders and a third rotatably mounted spiral folder spaced between and above said pair of folders, all three folders being adapted to receive and make spaced folds in a web of paper, and a wigwag chute oscillating about a horizontal axis to feed the web of paper to the folders, the combination with said folders of a

first plurality of rotatably mounted brushes engaging the paper web beyond the discharge end of the chute in the vicinity of one fold in the web;

a second plurality of rotatably mounted brushes engaging the web at a position adjacent another fold and vertically spaced from the first-mentioned plurality of brushes, all said brushes being located to assist in forming said folds; and

means to rotate the brushes and folders in timed relation.

5. The combination as in claim 4 in which individual brushes of said plurality of brushes are located in the vicinity of the periphery of each one of the three spirals.

6. The combination as in claim 4 in which each brush has a plurality of flexible filaments terminating in a substantially circular arc of approximately 180° extent.