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IN THE UNITED STATES DISTRICT COURT

FOR THE SOUTHERN DISTRICT OF CALIFORNIA

SEOUL LASER DIEBOARD SYSTEM CO. LTD., a South Korea corporation,

Plaintiff,

v.

COMPUTERIZED CUTTERS, INC., a Texas corporation

Defendant.

Case No. '07 CV 1005 JAH CAB

COMPLAINT FOR PATENT INFRINGEMENT

DEMAND FOR JURY TRIAL

Plaintiff, SEOUL LASER DIEBOARD SYSTEM CO. LTD. ("SDS"), a South Korea corporation, brings this action and hereby alleges as follows:

NATURE OF ACTION

This is an action for Patent Infringement against Defendant COMPUTERIZED CUTTERS, INC. ("CCI"), a Texas corporation.

PARTIES

1. SDS is a corporation organized under, and existing by virtue of, the laws of the nation of the Republic of Korea, also known as South Korea, with a principal place of business located at 13110 Sunstone Pointe, San Diego, California 92130.

2. On information and belief, SDS alleges Defendant CCI is a corporation organized under, and existing by the virtue of, the laws of the State of Texas, with its principal place of

business located at 821 Jupiter Road, Suite 405, Plano, Texas 75074.

JURISDICTION AND VENUE

3. This Court has personal jurisdiction over CCI, who has purposefully availed itself of the laws of the State of California.

4. This Court has subject matter jurisdiction under 35 U.S.C. §§101 et seq. and 28 U.S.C. §1338(a), by virtue of the fact that this is an action for Patent Infringement involving claims under the laws of the United States concerning patents.

5. Venue is proper in this district under 28 U.S.C. §§1391 and 1400(b) by virtue of the fact: (i) SDS is a corporation that maintains its principal place of business in San Diego, California, within the Southern District of California; (ii) CCI does and has done business within the Southern District of California; (iii) CCI has committed acts of infringement within the Southern District of California by purposefully directing the manufacture of infringing products, which are in turn used, advertised, offered for sale or sold within the Southern District of California; (iv) CCI has committed acts of infringement within the Southern District of California by purposefully directing the use, advertisement, offer for sale or sale of infringing products within the Southern District of California; (v) CCI is causing damage to SDS within the Southern District of California; and (vi) a substantial part of the events or omissions giving rise to the claims herein occurred within the Southern District of California.

FACTUAL ALLEGATIONS

A. PATENTS-IN-SUIT.

6. SDS is the current assignee of United States Letters Patent No. 5,870,919 (the "'919 patent") entitled "Folding System for a Cutting Blade," which issued to inventor Byung-Jun Song on February 16, 1999. SDS's rights in and to the '919 patent include the right to sue for past infringements. Attached hereto as **Exhibit A** and incorporated herein by reference is a true and correct copy of the '919 patent.

7. SDS is the current assignee of United States Letters Patent No. 6,128,940 (the "'940 patent") entitled "Folding System for a Cutting Blade," which issued to inventor Byung-Jun Song on October 10, 2000. SDS's rights in and to the '940 patent include the right to sue for

past infringements. Attached hereto as **Exhibit B** and incorporated herein by reference is a true and correct copy of the '940 patent.

8. SDS is the current assignee of United States Letters Patent No. 6,405,574 (the "'574 patent") entitled "Folding System for a Cutting Blade," which issued to inventor Byung-Jun Song on June 18, 2002. SDS's rights in and to the '574 patent include the right to sue for past infringements. Attached hereto as **Exhibit C** and incorporated herein by reference is a true and correct copy of the '574 patent.

9. In accordance with the requirements of 35 U.S.C. §287(a), SDS duly marks all of its products that are embodied in the '919 patent, the '940 patent, and the '574 patent, as well as any and all other relevant issued patents and pending patent applications by appropriately specifying the applicable patent numbers or "patent pending" status on such products, as necessary.

B. BACKGROUND.

10. SDS is, and at all times relevant to the matters alleged in this Complaint was, in the business of, among other things, operating as a machine tooling company, pioneering technology for bending and cutting metallic and other related material. SDS produces a successful line of products as a result of its innovative research and development efforts.

11. SDS enjoys a growing intellectual property portfolio in the U.S. and other countries, which portfolio includes the '919 patent, the '940 patent, and the '574 patent, as well as several pending U.S. patent applications in the area of bending and cutting metal. SDS's array of patents and innovative products is due to the company's significant investment of resources necessary to bring such products to the public and expand its intellectual property.

12. On information and belief, SDS alleges CCI is Texas company, which touts itself as "one of the premier CNC machine builders in Texas." SDS alleges CCI manufactures CNC channel letter fabrication machines, CNC routers, metal fastening machines and other products related to bending and cutting metallic and other related material.

13. CCI's products include equipment for use in the manufacture of signs, which equipment automatically bends channel letters. One product in particular is CCI's "ACCU-

BEND" machine. According to CCI, the "ACCU-BEND" will automatically and "completely layout, notch, flange (bend the notched 1/2 inch bottom), and completely bend the full final shape of the channel letter return...What normally would take 30 to 45 minutes to shape and form by hand, the ACCU-BEND completes perfectly in about 4 to 5 minutes."

14. On information and belief, SDS alleges CCI is the current assignee of United States Letters Patent No. 5,881,591 (the "CCI patent") entitled "Automatic Channel Letter Bending Machine," which issued to inventor Carl Ondracek on March 16, 1999. Attached hereto as **Exhibit D** and incorporated herein by reference is a true and correct copy of the CCI patent.

15. On information and belief, SDS alleges the CCI patent embodies one or more if the CCI products, including the "ACCU-BEND" machine.

16. Among other forms of media and channels of trade, CCI advertises and offers for sale its products, including the "ACCU-BEND" machine, on an Internet website located at the URL corresponding to the domain name www.computerizedcutters.com.

C. INFRINGEMENT.

17. In late 2006, SDS discovered CCI appeared to be manufacturing, advertising, offering for sale, and selling machine tools for bending metallic material, including the "ACCU-BEND" machine and other products depicted on CCI's Internet website. SDS concluded CCI's products infringed one or more claims in each of SDS's '919 patent, '940 patent, and '574 patent.

18. On January 19, 2007, counsel for SDS contacted CCI, informing the company that its products infringed one or more claims of the three patents-in-suit. SDS indicated its good-faith desire to amicably and promptly resolve these infringement issues through negotiations and settlement, rather than litigation.

19. Through its own counsel, CCI responded in a series of letters between February and March 2007, ostensibly expressing interest in settlement. Despite CCI's purported wish to avoid a lawsuit, SDS's efforts to resolve its differences with CCI without litigation failed.

20. SDS further learned that even after CCI received notice in January 2007 of its infringement of SDS's patents and continuing through the duration of the months of negotiations with SDS, CCI sustained its practice of manufacturing, advertising, offering for sale, and selling

machine tools for bending metallic material, including the "ACCU-BEND" machine, all of which infringed SDS's '919, '940, and '574 patents.

21. The above-entitled action followed.

FIRST CLAIM FOR RELIEF

(Infringement of U.S. Patent No. 5,870,919)

22. SDS hereby realleges and incorporates by this reference paragraphs 1 through 21 above as though fully set forth herein.

23. CCI has infringed and continues to infringe one or more of the claims of the '919 patent by making, using, selling and offering to sell, and by inducing and contributing to others' infringement through their sales, offers for sale, and use of certain machine tools for bending metallic material, including without limitation the "ACCU-BEND" machine and other products depicted on CCI's Internet website, all without authorization or license from SDS.

24. On information and belief, SDS alleges CCI has been, and is currently, infringing the '919 patent in violation of 35 U.S.C. §271. CCI's acts of infringement include direct infringement and/or infringement under the doctrine of equivalents.

25. CCI has continued its infringement despite having notice of the '919 patent. CCI has committed and is committing willful and deliberate patent infringement. On information and belief SDS alleges CCI's acts of willful and deliberate infringement will continue after service of this Complaint, rendering this case appropriate for treble damages under 35 U.S.C. §284 and making this an exceptional case under 35 U.S.C. §285.

26. As a result of CCI's infringement, SDS has, and will suffer, monetary damages and irreparable injury. SDS's monetary damages include, without limitation, lost profits, or at a minimum, the right to recover a reasonable royalty. Furthermore, unless CCI is enjoined by this Court from continuing its infringement of the '919 patent, SDS has, and will suffer, additional irreparable damages and impairment of the value of its patent rights. Thus, an injunction against further infringement is appropriate.

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SECOND CLAIM FOR RELIEF

(Infringement of U.S. Patent No. 6,128,940)

27. SDS hereby realleges and incorporates by this reference paragraphs 1 through 26 above as though fully set forth herein.

28. CCI has infringed and continues to infringe one or more of the claims of the '940 patent by making, using, selling and offering to sell, and by inducing and contributing to others' infringement through their sales, offers for sale, and use of certain machine tools for bending metallic material, including without limitation the "ACCU-BEND" machine and other products depicted on CCI's Internet website, all without authorization or license from SDS.

29. On information and belief, SDS alleges CCI has been, and is currently, infringing the '940 patent in violation of 35 U.S.C. §271. CCI's acts of infringement include direct infringement and/or infringement under the doctrine of equivalents.

30. CCI has continued its infringement despite having notice of the '940 patent. CCI has committed and is committing willful and deliberate patent infringement. On information and belief SDS alleges CCI's acts of willful and deliberate infringement will continue after service of this Complaint, rendering this case appropriate for treble damages under 35 U.S.C. §284 and making this an exceptional case under 35 U.S.C. §285.

31. As a result of CCI's infringement, SDS has, and will suffer, monetary damages and irreparable injury. SDS's monetary damages include, without limitation, lost profits, or at a minimum, the right to recover a reasonable royalty. Furthermore, unless CCI is enjoined by this Court from continuing its infringement of the '940 patent, SDS has, and will suffer, additional irreparable damages and impairment of the value of its patent rights. Thus, an injunction against further infringement is appropriate.

THIRD CLAIM FOR RELIEF

(Infringement of U.S. Patent No. 6,405,574)

32. SDS hereby realleges and incorporates by this reference paragraphs 1 through 33 above as though fully set forth herein.

/ / /

33. CCI has infringed and continues to infringe one or more of the claims of the '574 patent by making, using, selling and offering to sell, and by inducing and contributing to others' infringement through their sales, offers for sale, and use of certain machine tools for bending metallic material, including without limitation the "ACCU-BEND" machine and other products depicted on CCI's Internet website, all without authorization or license from SDS.

34. On information and belief, SDS alleges CCI has been, and is currently, infringing the '574 patent in violation of 35 U.S.C. §271. CCI's acts of infringement include direct infringement and/or infringement under the doctrine of equivalents.

35. CCI has continued its infringement despite having notice of the '574 patent. CCI has committed and is committing willful and deliberate patent infringement. On information and belief SDS alleges CCI's acts of willful and deliberate infringement will continue after service of this Complaint, rendering this case appropriate for treble damages under 35 U.S.C. §284 and making this an exceptional case under 35 U.S.C. §285.

36. As a result of CCI's infringement, SDS has, and will suffer, monetary damages and irreparable injury. SDS's monetary damages include, without limitation, lost profits, or at a minimum, the right to recover a reasonable royalty. Furthermore, unless CCI is enjoined by this Court from continuing its infringement of the '574 patent, SDS has, and will suffer, additional irreparable damages and impairment of the value of its patent rights. Thus, an injunction against further infringement is appropriate.

WHEREFORE, Plaintiff SEOUL LASER DIEBOARD SYSTEM CO. LTD. requests judgment as follows:

1. That judgment be entered against Defendant COMPUTERIZED CUTTERS, INC. concluding that Defendant COMPUTERIZED CUTTERS, INC. is willfully infringing Plaintiff SEOUL LASER DIEBOARD SYSTEM CO. LTD.'s United States Letters Patent Nos. 5,870,919, 6,128,940, and 6,405,574;

2. That Defendant COMPUTERIZED CUTTERS, INC., its agents, servants, employees, successors and assignors, and all those acting under the authority of, or in privity or concert with it, and each of them, be permanently enjoined from

directly or indirectly infringing United States Letters Patent Nos. 5,870,919, 6,128,940, and 6,405,574;

3. That judgment be entered for damages, together with prejudgment interest, to compensate Plaintiff SEOUL LASER DIEBOARD SYSTEM CO. LTD. for Defendant COMPUTERIZED CUTTERS, INC.'s infringement of United States Letters Patent Nos. 5,870,919, 6,128,940, and 6,405,574;

4. That judgment be entered for treble damages pursuant to 35 U.S.C. §284;

5. That judgment be entered that this case is an exceptional case within the meaning of 35 U.S.C. §285, and for an award of reasonable attorneys' fees to Plaintiff SEOUL LASER DIEBOARD SYSTEM CO. LTD.;

6. That judgment be entered for costs to be awarded to Plaintiff SEOUL LASER DIEBOARD SYSTEM CO. LTD.; and

7. For such other and further relief as the Court may deem proper under the circumstances.

DATED: May 31, 2007

PROCOPIO, CORY, HARGREAVES & SAVITCH LLP

By: _____
Anthony J. Dain
Frederic G. Ludwig, III
Attorneys for Plaintiff,
SEOUL LASER DIEBOARD SYSTEM CO. LTD., a South Korea corporation

DEMAND FOR JURY TRIAL

Plaintiff SEOUL LASER DIEBOARD SYSTEM CO. LTD. respectfully requests a jury trial.

DATED: May 31, 2007

PROCOPIO, CORY, HARGREAVES & SAVITCH LLP

By: _____
Anthony J. Dain
Frederic G. Ludwig, III
Attorneys for Plaintiff,
SEOUL LASER DIEBOARD SYSTEM CO. LTD., a South Korea corporation

EXHIBIT A

US005870919A

United States Patent [19]

Song

[11] Patent Number: 5,870,919

[45] Date of Patent: Feb. 16, 1999

[54] **FOLDING SYSTEM FOR A CUTTING BLADE**

[75] Inventor: **Byung-Jun Song**, Kwangmyung, Rep. of Korea

[73] Assignee: **SDS USA, Inc.**, Northvale, N.J.

[21] Appl. No.: **49,391**

[22] Filed: **Mar. 27, 1998**

Related U.S. Application Data

[63] Continuation of Ser. No. 668,379, Jun. 21, 1996, Pat. No. 5,787,750.

[30] **Foreign Application Priority Data**

Jun. 22, 1995 [KR] Rep. of Korea 95-16975

[51] **Int. Cl.**[6] **B21D 5/16**

[52] **U.S. Cl.** **72/294**; 72/307; 72/319

[58] **Field of Search** 72/307, 294, 306, 72/217, 388, 387

[56] **References Cited**

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468,301	2/1892	Cooper	72/388
3,286,500	11/1966	Weiss	72/217
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5,463,890	11/1995	Tachibana .	

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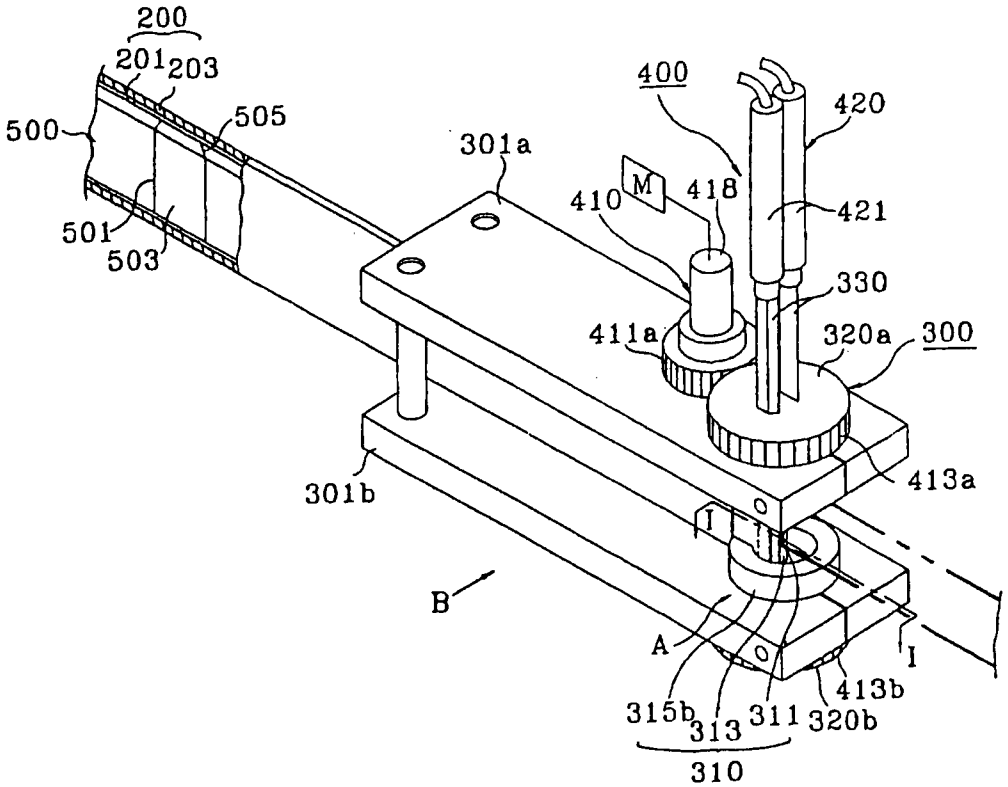
2116086 9/1983 United Kingdom .

Primary Examiner—Daniel C. Crane
Attorney, Agent, or Firm—F. Chau & Associates, LLP

[57] **ABSTRACT**

The present invention provides an unified folding system for processing in one work line all working processes needed in cutting and folding a cutting blade in a shape suitable to a sheet matter molding. A cutting blade supplied from a transferring unit of the cutting blade is cut in a length suitable to a sheet matter molding configuration in a cutting molding unit adjacent thereto, simultaneously the cutting tip used in cutting is transferred together with the cutting blade to a folding device side through a guide member set which is to be contacted with the cutting molding unit, the cutting blade transferred to the folding device is folded in a predetermined shape by a folding member which performs a going-straight movement and a rotating movement, and thereby, at this time, the cutting tip is detached outside by a tare. Accordingly, a working efficiency and a productivity in the cutting and folding of the cutting blade are improved and increased.

12 Claims, 5 Drawing Sheets



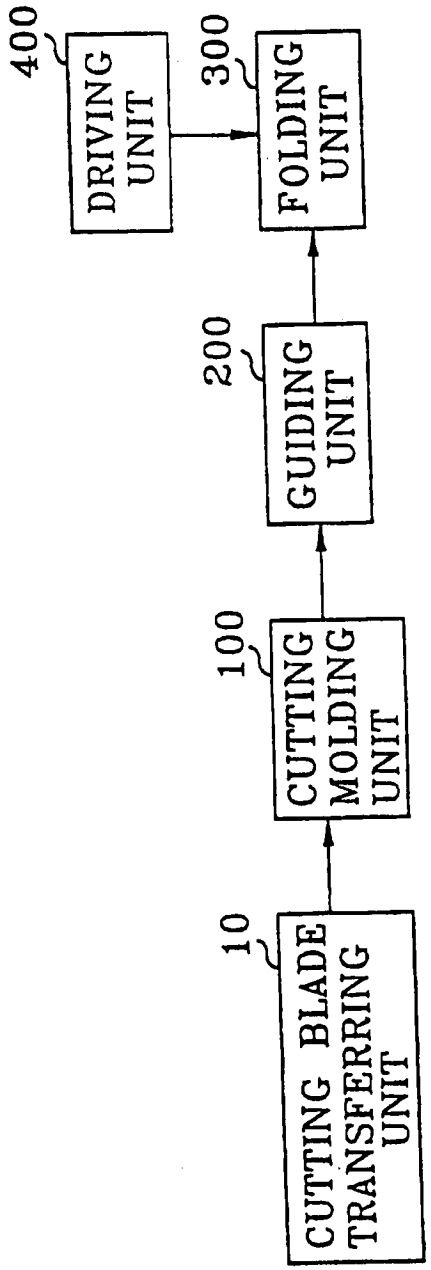

400
DRIVING UNIT
300
FOLDING UNIT
200
GUIDING UNIT
100
CUTTING MOLDING UNIT
10
CUTTING BLADE TRANSFERRING UNIT

FIG. 1

FIG. 2

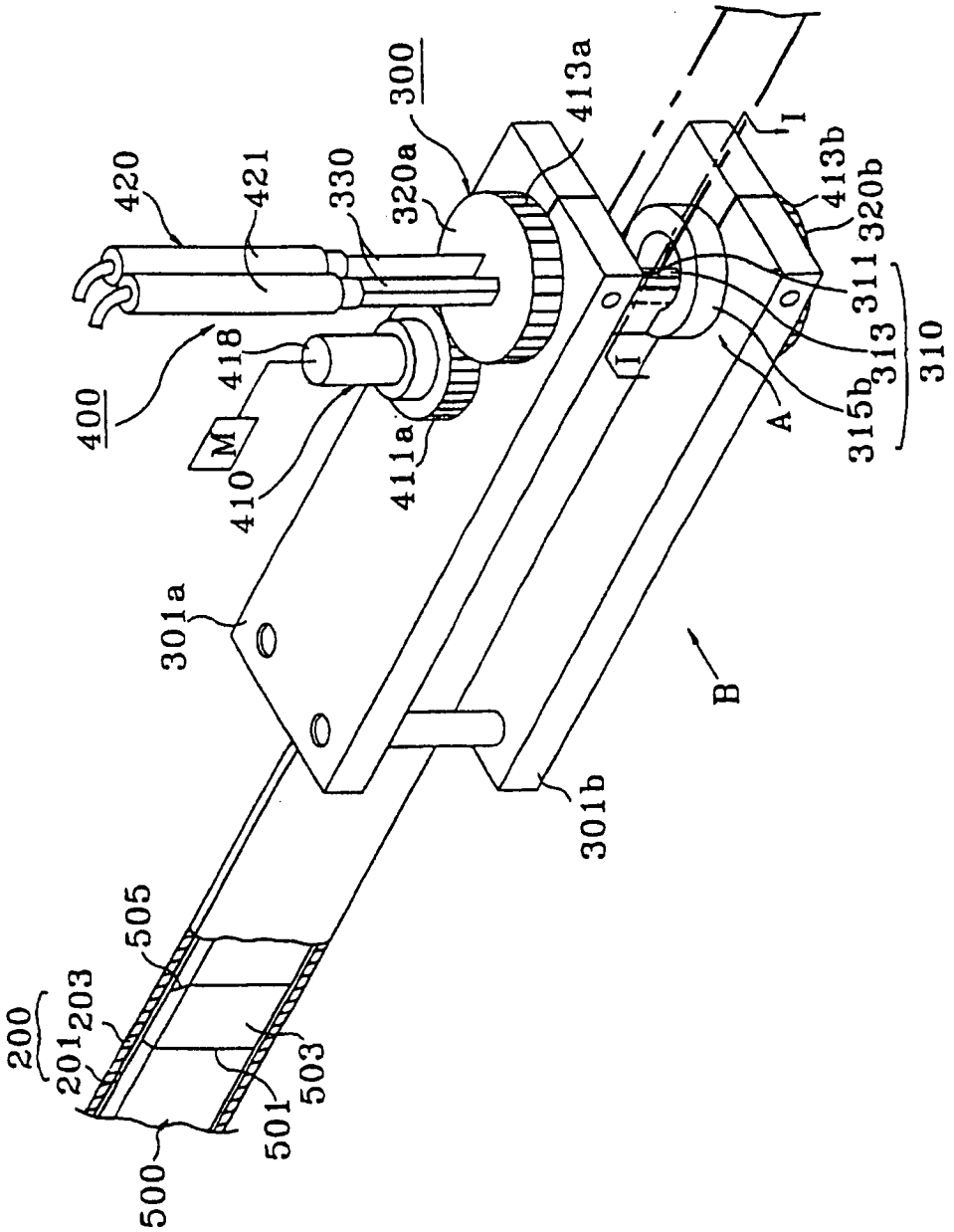

300
413a
420
421
330
320a
413b
320b
311
313
310
315b
A
400
418
M
410
411a
301a
B
301b
505
200
203
201
503
501
500

FIG. 3

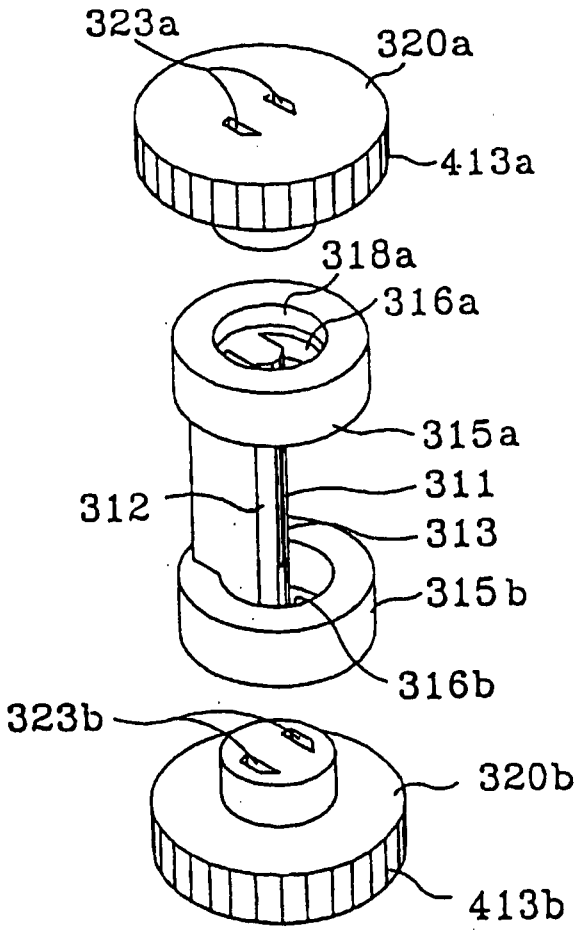
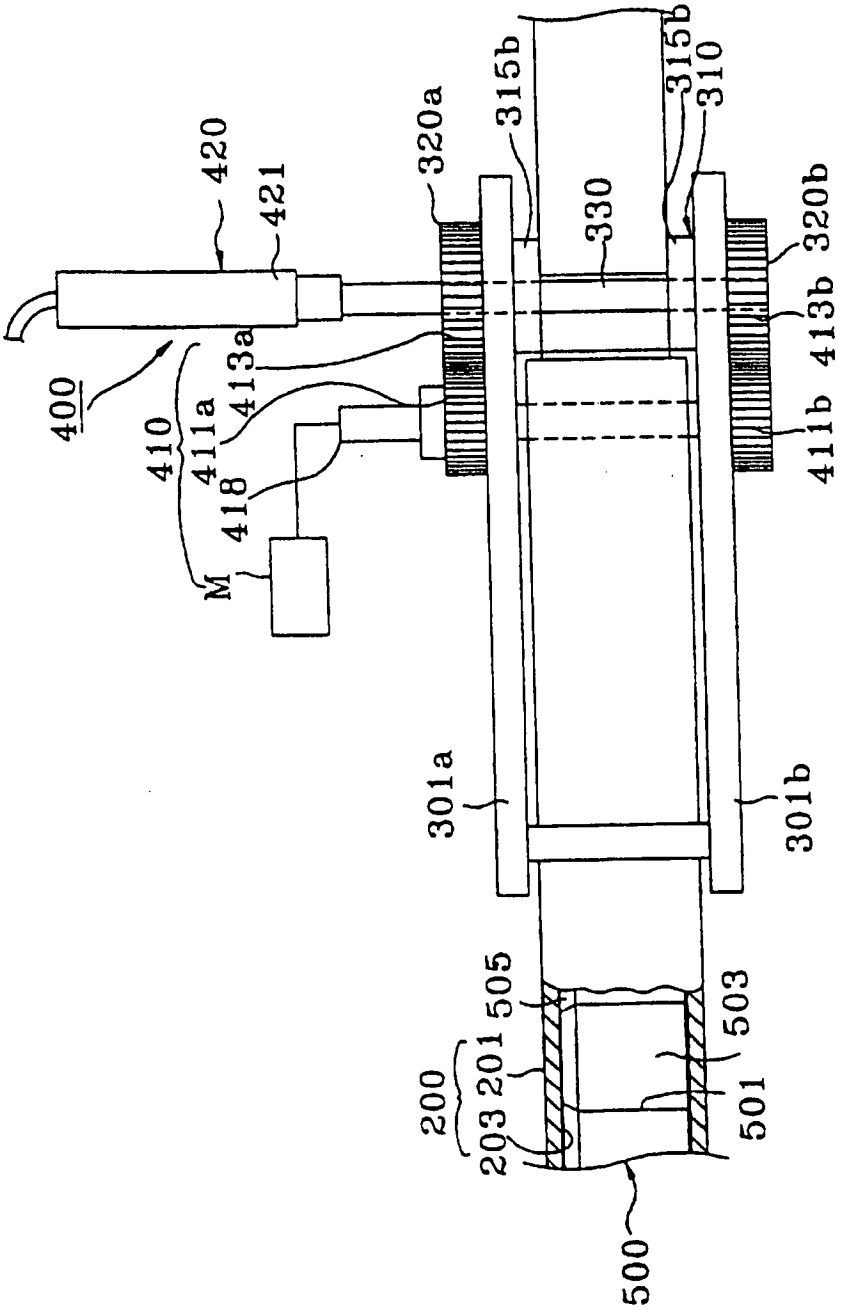

323a
320a
413a
318a
316a
315a
312
311
313
315b
316b
323b
320b
413b

FIG. 4


420
421
320a
315b
315b
310
330
320b
413b
411b
400
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411a
413a
418
M
301a
301b
505
503
200
201
203
501
500

FIG. 6

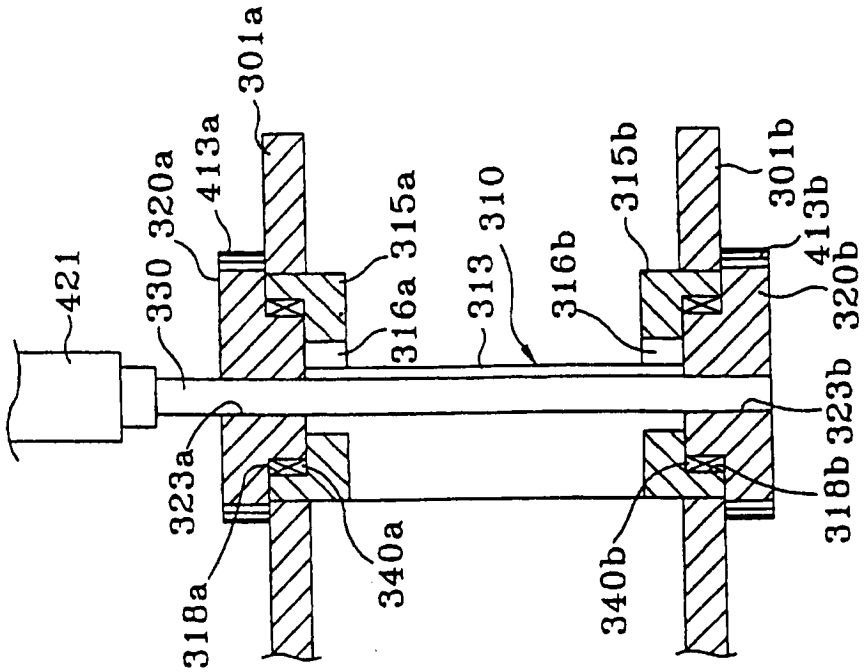
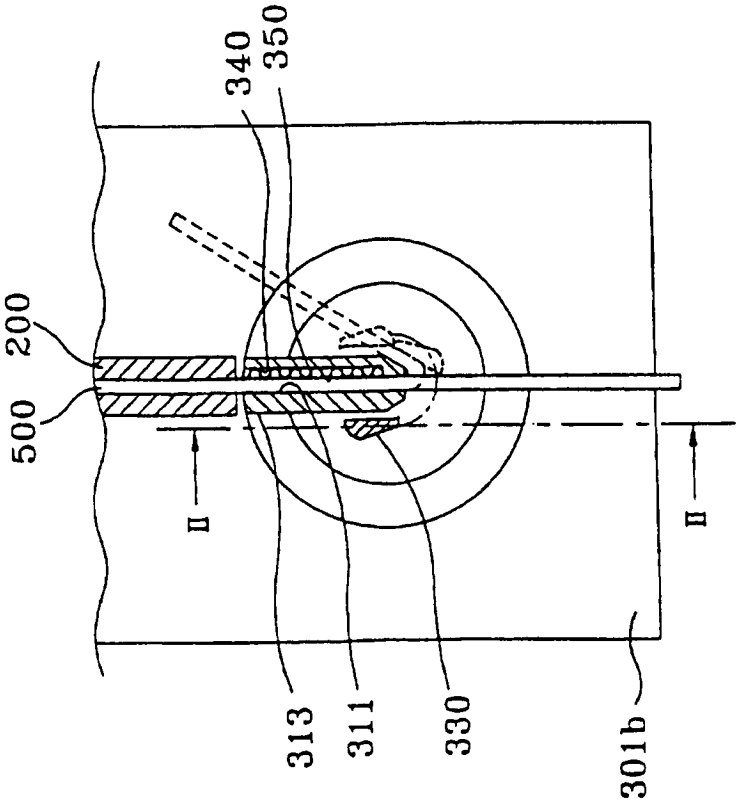

301a
413a
320a
330
421
315a
316a
313
310
316b
315b
301b
413b
320b
323b
318b
340b
340a
323a
318a

FIG. 5


340
350
200
500
II
II
313
311
330
301b

FOLDING SYSTEM FOR A CUTTING BLADE

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a continuation application of U.S. application Ser. No. 08/668,379, filed Jun. 21, 1996, now U.S. Pat. No. 5,787,750, which claims the benefit of Korean Application No. 95-16975 filed Jun. 22, 1995.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a folding system of a cutting blade used in forming a folding line on a sheet matter so that the sheet matter, such as paper or plastic, etc., may be made into a predetermined shape, and more particularly to a folding system of the cutting blade being used so that cutting and folding functions associated with the cutting blade can be performed in one process.

2. Description of the Related Art

Generally, the cutting blade is attached to a pattern for use in pressing a folding or a cutting line on plate matters such as paper, canvas, leather, plastic, etc. The plate matters with such pressed lines can be used in a folded shape like a box. Accordingly, in order to assemble and process the plate matter into a predetermined box shape with the cutting blade, it is necessary that the cutting blade is folded in a shape suitable to forming the processing line in the box shape.

Conventional art for the folding device of a cutting blade is disclosed, for example, in Japan Patent No. 1988-309328 and No. 1990-20619. In the conventional art, however, a folded member used as a cutting blade is constructed by a rotary body that converts only a straight line movement into an orthogonal direction against the folded member on an end part of the folded member, or performs only a revolving movement centered about one point. Therefore, a disadvantage along with the use of the prior art cutting blade assemblies is that the folded angle of a processed member is limited to a single range of motion. Also, since two discrete functions are required, namely after a cutting work in separated places, then moving it into a folding device individually, and then the folding work is performed, or after the folding work, then moving it into a cutting device one by one, and then the cutting work is performed, additional time and labor are required, and the overall efficiency of the process decreases.

SUMMARY OF THE INVENTION

Therefore, to solve the above problem, it is an object of the present invention to provide a system for folding a cutting blade to improve a work efficiency and a productivity, by continuously performing all work elements needed in the cutting and folding works of the cutting blade provided in a sheet matter molding, in one work line, the system comprising:

a transferring unit for transferring the cutting blade;

cutting means, situated between the transferring unit and a guide nozzle, for cutting the cutting blade, which is supplied from the transferring unit, in a length substantially corresponding to the sheet material molding configuration, wherein a cutting tip is formed on the cutting blade;

a guide member of a hollow shape, interposed the cutting means and a folding means and configured to connect the cutting means and the folding means, said guide member having a passage for guiding the cutting blade through the cutting means to the folding means;

folding means, supported such that it may be revolved and moved in a straight line direction to apply a force against the cutting blade passing through the guide member, the folding means positioned adjacent the guide member, and for folding the cutting blade to a predetermined angle, the folding means including at least two folding members;

first driving means configured to engage the folding means, for revolving and driving the folding means against the cutting blade; and

second driving means configured to engage the folding means and move at least one of the folding members of the folding means to a position adjacent the cutting blade, prior to driving the first driving means.

BRIEF DESCRIPTION OF THE DRAWINGS

The preferred embodiments are described with reference to the drawings wherein:

FIG. 1 is a block diagram for a folding system of a cutting blade according to the present invention;

FIG. 2 is a detailed perspective view showing a guiding unit and a folding unit of the cutting blade shown in FIG. 1;

FIG. 3 is a separated perspective view showing a unit "A" separated from FIG. 2;

FIG. 4 is a side view shown from a direction "B" of an arrow marking of FIG. 2;

FIG. 5 is a cross-sectional view taken along a line I—I of FIG. 2; and

FIG. 6 is a longitudinal sectional view taken along a line II—II of FIG. 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention will be described below in more detail with reference to the accompanying drawings.

FIG. 1 shows a block diagram of a folding system according to the present invention. In FIG. 1, the folding system of the cutting blade comprises a transferring unit **10** for transferring the cutting blade of a roll shape, a cutting molding unit **100** for cutting and processing the transferred cutting blade in a length suitable to a sheet material molding (not shown), a guiding unit **200**, positioned between the cutting molding unit **100** and a folding unit **300** for the cutting blade so as to be connected mutually, for stably guiding the cutting blade which is passed through cutting molding unit **100** to folding unit **300**, the folding unit **300** positioned adjacent to the guiding unit **200**, for folding the cutting blade transferred through the guiding unit **200** with a predetermined angle, and a driving unit **400** for driving the folding unit **300**, and thus a process work of the cutting blade provided to a sheet material molding is performed in succession. The detailed construction and operation of the above embodiment are explained below. The above cutting molding unit **100** is applied from Japan Patent No. 80607 entitled "Multi-purpose Cutter of a Cutting Blade for Die Cutter" filed by the present applicant on Dec. 11, 1991 and incorporated by reference herein. A detailed explanation for the cutting molding unit is therefore omitted below.

FIG. 2 is a detailed perspective view showing only a portion of the guiding unit associated with the cutting blade and the folding unit, shown schematically in FIG. 1. FIG. 3 is an exploded perspective view showing only a unit "A"

separated from FIG. **2**. FIG. **4** is a side view shown from a direction "B" of an arrow marking of FIG. **2**. The guiding unit **200** is constructed by a guide nozzle **201** of a hollow structure configured and dimensioned to stably transfer a cutting blade **500** passed through the cutting molding unit to the folding unit **300**.

Referring now to FIG. **2**, guide nozzle **201** has a guiding passage **203** of a size such that cutting blade **500** can pass through freely, and two openings situated near the cutting molding unit **100** and the folding unit **300**, respectively. The guide nozzle **201** is configured so that the cutting blade **500** may be moved together with a cutting tip **503** of a cutting portion **501**.

Referring now to FIG. **3**, folding unit **300** includes a fixing body **310** connected to folding and rotary bodies **320***a* and **320***b* for the folding, which are set on substantially rectangular shaped supporting frames **301***a* and **301***b*. The supporting frames **301***a* and **301***b* are situated spaced apart with an interval therebetween wherein the guide nozzle **201** can be situated. The fixing body **310** for the folding function is constructed by a folding body **313** having a guiding entrance **311** of a size through which the cutting blade **500** can be passed, and by annular support portions **315***a* and **315***b* formed on both ends of the folding body **313**. The guiding entrance **311** of the folding body **313** is connected with the guiding passage **203** of the guide nozzle **201** such that the cutting blade **500** may enter inside the guiding entrance **311** freely. An end side portion of the guiding entrance **311** is preferably a slant side **312** to enhance the folding of the cutting blade **500**.

The annular support portions **315***a* and **315***b* are provided to fixedly attach the folding body **313** to supporting frames **301***a* and **301***b*. As described later in FIG. **6** in detail, the annular support portions **315***a* and **315***b* include guiding slots **316***a* and **316***b* of a round shape, and round housing units **318***a* and **318***b* for housing rotary bodies **320***a* and **320***b* which may be rotated to facilitate the folding function. The rotary bodies **320***a* and **320***b* are configured to be rotatably housed within the round housing units **318***a* and **318***b* arranged on both sides of the fixing body **310**. For a smooth revolving operation of the rotary bodies **320***a* and **320***b*, it is preferable to set bearings **340***a* and **340***b* on the inside circumference portion of the housing units **318***a* and **318***b*, as shown in FIG. **6**. The rotary bodies **320***a* and **320***b* have guide holes **323***a* and **323***b* pierced therein and are configured to contact with the guide slots **316***a* and **316***b*.

The guide holes **323***a* and **323***b* are provided to insertably receive a folding member **330** to facilitate movement thereof, and are configured and dimensioned corresponding to a cross-sectional shape of the folding member **330**. Although an example of the guide holes **323***a* and **323***b* is shown in the figures wherein each guide hole has a folding member set therein, it is preferable that only one folding member is set at a given time during operation. Referring now to FIG. **6**, the folding member **330** is dimensioned to connect the rotary bodies **320***a* and **320***b* to each other while being positioned on the outer sides of supporting frames **301***a* and **301***b*. Accordingly, the folding member **330** is inserted through guide hole **323***a* of rotary body **320***a*, passes through a lateral side of the fixing body **310**, and is inserted into guide hole **323***b* inside of rotary body **320***b* and is capable of being moved upwards and downwards. The folding member **330** inserted for mutual connection of rotary bodies **320***a* and **320***b* is provided for the folding work of the cutting blade **500**, revolving together with the rotary bodies **320***a* and **320***b*. When the folding work is not being performed, the folding member **330** is completely apart from folding body **313** and is moved towards an upper side. These operations are performed by the driving unit **400** mentioned later.

Although two folding members **330** are shown in the drawings, for exemplary purposes, only one can be set.

Referring now to FIGS. **2** and **4**, driving unit **400** includes a first driving unit **410** provided to revolve the rotary bodies **320***a* and **320***b* and a second driving unit **420** provided to move folding member **330** upwards and downwards from the folding body **313**. The first driving unit **410** includes first toothed portions **411***a* and **411***b* which are fixed at both ends of a rotating shaft **418** which is rotatably within the supporting frames **301***a* and **301***b*. Second toothed portions **413***a* and **413***b* which are set on the outer circumference surface of the revolving bodies **320***a* and **320***b* are configured to mesh with the first toothed portions **411***a* and **411***b*. A servo motor M is operatively connected to the rotating shaft **418**. The second driving unit **420** is a cylinder **421** connected to one end of the folding member **330** to be moved upwards and downwards for the purpose of performing an expansion operation. As an operating source of the cylinder **421** any one of either oil-hydraulic pressure or air pressure can be used.

FIG. **5** is a cross-sectional view taken along a line I—I of FIG. **2**. FIG. **6** is a longitudinal sectional view taken along a line II—II of FIG. **5**. Folding member **330** has a substantially triangular shape, which enables the cutting blade **500** to be folded easily even without applying an immoderate force. To fold the cutting blade **500** easily, an application of any other shape excepting the triangulate shape doesn't matter. On any one side of the guiding entrance **311** of the fixing body **313**, which is supported to enable passing of the cutting blade **500**, a fixation hole **340** is set. In the inside of the fixation hole **340**, a steel wire spring **350** is set with one portion jutting out to a center position of the guiding entrance **311** through which the cutting blade **500** passes.

The steel wire spring **350** elastically supports the cutting blade **500** as it passes through the guiding entrance **311**, and moves the cutting blade **500** within a predetermined channel, thereby heightening a precision of the folding work. Also, by setting a magnetic substance instead of the steel wire spring **350**, the same effect as the steel wire spring can be achieved.

Though FIG. **5** shows, as an example, a structure in which the steel wire spring **350** is set on any one side of the guiding entrance **311**, it is contemplated that it may be positioned on both sides. As shown in FIG. **6**, the folding member **330** is extended when the cylinder **421** is driven, and is inserted into the guide holes **323***a* and **323***b* inside rotary bodies **320***a* and **320***b*, which are formed in the housing units **318***a* and **318***b* of the round shape of the fixing body **310** for rotational movement therein. When the rotary bodies **320***a* and **320***b* are rotated, the folding member **330** is integrally rotated along the guide slots **316***a* and **316***b* together with the folding member **330**.

An operation embodiment of the folding system and an effect according to the present invention with the construction as above-mentioned are re-explained in detail referring to FIGS. **1** to **6**.

The cutting blade **500** wound in a roll shape is transferred to the folding unit **300**, which performs the folding work, by the transferring unit **10**, having a transfer roller, through the cutting molding unit **100** and the guide nozzle **201**. At this time, the cutting molding unit **100** performs a cutting work for cutting the cutting blade **500**, passing through the cutting molding unit **100**, in the length necessary for the sheet

matter molding. Herewith, the cutting tip **503** is kept and maintained on the cutting blade **500** without detachment from the cutting portion **501** of the cutting blade **500**. This is to prevent damage to blade unit **505** which may be caused by a collision during a transfer of the cutting blade **500** through the guide nozzle **201**. The cutting molding unit **100** is applied from Japan Patent No. 80607 issued to the present applicant, and, therefore, the detailed operating description thereof is omitted.

Even if the cutting tip **503**, formed on the cutting blade **500**, is detached from the cutting molding unit **100**, the cutting tip **503** passes through the guide nozzle **201** continuously and thereby there is no cause for its detachment. As shown in FIGS. **2** and **4**, the cutting blade **500** passed through the guide nozzle **201** pierces through the guiding entrance **311** of the fixing body **313**, and then goes out to the outer side of the supporting frames **301***a* and **301***b*.

The cutting blade **500** passing through the guiding entrance **311** contacts with the steel wire spring **350** as shown in FIG. **5**, but the steel wire spring **350** has an elastic force, so it doesn't become an obstacle to pass the cutting blade **500** at all. The steel wire spring **350** is provided to support the cutting blade **500** with the elastic force to dampen or prevent a fluctuation in the cutting blade **500** which may be caused by a sudden stop of the transfer roller **10**. The cutting blade **500** passed through the guiding entrance **311** is then folded in the shape suitable to a molding of the sheet material. In folding the cutting blade **500**, the transfer roller **10** stops and the transferring work of the cutting blade **500** is temporarily in a stopped state. At the same time as the stop of the transfer roller **10**, the second driving unit **420** between the driving units **400** operates first.

If only one cylinder **421** out of the second driving unit **420** falls in the operation, the second driving unit **420** remains situated in a position as shown in FIG. **2**. The folding member **330** of one body with the cylinder **421** is inserted into the guide holes **323***a* and **323***b* inside of the rotary bodies **320***a* and **320***b* as shown in FIGS. **4** and **6**, and is also situated on any one side of the fixing body **313** adjacent to the cutting blade **500**. The guide holes **323***a* and **323***b* are formed on the same position, therefore the folding member **330** is inserted naturally when the cylinder **421** performs the falling operation. When the folding member **330** moved and is completed in moving to the position adjacent the cutting blade **500**, the first driving unit **410** operates. The first driving unit **410** is rotated by driving the servo motor M. By driving the servo motor M, the first toothed portions **411***a* and **411***b* are simultaneously rotated by means of the rotating shaft **418**. By a meshing operation between the first toothed portions **411***a* and **411***b* and the second toothed portions **413***a* and **413***b*, the revolving bodies **320***a* and **320***b* are rotated about a supporting point of the fixing body **310**. When the revolving bodies **320***a* and **320***b* are rotated, the folding member **330** is also rotated. That is, the folding member **330** is rotated and moved around a periphery of the fixing body **313** along the guide slot **316***b* from any one side of the fixing body **313** for the folding operation as shown in FIG. **5**. At this time, the moved folding member **330** contacts with the cutting blade **500** which extends through the guiding entrance **311**, thereby the cutting blade **500** is naturally folded by a rotating force of the folding member **330** along a slant face **312** of the fixing body **313**. Meanwhile, the cutting tip **503** put on the cutting blade **500** is automatically separated by a tare and is collected when the cutting blade **500** extends through the outside of the guiding entrance **311**.

Since the servo motor M stops the operation when the cutting blade **500** completes the folding, an immoderate rotation force of the rotary bodies **320***a* and **320***b* connected with the folding member **330** is not required. When the folding work of the cutting blade **500** is completed, the folding member **330** returns to an original position by an operation of the cylinder **421** of the second driving unit **420** as shown in FIG. **2**. When the transfer roller **10** begins to operate again, the cutting blade **500** moves to the outer side of the guiding entrance **311** of the fixing body **313**. While in that position, if a need exists to fold a predetermined unit of the cutting blade **500** in a direction opposite that which was described above, an operation of the transfer roller **10** stops, and at the same time the other folding member **330** falls and moves, and then the same steps as discussed above are repeated. As long as the cutting blade **500** is supplied, it may continuously be formed into any desired configuration. In the above-mentioned embodiment, though each step is explained separately for the understanding of the step for the folding work of the cutting blade, all processes such as a supply, a cutting, a folding work of the cutting blade, etc. can be performed by an automation controlled by a computer, etc.

As afore-mentioned, according to the present invention, all works necessary for the cutting and the folding of the cutting blade in the shape corresponding to the sheet material molding are performed in succession by one process with a unified construction, thereby resulting in an improvement of the cutting and folding works of the cutting blade and a productivity increase.

While only certain embodiments of the invention have been specifically described herein, it will apparent that numerous modifications may be made thereto without departing from the spirit and scope of the invention.

What is claimed is:

1. A metallic ribbon stock folding apparatus comprising:

a transferring unit for transfer of ribbon stock through a passage formed by a guide, said passage defining a longitudinal axis;

a rotary assembly having first and second rotary bodies spaced to receive ribbon stock therebetween;

at least one retractable elongate member, said elongate member mounted for movement between a retracted position where said elongate member is disengaged from at least one of said rotary bodies and an extended position where said elongate member engages both said first and second rotary bodies; and

said rotary assembly configured for arcuate motion relative to said guide from a first position toward at least one second position to fold a portion of said ribbon stock by said elongate member.

2. The metallic ribbon stock folding apparatus as recited in claim **1** wherein a retractable elongate member can be sequentially positioned on opposite sides of said longitudinal axis.

3. The metallic ribbon stock folding apparatus as recited in claim **1** comprising two elongate members.

4. The metallic ribbon stock folding apparatus as recited in claim **1** wherein the at least one retractable elongate member has a substantially trapezoidal cross-section.

5. The metallic ribbon stock folding apparatus as recited in claim **4** wherein the at least one retractable elongate member has a stock engaging edge formed by the intersection of at least two sides of the substantially trapezoidal cross-section.

6. The metallic ribbon stock folding apparatus as recited in claim **1** wherein the at least one elongate member contacts ribbon stock for folding ribbon stock in a direction which is substantially transverse to said longitudinal axis.

7. The metallic ribbon stock folding apparatus as recited in claim 1 further comprising a supply of metallic ribbon stock.

8. A method of folding metallic ribbon stock comprising the steps of:

transferring ribbon stock through a passage formed by a guide, said passage defining a longitudinal axis;

providing at least one retractable elongate member;

providing at least one rotary assembly having first and second rotary bodies spaced to receive ribbon stock therebetween;

moving said elongate member between a retracted position where said elongate member is disengaged from at least one of said rotary bodies to an extended position to engage both first and second rotary bodies with said elongate member; and

rotating said rotary assembly in an arcuate motion relative to said guide from a first position toward at least one second position to fold a portion of ribbon stock by said elongate member.

9. The method of folding metallic ribbon stock as recited in claim 8, further comprising the step of:

cutting ribbon stock at a predetermined length.

10. The method of folding metallic ribbon stock as recited in claim 8, further comprising the step of:

sequentially positioning a retractable elongate member on opposite sides of said longitudinal axis.

11. The method of folding metallic ribbon stock as recited in claim 8, further comprising the step of:

contacting the ribbon stock with a stock engaging edge formed on the elongate member and folding said ribbon stock in a direction which is substantially transverse to said longitudinal axis.

12. A system for folding metallic ribbon stock comprising:

a supply of ribbon stock;

a frame;

a guide mounted in said frame, said guide having a passage therein, said passage defining a longitudinal axis;

a transferring unit for controlled transfer of said ribbon stock through said passage in said guide;

a cutter for cutting said ribbon stock at a predetermined location;

at least one rotary assembly having first and second rotary bodies spaced to receive ribbon stock therebetween;

at least one retractable elongate member said elongate member mounted for movement between a retracted position where said elongate member is disengaged from at least one of said rotary bodies and an extended position where said elongate member engages both said first and second rotary bodies; and

said rotary assembly configured for arcuate motion relative to said guide to move said elongate member integrally with both first and second rotary bodies from a first position toward at least one second position to fold a portion of said ribbon stock by said elongate member.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO.: 5,870,919

DATED: February 16, 1999

INVENTOR(S): Byung-Jun Song

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 2, line 59, change "JAPAN" to --KOREAN--.

Column 5, line 7, change "JAPAN" to --KOREAN--.

Signed and Sealed this

Second Day of November, 1999

Attest:

Attesting Officer

Q. TODD DICKINSON

Acting Commissioner of Patents and Trademarks

US005870919C1

(12) EX PARTE REEXAMINATION CERTIFICATE (5216th)

United States Patent
Song

(10) Number: US 5,870,919 C1
(45) Certificate Issued: Oct. 11, 2005

(54) **FOLDING SYSTEM FOR A CUTTING BLADE**

(75) Inventor: **Byung-Jun Song**, Kwangmyung (KR)

(73) Assignee: **SDS USA, Inc.**, Northvale, NJ (US)

Reexamination Request:
No. 90/006,549, Feb. 18, 2003

Reexamination Certificate for:

Patent No.:	**5,870,919**
Issued:	**Feb. 16, 1999**
Appl. No.:	**09/049,391**
Filed:	**Mar. 27, 1998**

Certificate of Correction issued Nov. 2, 1999.

Related U.S. Application Data

(63) Continuation of application No. 08/668,379, filed on Jun. 21, 1996, now Pat. No. 5,787,750.

(30) **Foreign Application Priority Data**

Jun. 22, 1995 (KR) 95-16975

(51) **Int. Cl.**[7] **B21D 5/16**
(52) **U.S. Cl.** **72/294**; 72/307; 72/319
(58) **Field of Search** ..... 72/217, 294, 306, 72/307, 387, 388; 140/71 R, 105

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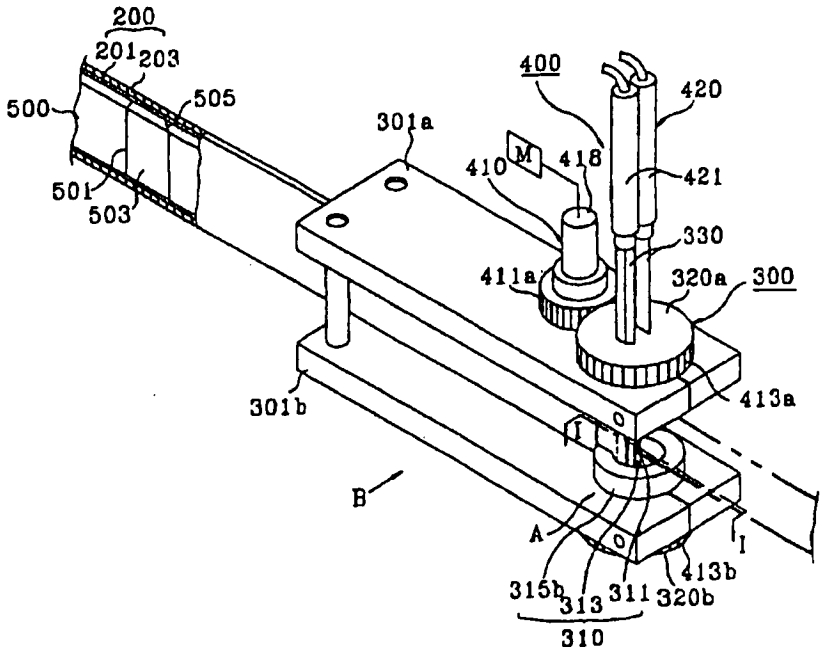
Primary Examiner—Lowell A. Larson

(57) **ABSTRACT**

The present invention provides an unified folding system for processing in one work line all working processes needed in cutting and folding a cutting blade in a shape suitable to a sheet matter molding. A cutting blade supplied from a transferring unit of the cutting blade is cut in a length suitable to a sheet matter molding configuration in a cutting molding unit adjacent thereto, simultaneously the cutting tip used in cutting is transferred together with the cutting blade to a folding device side through a guide member set which is to be contacted with the cutting molding unit, the cutting blade transferred to the folding device is folded in a predetermined shape by a folding member which performs a going-straight movement and a rotating movement, and thereby, at this time, the cutting tip is detached outside by a tare. Accordingly, a working efficiency and a productivity in the cutting and folding of the cutting blade are improved and increased.



EX PARTE REEXAMINATION CERTIFICATE ISSUED UNDER 35 U.S.C. 307

THE PATENT IS HEREBY AMENDED AS INDICATED BELOW.

Matter enclosed in heavy brackets [ ] appeared in the patent, but has been deleted and is no longer a part of the patent; matter printed in italics indicates additions made to the patent.

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

Claims **1, 8** and **12** are determined to be patentable as amended.

Claims **2–7** and **9–11**, dependent on an amended claim, are determined to be patentable.

1. A metallic ribbon stock folding apparatus comprising:

a transferring unit for transfer of ribbon stock through a passage formed by a guide, said passage defining a longitudinal axis;

a rotary assembly having first and second rotary bodies spaced to receive ribbon stock therebetween;

at least one retractable elongate member, said elongate member mounted for movement between a retracted position where said elongate member is disengaged from at least one of said rotary bodies and an extended position where said elongate member engages both said first and second rotary bodies; and

said rotary assembly configured for arcuate motion relative to said guide from a first position toward at least one second position to fold a portion of said ribbon stock by *engaging said ribbon stock against said guide with* said elongate member.

8. A method of folding metallic ribbon stock comprising the steps of:

transferring ribbon stock through a passage formed by a guide, said passage defining a longitudinal axis;

providing at least one retractable elongate member;

providing at least one rotary assembly having first and second rotary bodies spaced to receive ribbon stock therebetween;

moving said elongate member between a retracted position where said elongate member is disengaged from at least one of said rotary bodies to an extended position to engage both first and second rotary bodies with said elongate member; and

rotating said rotary assembly in an arcuate motion relative to said guide from a first position toward at least one second position to fold a portion of ribbon stock by *engaging said ribbon stock against said guide with* said elongate member.

12. A system for folding metallic ribbon stock comprising:

a supply of ribbon stock;

a frame;

a guide mounted in said frame, said guide having a passage therein, said passage defining a longitudinal axis;

a transferring unit for controlled transfer of said ribbon stock through said passage in said guide;

a cutter for cutting said ribbon stock at a predetermined location;

at least one rotary assembly having first and second rotary bodies spaced to receive ribbon stock therebetween;

at least one retractable elongate member said elongate member mounted for movement between a retracted position where said elongate member is disengaged from at least one of said rotary bodies and an extended position where said elongate member engages both said first and second rotary bodies; and

said rotary assembly configured for arcuate motion relative to said guide to move said elongate member integrally with both first and second rotary bodies from a first position toward at least one second position to fold a portion of said ribbon stock by *engaging said ribbon stock against said guide with* said elongate member.

* * * * *

US006128940A

United States Patent [19]

Song

[11] Patent Number: 6,128,940

[45] Date of Patent: *Oct. 10, 2000

[54] **FOLDING SYSTEM FOR A CUTTING BLADE**

[75] Inventor: **Byung-Jun Song**, Kwangmyung, Rep. of Korea

[73] Assignee: **SDS USA, Inc.**, Northvale, N.J.

[*] Notice: This patent is subject to a terminal disclaimer.

[21] Appl. No.: **09/247,408**

[22] Filed: **Feb. 10, 1999**

Related U.S. Application Data

[63] Continuation of application No. 09/049,391, Mar. 27, 1998, Pat. No. 5,870,919, which is a continuation of application No. 08/668,379, Jun. 21, 1996, Pat. No. 5,787,750.

[30] **Foreign Application Priority Data**

Jun. 22, 1995 [KR] Rep. of Korea 95-16975

[51] **Int. Cl.**[7] **B21D 5/16**

[52] **U.S. Cl.** **72/294**; 72/307; 72/319

[58] **Field of Search** 72/307, 294, 306, 72/217, 388, 387, 319

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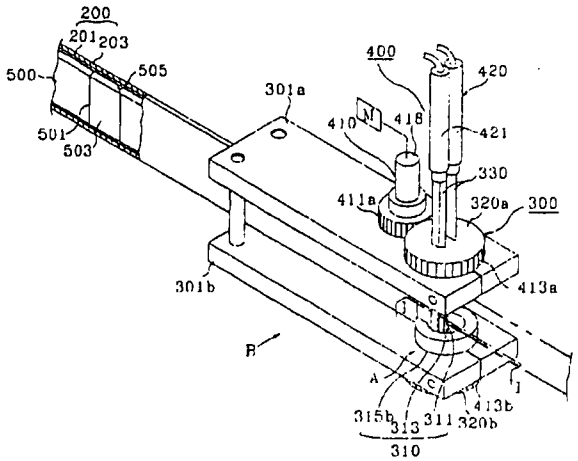
Primary Examiner—Daniel C. Crane

Attorney, Agent, or Firm—F. Chau & Associates, LLP

[57] **ABSTRACT**

The present invention provides an unified folding system for processing in one work line all working processes needed in cutting and folding a cutting blade in a shape suitable to a sheet matter molding. A cutting blade supplied from a transferring unit of the cutting blade is cut in a length suitable to a sheet matter molding configuration in a cutting molding unit adjacent thereto, simultaneously the cutting tip used in cutting is transferred together with the cutting blade to a folding device side through a guide member set which is to be contacted with the cutting molding unit, the cutting blade transferred to the folding device is folded in a predetermined shape by a folding member which performs a going-straight movement and a rotating movement, and thereby, at this time, the cutting tip is detached outside by a tare. Accordingly, a working efficiency and a productivity in the cutting and folding of the cutting blade are improved and increased.

19 Claims, 5 Drawing Sheets



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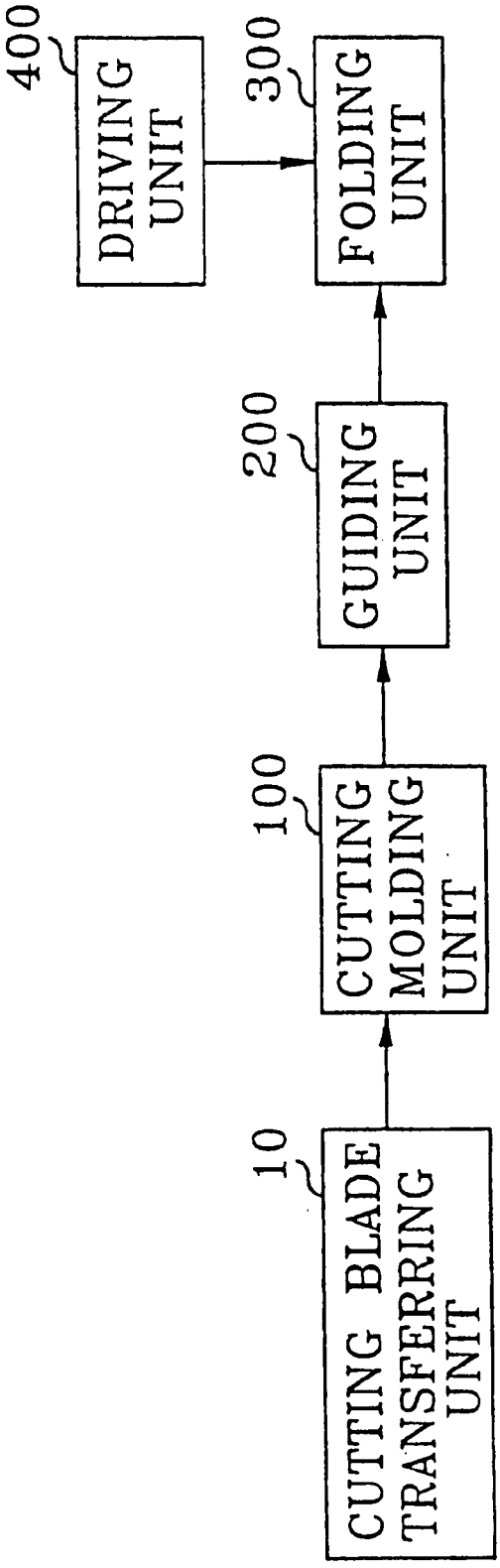

400
DRIVING UNIT
300
FOLDING UNIT
200
GUIDING UNIT
100
CUTTING MOLDING UNIT
10
CUTTING BLADE TRANSFERRING UNIT

FIG. 1

FIG. 2

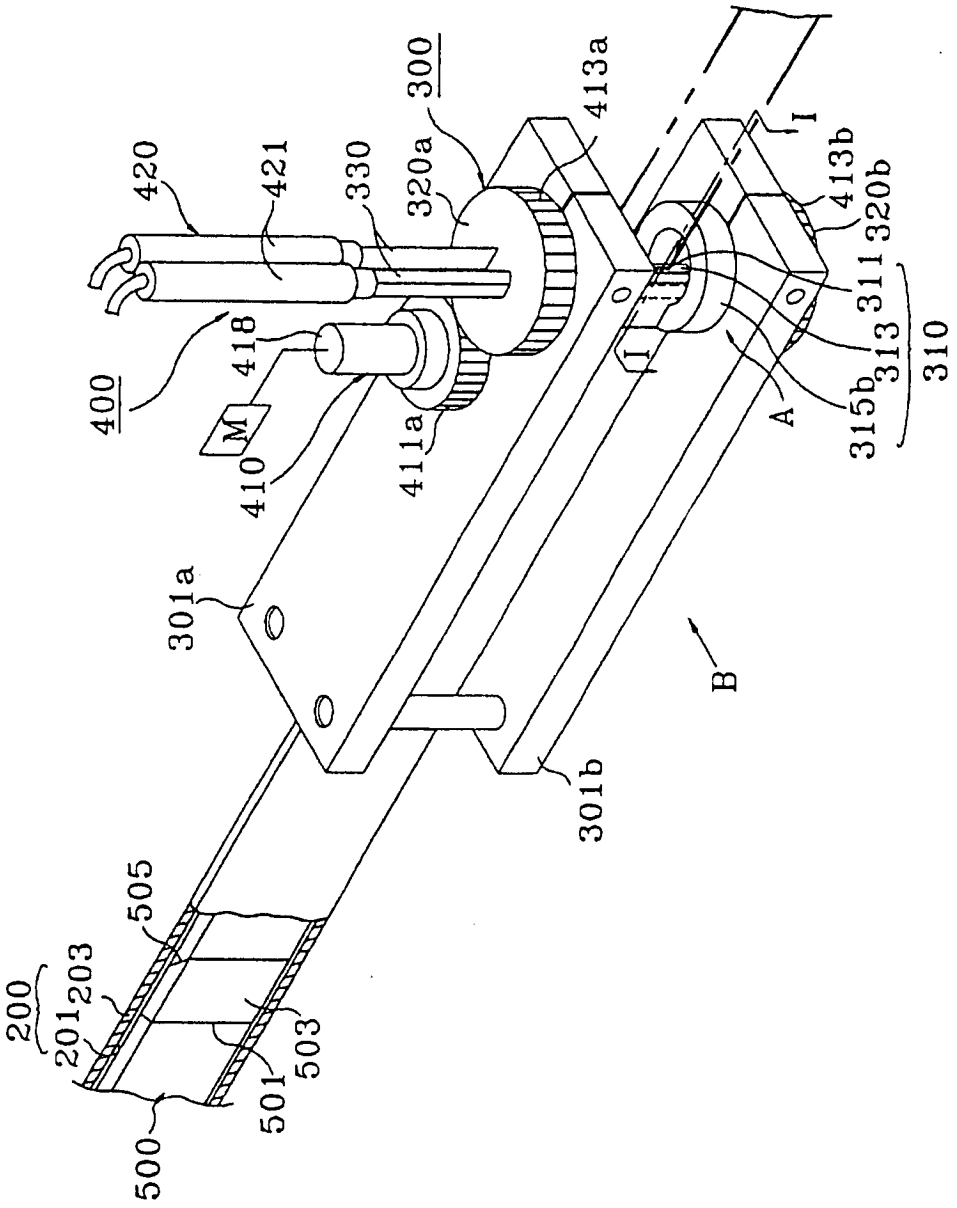

300
413a
420
421
330
320a
413b
320b
I
311
313
310
315b
A
400
418
M
410
411a
301a
B
301b
505
200
203
201
503
501
500

FIG. 3

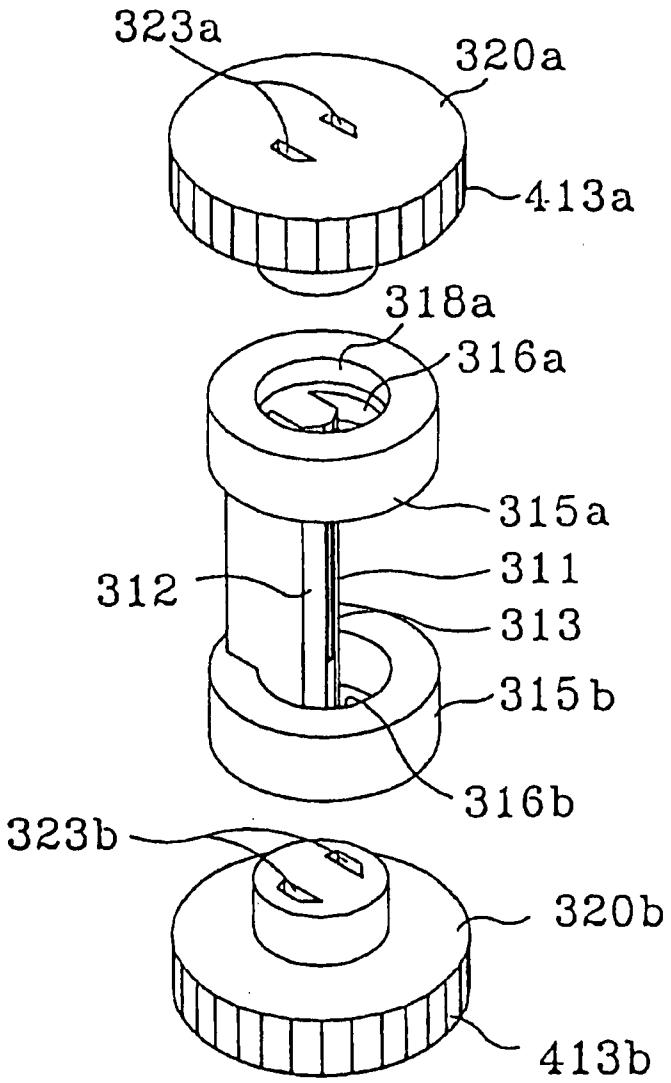

323a
320a
413a
318a
316a
315a
312
311
313
315b
316b
323b
320b
413b

FIG. 4

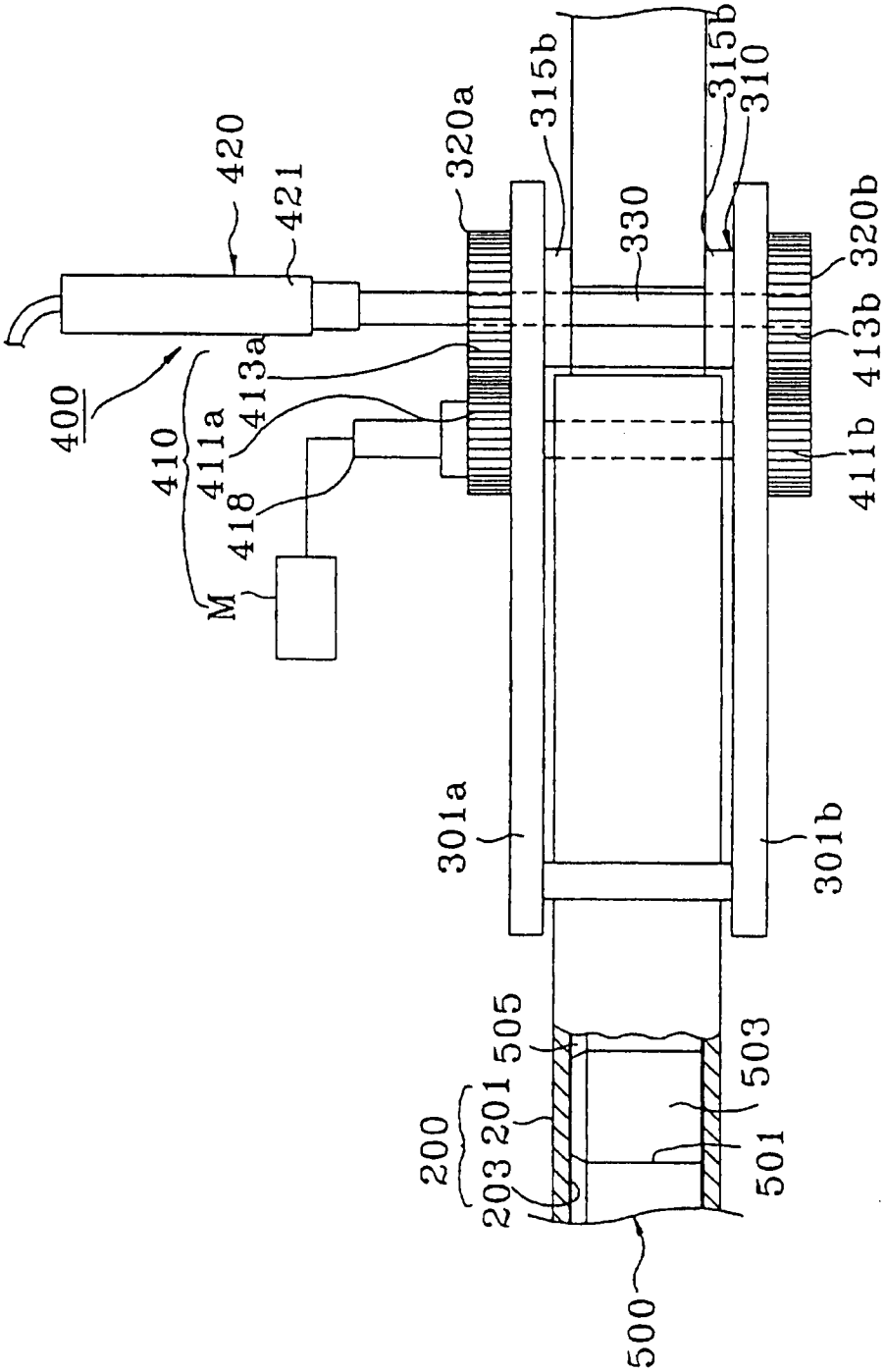

420
421
320a
315b
315b
310
330
320b
413b
411b
400
410
411a
413a
418
M
301a
301b
505
503
200
201
203
501
500

FIG. 6

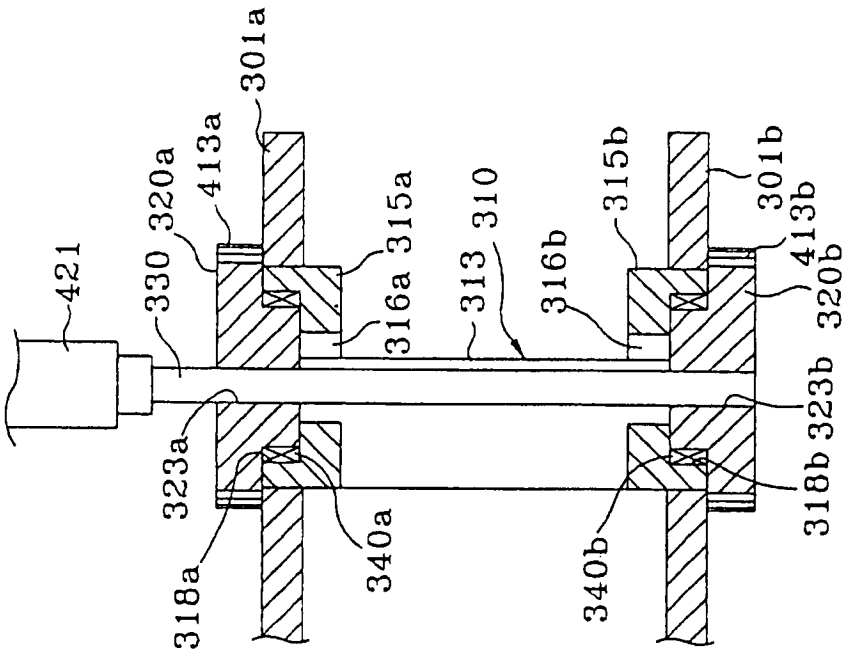
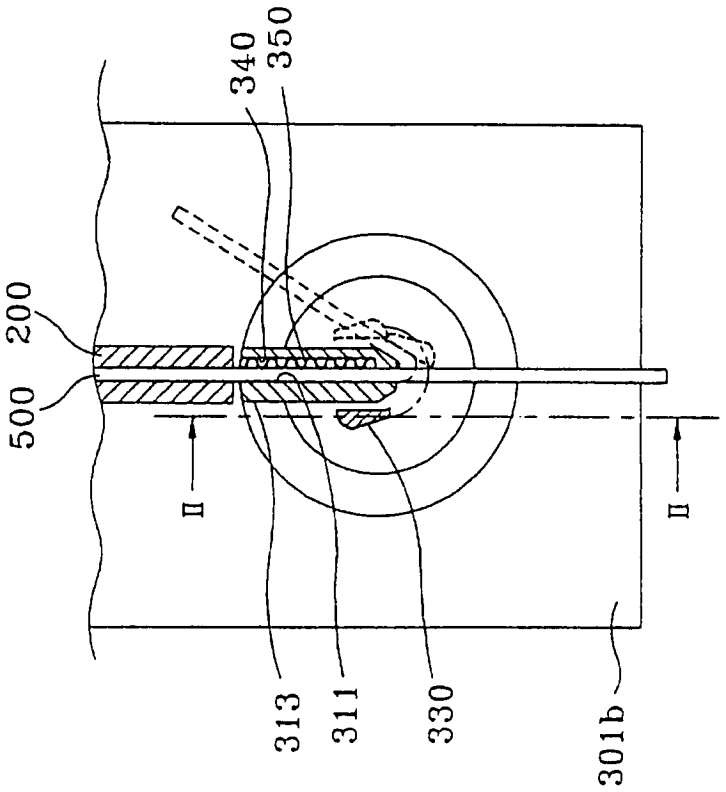

301a
413a
320a
330
421
315a
316a
313
310
316b
315b
301b
413b
320b
323b
318b
323a
318a
340a
340b

FIG. 5


340
350
200
500
II
II
313
311
330
301b

FOLDING SYSTEM FOR A CUTTING BLADE

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a continuation application of U.S. application Ser. No. 09/049,391, filed Mar. 27, 1998, now U.S. Pat. No. 5,870,919, which is a continuation of U.S. application Ser. No. 08/668,379, filed Jun. 21, 1996, now U.S. Pat. No. 5,787,750, which claims the benefit of Korean Application No 1995/16975, filed Jun. 22, 1995.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a folding system of a cutting blade used in forming a folding line on a sheet matter so that the sheet matter, such as paper or plastic, etc., may be made into a predetermined shape, and more particularly to a folding system of the cutting blade being used so that cutting and folding functions associated with the cutting blade can be performed in one process.

2. Description of the Related Art

Generally, the cutting blade is attached to a pattern for use in pressing a folding or a cutting line on plate matters such as paper, canvas, leather, plastic, etc. The plate matters with such pressed lines can be used in a folded shape like a box. Accordingly, in order to assemble and process the plate matter into a predetermined box shape with the cutting blade, it is necessary that the cutting blade is folded in a shape suitable to forming the processing line in the box shape.

Conventional art for the folding device of a cutting blade is disclosed, for example, in Japan Patent No. 1988-309328 and No. 1990-20619. In the conventional art, however, a folded member used as a cutting blade is constructed by a rotary body that converts only a straight line movement into an orthogonal direction against the folded member on an end part of the folded member, or performs only a revolving movement centered about one point. Therefore, a disadvantage along with the use of the prior art cutting blade assemblies is that the folded angle of a processed member is limited to a single range of motion. Also, since two discrete functions are required, namely after a cutting work in separated places, then moving it into a folding device individually, and then the folding work is performed, or after the folding work, then moving it into a cutting device one by one, and then the cutting work is performed, additional time and labor are required, and the overall efficiency of the process decreases.

SUMMARY OF THE INVENTION

Therefore, to solve the above problem, it is an object of the present invention to provide a system for folding a cutting blade to improve a work efficiency and a productivity, by continuously performing all work elements needed in the cutting and folding works of the cutting blade provided in a sheet matter molding, in one work line, the system comprising:

a transferring unit for transferring the cutting blade;

cutting means, situated between the transferring unit and a guide nozzle, for cutting the cutting blade, which is supplied from the transferring unit, in a length substantially corresponding to the sheet material molding configuration, wherein a cutting tip is formed on the cutting blade;

a guide member of a hollow shape, interposed the cutting means and a folding means and configured to connect the cutting means and the folding means, said guide member having a passage for guiding the cutting blade through the cutting means to the folding means;

folding means, supported such that it may be revolved and moved in a straight line direction to apply a force against the cutting blade passing through the guide member, the folding means positioned adjacent the guide member, and for folding the cutting blade to a predetermined angle, the folding means including at least two folding members;

first driving means configured to engage the folding means, for revolving and driving the folding means against the cutting blade; and

second driving means configured to engage the folding means and move at least one of the folding members of the folding means to a position adjacent the cutting blade, prior to driving the first driving means.

BRIEF DESCRIPTION OF THE DRAWINGS

The preferred embodiments are described with reference to the drawings wherein:

FIG. **1** is a block diagram for a folding system of a cutting blade according to the present invention;

FIG. **2** is a detailed perspective view showing a guiding unit and a folding unit of the cutting blade shown in FIG. **1**;

FIG. **3** is a separated perspective view showing a unit "A" separated from FIG. **2**;

FIG. **4** is a side view shown from a direction "B" of an arrow marking of FIG. **2**;

FIG. **5** is a cross-sectional view taken along a line I—I of FIG. **2**; and

FIG. **6** is a longitudinal sectional view taken along a line II—II of FIG. **5**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention will be described below in more detail with reference to the accompanying drawings.

FIG. **1** shows a block diagram of a folding system according to the present invention. In FIG. **1**, the folding system of the cutting blade comprises a transferring unit **10** for transferring the cutting blade of a roll shape, a cutting molding unit **100** for cutting and processing the transferred cutting blade in a length suitable to a sheet material molding (not shown), a guiding unit **200**, positioned between the cutting molding unit **100** and a folding unit **300** for the cutting blade so as to be connected mutually, for stably guiding the cutting blade which is passed through cutting molding unit **100** to folding unit **300**, the folding unit **300** positioned adjacent to the guiding unit **200**, for folding the cutting blade transferred through the guiding unit **200** with a predetermined angle, and a driving unit **400** for driving the folding unit **300** and thus a process work of the cutting blade provided to a sheet material molding is performed in succession. The detailed construction and operation of the above embodiment are explained below. The above cutting molding unit **100** is applied from Korean Patent No. 80607 entitled "Multi-purpose Cutter of a Cutting Blade for Die Cutter" filed by the present applicant on Dec. 11, 1991 and incorporated by reference herein. A detailed explanation for the cutting molding unit is therefore omitted below.

FIG. **2** is a detailed perspective view showing only a portion of the guiding unit associated with the cutting blade and the folding unit, shown schematically in FIG. **1**. FIG. **3**

is an exploded perspective view showing only a unit "A" separated from FIG. **2**. FIG. **4** is a side view shown from a direction "B" of an arrow marking of FIG. **2**. The guiding unit **200** is constructed by a guide nozzle **201** of a hollow structure configured and dimensioned to stably transfer a cutting blade **500** passed through the cutting molding unit to the folding unit **300**.

Referring now to FIG. **2**, guide nozzle **201** has a guiding passage **203** of a size such that cutting blade **500** can pass through freely, and two openings situated near the cutting molding unit **100** and the folding unit **300**, respectively. The guide nozzle **201** is configured so that the cutting blade **500** may be moved together with a cutting tip **503** of a cutting portion **501**.

Referring now to FIG. **3**, folding unit **300** includes a fixing body **310** connected to folding and rotary bodies **320***a* and **320***b* for the folding, which are set on substantially rectangular shaped supporting frames **301***a* and **301***b*. The supporting frames **301***a* and **301***b* are situated spaced apart with an interval therebetween wherein the guide nozzle **201** can be situated. The fixing body **310** for the folding function is constructed by a folding body **313** having a guiding entrance **311** of a size through which the cutting blade **500** can be passed, and by annular support portions **315***a* and **315***b* formed on both ends of the folding body **313**. The guiding entrance **311** of the folding body **313** is connected with the guiding passage **203** of the guide nozzle **201** such that the cutting blade **500** may enter inside the guiding entrance **311** freely. An end side portion of the guiding entrance **311** is preferably a slant side **312** to enhance the folding of the cutting blade **500**.

The annular support portions **315***a* and **315***b* are provided to fixedly attach the folding body **313** to supporting frames **301***a* and **301***b*. As described later in FIG. **6** in detail, the annular support portions **315***a* and **315***b* include guiding slots **316***a* and **316***b* of a round shape, and round housing units **318***a* and **318***b* for housing rotary bodies **320***a* and **320***b* which may be rotated to facilitate the folding function. The rotary bodies **320***a* and **320***b* are configured to be rotatably housed within the round housing units **318***a* and **318***b* arranged on both sides of the fixing body **310**. For a smooth revolving operation of the rotary bodies **320***a* and **320***b*, it is preferable to set bearings **340***a* and **340***b* on the inside circumference portion of the housing units **318***a* and **318***b*, as shown in FIG. **6**. The rotary bodies **320***a* and **320***b* have guide holes **323***a* and **323***b* pierced therein and are configured to contact with the guide slots **316***a* and **316***b*.

The guide holes **323***a* and **323***b* are provided to insertably receive a folding member **330** to facilitate movement thereof, and are configured and dimensioned corresponding to a cross-sectional shape of the folding member **330**. Although an example of the guide holes **323***a* and **323***b* is shown in the figures wherein each guide hole has a folding member set therein, it is preferable that only one folding member is set at a given time during operation. Referring now to FIG. **6**, the folding member **330** is dimensioned to connect the rotary bodies **320***a* and **320***b* to each other while being positioned on the outer sides of supporting frames **301***a* and **301***b*. Accordingly, the folding member **330** is inserted through guide hole **323***a* of rotary body **320***a* passes through a lateral side of the fixing body **310**, and is inserted into guide hole **323***b* inside of rotary body **320***b* and is capable of being moved upwards and downwards. The folding member **330** inserted for mutual connection of rotary bodies **320***a* and **320***b* is provided for the folding work of the cutting blade **500**, revolving together with the rotary bodies **320***a* and **320***b*. When the folding work is not being performed, the folding member **330** is completely apart from folding body **313** and is moved towards an upper side. These operations are performed by the driving unit **400** mentioned later.

Although two folding members **330** are shown in the drawings, for exemplary purposes, only one can be set.

Referring now to FIGS. **2** and **4**, driving unit **400** includes a first driving unit **410** provided to revolve the rotary bodies **320***a* and **320***b* and a second driving unit **420** provided to move folding member **330** upwards and downwards from the folding body **313**. The first driving unit **410** includes first toothed portions **411***a* and **411***b* which are fixed at both ends of a rotating shaft **418** which is rotatably within the supporting frames **301***a* and **301***b*. Second toothed portions **413***a* and **413***b* which are set on the outer circumference surface of the revolving bodies **320***a* and **320***b* are configured to mesh with the first toothed portions **411***a* and **411***b*. A servo motor M is operatively connected to the rotating shaft **418**. The second driving unit **420** is a cylinder **421** connected to one end of the folding member **330** to be moved upwards and downwards for the purpose of performing an expansion operation. As an operating source of the cylinder **421** any one of either oil-hydraulic pressure or air pressure can be used.

FIG. **5** is a cross-sectional view taken along a line I—I of FIG. **2**. FIG. **6** is a longitudinal sectional view taken along a line II—II of FIG. **5**. Folding member **330** has a substantially triangular shape, which enables the cutting blade **500** to be folded easily even without applying an immoderate force. To fold the cutting blade **500** easily, an application of any other shape excepting the triangulate shape doesn't matter. On any one side of the guiding entrance **311** of the fixing body **313**, which is supported to enable passing of the cutting blade **500**, a fixation hole **340** is set. In the inside of the fixation hole **340**, a steel wire spring **350** is set with one portion jutting out to a center position of the guiding entrance **311** through which the cutting blade **500** passes.

The steel wire spring **350** elastically supports the cutting blade **500** as it passes through the guiding entrance **311**, and moves the cutting blade **500** within a predetermined channel, thereby heightening a precision of the folding work. Also, by setting a magnetic substance instead of the steel wire spring **350**, the same effect as the steel wire spring can be achieved.

Though FIG. **5** shows, as an example, a structure in which the steel wire spring **350** is set on any one side of the guiding entrance **311**, it is contemplated that it may be positioned on both sides. As shown in FIG. **6**, the folding member **330** is extended when the cylinder **421** is driven, and is inserted into the guide holes **323***a* and **323***b* inside rotary bodies **320***a* and **320***b*which are formed in the housing units **318***a* and **318***b* of the round shape of the fixing body **310** for rotational movement therein. When the rotary bodies **320***a* and **320***b* are rotated, the folding member **330** is integrally rotated along the guide slots **316***a* and **3 16***b* together with the folding member **330**.

An operation embodiment of the folding system and an effect according to the present invention with the construction as above-mentioned are re-explained in detail referring to FIGS. **1** to **6**.

The cutting blade **500** wound in a roll shape is transferred to the folding unit **300**, which performs the folding work, by the transferring unit **10**, having a transfer roller, through the cutting molding unit **100** and the guide nozzle **201**. At this time, the cutting molding unit **100** performs a cutting work for cutting the cutting blade **500**, passing through the cutting

molding unit **100**, in the length necessary for the sheet matter molding. Herewith, the cutting tip. **503** is kept and maintained on the cutting blade **500** without detachment from the cutting portion **501** of the cutting blade **500**. This is to prevent damage to blade unit **505** which may be caused by a collision during a transfer of the cutting blade **500** through the guide nozzle **201**. The cutting molding unit **100** is applied from Korean Patent No. 80607 issued to the present applicant, and, therefore, the detailed operating description thereof is omitted.

Even if the cutting tip **503**, formed on the cutting blade **500**, is detached from the cutting molding unit **100**, the cutting tip **503** passes through the guide nozzle **201** continuously and thereby there is no cause for its detachment. As shown in FIGS. **2** and **4**, the cutting blade **500** passed through the guide nozzle **201** pierces through the guiding entrance **311** of the fixing body **313**, and then goes out to the outer side of the supporting frames **301***a* and **301***b*.

The cutting blade **500** passing through the guiding entrance **311** contacts with the steel wire spring **350** as shown in FIG. **5**, but the steel wire spring **350** has an elastic force, so it doesn't become an obstacle to pass the cutting blade **500** at all. The steel wire spring **3 50** is provided to support the cutting blade **500** with the elastic force to dampen or prevent a fluctuation in the cutting blade **500** which may be caused by a sudden stop of the transfer roller **10**. The cutting blade **500** passed through the guiding entrance **311** is then folded in the shape suitable to a molding of the sheet material. In folding the cutting blade **500**, the transfer roller **10** stops and the transferring work of the cutting blade **500** is temporarily in a stopped state. At the same time as the stop of the transfer roller **10**, the second driving unit **420** between the driving units **400** operates first.

If only one cylinder **421** out of the second driving unit **420** falls in the operation, the second driving unit **420** remains situated in a position as shown in FIG. **2**. The folding member **330** of one body with the cylinder **421** is inserted into the guide holes **323***a* and **323***b* inside of the rotary bodies **320***a* and **320***b* as shown in FIGS. **4** and **6**, and is also situated on any one side of the fixing body **313** adjacent to the cutting blade **500**. The guide holes **323***a* and **323***b* are formed on the same position, therefore the folding member **330** is inserted naturally when the cylinder **421** performs the falling operation. When the folding member **330** moved and is completed in moving to the position adjacent the cutting blade **500**, the first driving unit **410** operates. The first driving unit **410** is rotated by driving the servo motor M. By driving the servo motor M, the first toothed portions **411***a* and **411***b* are simultaneously rotated by means of the rotating shaft **418**. By a meshing operation between the first toothed portions **411***a* and **411***b* and the second toothed portions **413***a* and **413***b*, the revolving bodies **320***a* and **320***b* are rotated about a supporting point of the fixing body **310**. When the revolving bodies **320***a* and **320***b* are rotated, the folding member **330** is also rotated. That is the folding member **330** is rotated and moved around a periphery of the fixing body **313** along the guide slot **316***b* from any one side of the fixing body **313** for the folding operation as shown in FIG. **5**. At this time, the moved folding member **330** contacts with the cutting blade **500** which extends through the guiding entrance **311**, thereby the cutting blade **500** is naturally folded by a rotating force of the folding member **330** along a slant face **312** of the fixing body **313**. Meanwhile, the cutting tip **503** put on the cutting blade **500** is automatically separated by a tare and is collected when the cutting blade **500** extends through the outside of the guiding entrance **311**.

Since the servo motor M stops the operation when the cutting blade **500** completes the folding, an immoderate rotation force of the rotary bodies **320***a* and **320***b* connected with the folding member **330** is not required. When the folding work of the cutting blade **500** is completed, the folding member **330** returns to an original position by an operation of the cylinder **421** of the second driving unit **420** as shown in FIG. **2**. When the transfer roller **10** begins to operate again, the cutting blade **500** moves to the outer side of the guiding entrance **311** of the fixing body **313**. While in that position, if a need exists to fold a predetermined unit of the cutting blade **500** in a direction opposite that which was described above, an operation of the transfer roller **10** stops, and at the same time the other folding member **330** falls and moves, and then the same steps as discussed above are repeated. As long as the cutting blade **500** is supplied, it may continuously be formed into any desired configuration. In the above-mentioned embodiment, though each step is explained separately for the understanding of the step for the folding work of the cutting blade, all processes such as a supply, a cutting, a folding work of the cutting blade, etc. can be performed by an automation controlled by a computer, etc.

As afore-mentioned, according to the present invention, all works necessary for the cutting and the folding of the cutting blade in the shape corresponding to the sheet material molding are performed in succession by one process with a unified construction, thereby resulting in an improvement of the cutting and folding works of the cutting blade and a productivity increase.

While only certain embodiments of the invention have been specifically described herein, it will apparent that numerous modifications may be made thereto without departing from the spirit and scope of the invention.

What is claimed is:

1. A metallic ribbon stock folding apparatus, comprising:

a guide having a passage for passing ribbon stock, said passage defining a longitudinal plane;

an elongate member mounted for movement in a direction substantially transverse to said longitudinal plane between a retracted position and an extended position; and

a rotary assembly having first and second rotary bodies spaced to retrieve ribbon stock therebetween, said elongate member engaging both first and second rotary bodies when in the extended position, said rotary assembly configured for arcuate motion relative to said guide to move said elongate member from a first position toward at least one second position to fold a portion of said ribbon stock.

2. The metallic ribbon stock folding apparatus as recited in claim **1**, wherein said longitudinal plane is defined by a first side and a second side opposite said first side relative to said longitudinal plane and said elongate member can be sequentially positioned on said first and second sides of said longitudinal plane.

3. The metallic ribbon stock folding apparatus as recited in claim **1**, comprising two elongate members.

4. The metallic ribbon stock folding apparatus as recited in claim **1**, wherein said elongate member has a substantially trapezoidal cross-section.

5. The metallic ribbon stock folding apparatus as recited in claim **4**, where the elongate member has a stock engaging edge formed by the intersection of at least two sides of the substantially trapezoidal cross-section.

6. The metallic ribbon stock folding apparatus as recited in claim **1**, wherein the elongate member contacts ribbon

stock for folding ribbon stock in a direction which is substantially orthogonal to said longitudinal plane.

7. The metallic ribbon stock folding apparatus as recited in claim 1, wherein said metallic ribbon stock is a cutting blade.

8. A method of folding metallic ribbon stock, comprising the steps of:

transferring ribbon stock through a passage formed by a guide, said passage defining a longitudinal axis;

providing at least one retractable elongate member;

moving said elongate member between a disengaged position when it is retracted and an engaged position when it is extended relative to the guide;

providing at least one rotary assembly having first and second rotary bodies spaced to receive ribbon stock therebetween;

engaging both first and second rotary bodies with said elongate member when said elongate member is extended in the engaged position; and

rotating said rotary assembly in an arcuate motion relative to said guide from a first position toward at least one second position to fold a portion of ribbon stock.

9. The method of folding metallic ribbon stock as recited in claim 8, further comprising the steps of:

disengaging said elongate member from the first rotary body and engaging both said first and second rotary bodies at a third position, said third position being different from said first position; and

moving said elongate member from a third to a fourth position to fold a second portion of said ribbon stock.

10. The method of folding metallic ribbon stock as recited in claim 8, wherein said guide defines a longitudinal plane having a first side and a second side opposite said first side relative to said plane, the method further comprising the step of:

sequentially positioning the elongate member on said first and second sides of said longitudinal plane.

11. The method of folding metallic ribbon stock as recited in claim 8, further comprising the step of:

contacting the ribbon stock with a stock engaging edge formed on the elongate member and folding said ribbon stock in a direction which is substantially transverse to said longitudinal axis.

12. A system for folding a metallic ribbon stock in a shape conforming to a desired sheet material molding configuration, the system comprising:

a transferring unit for transferring the ribbon stock;

a guide member having a passage for guiding the ribbon stock during transfer by the transferring unit;

folding means, supported such that it may be revolved and moved in a straight line direction for applying a force against the ribbon stock passing through the guide member, the folding means positioned adjacent said guide member, and for folding the ribbon stock to a predetermined angle;

first driving means configured to engage said folding means, for revolving and driving the folding means against the ribbon stock;

second driving means configured to engage and move said folding means to a position adjacent the ribbon stock;

wherein said folding means comprises a supporting frame comprised of at least two plate shaped members, the guide member positioned between the at least two plate shaped members; a fixing body having a predetermined length and a guide entrance operatively connected with said guide member, wherein ends of the fixing body are rotatably fixed to the supporting frame, the fixing body having a guide slot formed therein for insertably receiving said folding means, and a pair of rotary bodies, rotatably connected to the ends of the fixing body for revolving the folding means, said pair of rotary bodies having a pair of guide holes formed therein for insertably receiving the folding means.

13. The system of claim 12, wherein the folding means have a substantially triangular cross-section.

14. The system of claim 12, wherein said guide entrance further comprises supporting means for moving the ribbon stock in a predetermined channel.

15. The system of claim 14, wherein said supporting means comprises a magnetic substance.

16. The system of claim 12, wherein said first driving means comprises:

a first toothed portion set on the pair of rotary bodies;

a second toothed portion set on both ends of a rotating shaft installed on the supporting frame, the second toothed portion configured to mesh with the first toothed portion; and

a servo motor coupled to the rotating shaft for rotating the rotating shaft.

17. The system of claim 12, wherein said second driving means comprises a cylinder, direct-connected to the folding means, for moving the folding means into and out of engagement with the pair of rotary bodies.

18. The system of claim 12, further comprising cutting means for cutting the ribbon stock supplied from said transferring unit in a length substantially corresponding to the sheet material molding configuration.

19. The system of claim 12, wherein the folding means are configured and dimensioned for connecting said pair of rotary bodies to each other through the guide holes of the pair of rotary bodies and the guide slots of the fixing body.

* * * * *

EXHIBIT C

US006405574B2

(12) **United States Patent**
Song

(10) **Patent No.: US 6,405,574 B2**
(45) **Date of Patent: *Jun. 18, 2002**

(54) **FOLDING SYSTEM FOR A CUTTING BLADE**

(75) Inventor: **Byung-Jun Song**, Kwangmyung (KR)

(73) Assignee: **SDS USA, Inc.**, Northvale, NJ (US)

(*) Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **09/575,095**

(22) Filed: **May 19, 2000**

Related U.S. Application Data

(63) Continuation of application No. 09/247,408, filed on Feb. 10, 1999, now Pat. No. 6,128,940, which is a continuation of application No. 09/049,391, filed on Mar. 27, 1998, now Pat. No. 5,870,919, which is a continuation of application No. 08/668,379, filed on Jun. 21, 1996, now Pat. No. 5,787,750.

(30) **Foreign Application Priority Data**

Jun. 22, 1995 (KR) 95-16975

(51) **Int. Cl.**[7] **B21D 5/16**
(52) **U.S. Cl.** **72/307**; 72/319
(58) **Field of Search** 72/294, 307, 388, 72/320, 319

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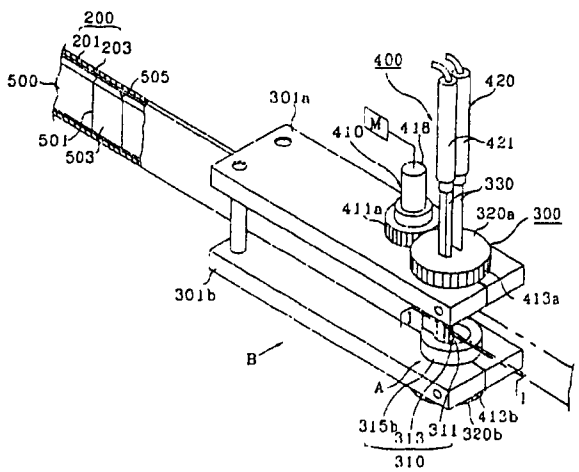
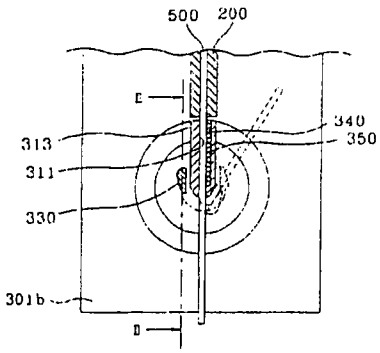
(74) *Attorney, Agent, or Firm*—F. Chau & Associates LLP

(57) **ABSTRACT**

The present invention provides an unified folding system for processing in one work line all working processes needed in cutting and folding a cutting blade in a shape suitable to a sheet matter molding. A cutting blade supplied from a transferring unit of the cutting blade is cut in a length suitable to a sheet matter molding configuration in a cutting molding unit adjacent thereto, simultaneously the cutting tip used in cutting is transferred together with the cutting blade to a folding device side through a guide member set which is to be contacted with the cutting molding unit, the cutting blade transferred to the folding device is folded in a predetermined shape by a folding member which performs a going-straight movement and a rotating movement, and thereby, at this time, the cutting tip is detached outside by a tare. Accordingly, a working efficiency and a productivity in the cutting and folding of the cutting blade are improved and increased.

23 Claims, 5 Drawing Sheets





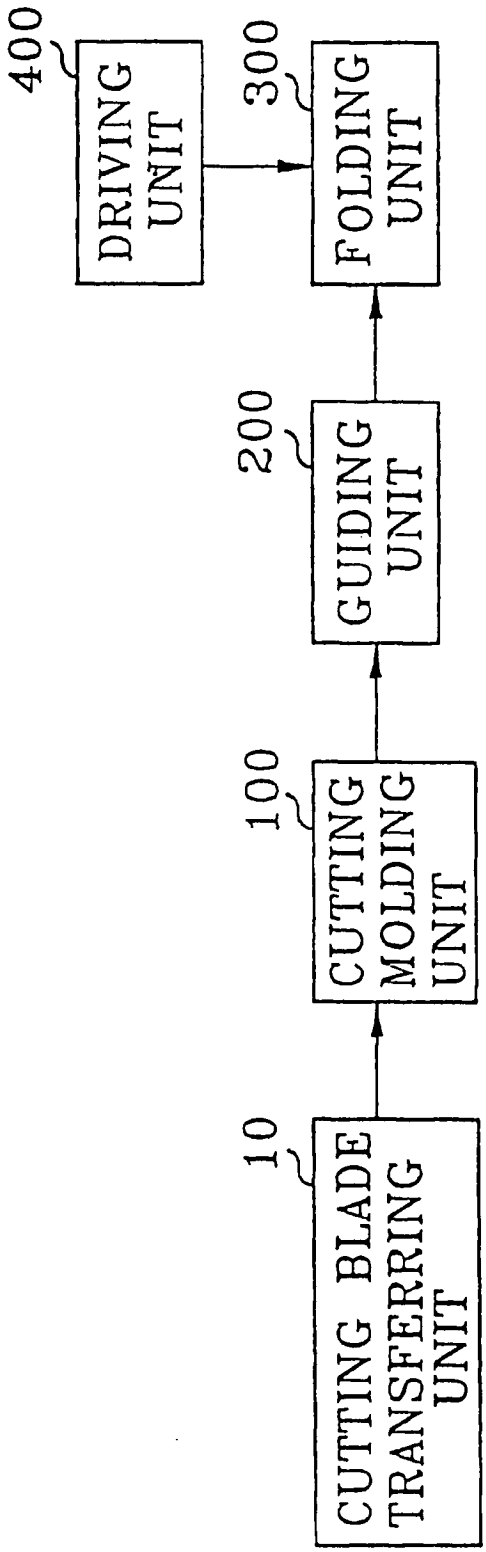

400
DRIVING UNIT
300
FOLDING UNIT
200
GUIDING UNIT
100
CUTTING MOLDING UNIT
10
CUTTING BLADE TRANSFERRING UNIT

FIG. 1

FIG. 2

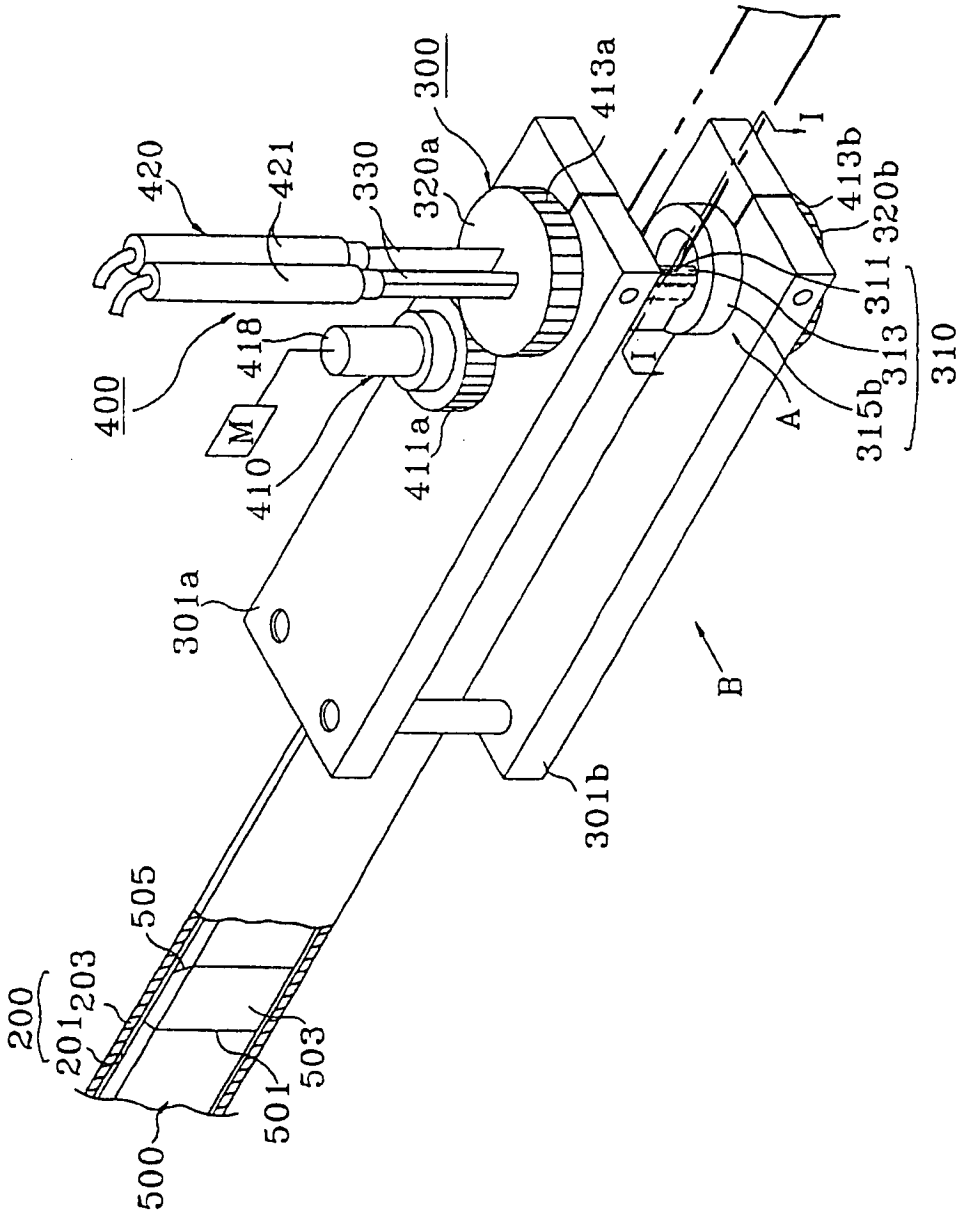

420
421
330
320a
300
413a
I
I
413b
320b
311
313
310
315b
A
400
418
M
410
411a
301a
B
301b
505
200
203
201
503
501
500

FIG. 3

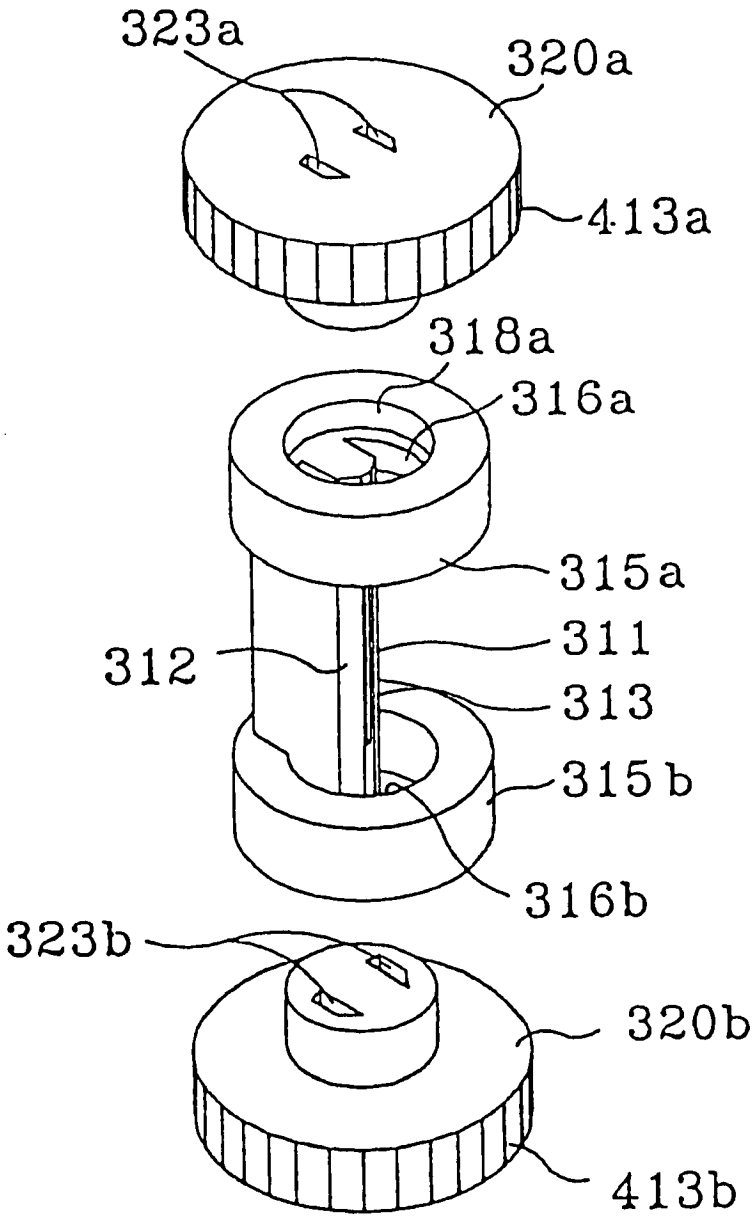

323a
320a
413a
318a
316a
315a
312
311
313
315b
316b
323b
320b
413b

FIG. 4

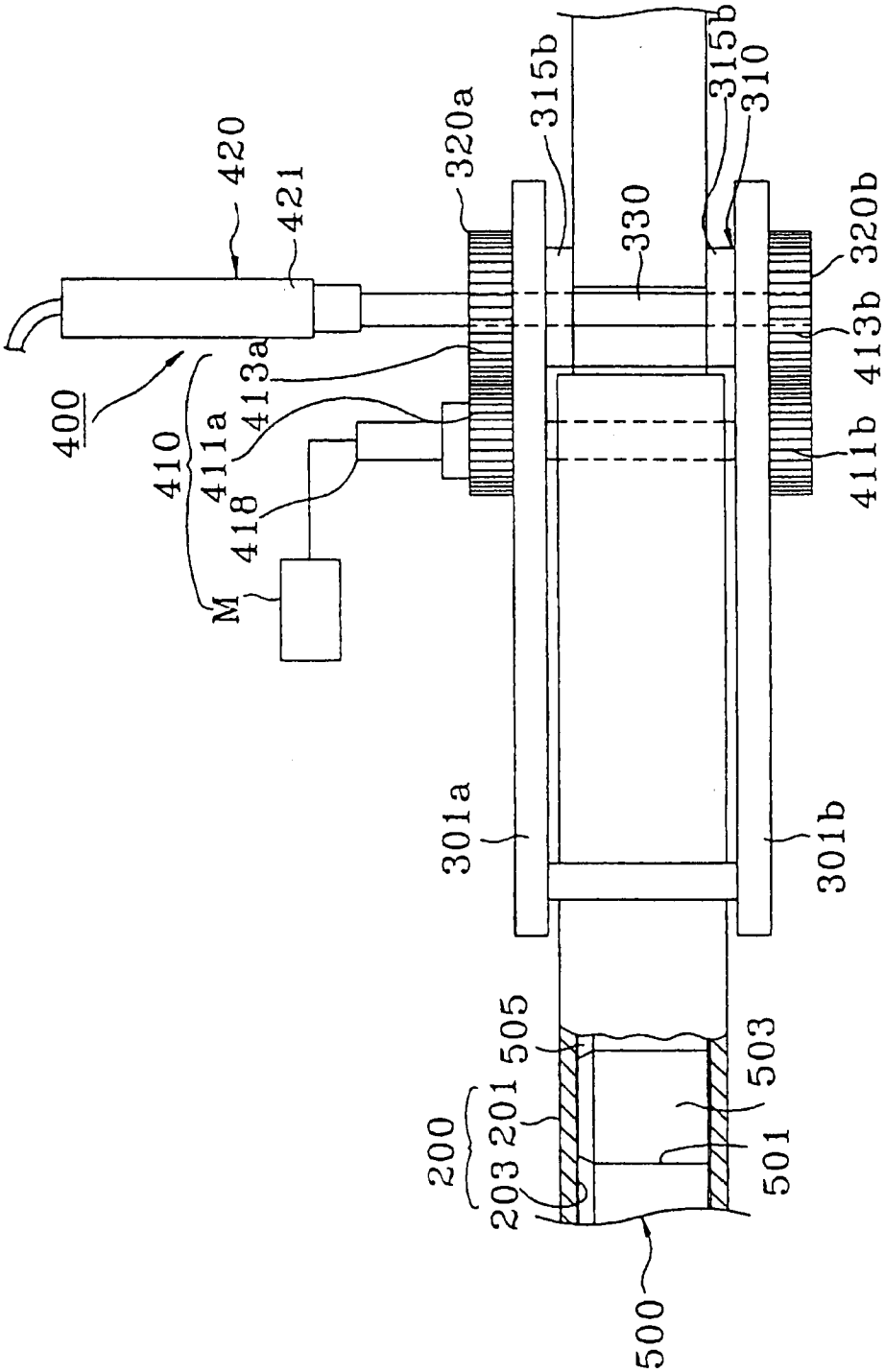

420
421
320a
315b
315b
310
330
320b
413b
411b
400
410
411a
413a
418
M
301a
301b
505
503
200
201
203
501
500

FIG. 6

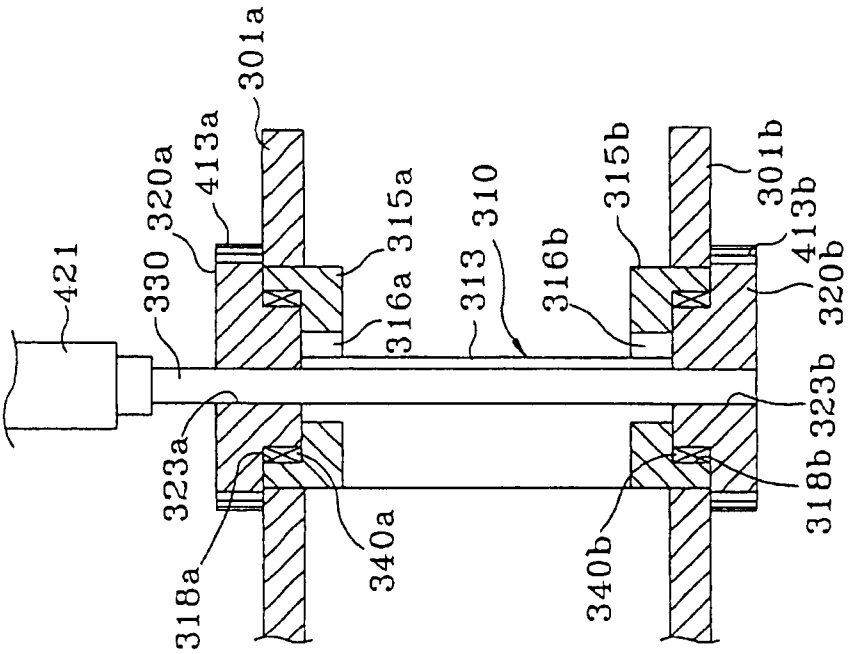
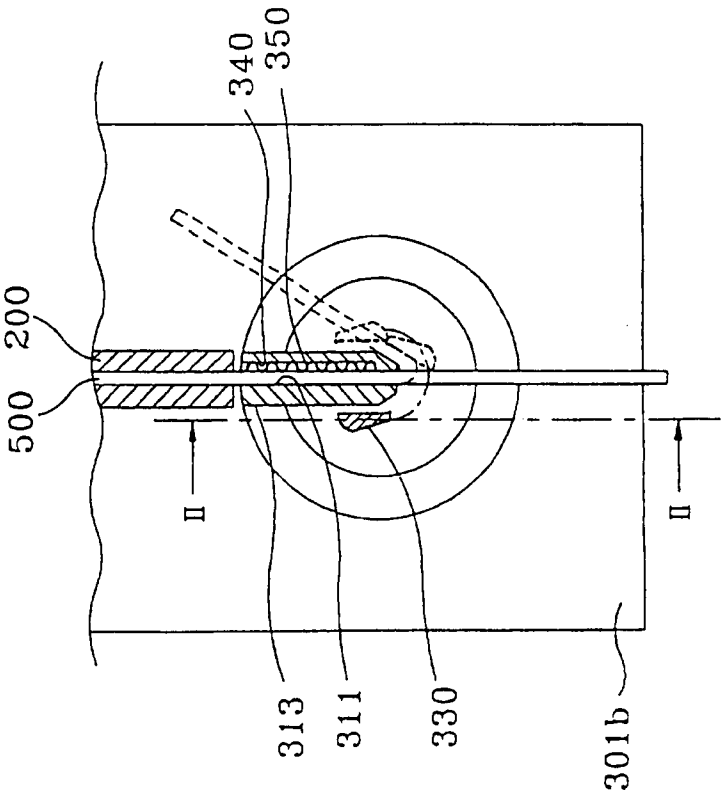

301a
413a
320a
330
421
315a
316a
313
310
316b
315b
301b
413b
320b
323b
318b
323a
318a
340a
340b

FIG. 5


340
350
200
500
II
II
313
311
330
301b

FOLDING SYSTEM FOR A CUTTING BLADE

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a continuation of application Ser. No. 09/247,408 filed Feb. 10, 1999, now Pat. No. 6,128,940, which is a continuation of U.S. application Ser. No. 09/049,391 filed Mar. 27. 1998, now U.S. Pat. No. 5,870,919, which is a continuation of U.S. application Ser. No. 08/668,379 filed Jun. 21, 1996, now U.S. Pat. No. 5,787,750, which claims the benefit of Korean Application No. 1995/16975, filed Jun. 22, 1995.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a folding system of a cutting blade used in forming a folding line on a sheet matter so that the sheet matter, such as paper or plastic, etc., may be made into a predetermined shape, and more particularly to a folding system of the cutting blade being used so that cutting and folding functions associated with the cutting blade can be performed in one process.

2. Description of the Related Art

Generally, the cutting blade is attached to a pattern for use in pressing a folding or a cutting line on plate matters such as paper, canvas, leather, plastic, etc. The plate matters with such pressed lines can be used in a folded shape like a box. Accordingly, in order to assemble and process the plate matter into a predetermined box shape with the cutting blade, it is necessary that the cutting blade is folded in a shape suitable to forming the processing line in the box shape.

Conventional art for the folding device of cutting blade is disclosed, for example, in Japan Patent No. 1988-309328 and No. 1990-20619. In the conventional art, however, a folded member used as a cutting blade is constructed by a rotary body that converts only a straight line movement into an orthogonal direction against the folded member on an end part of the folded member, or performs only a revolving movement centered about one point. Therefore, a disadvantage along with the use of the prior art cutting blade assemblies is that the folded angle of a processed member is limited to a single range of motion. Also, since two discrete functions are required, namely after a cutting work in separated places, then moving it into a folding device individually, and then the folding work is performed, or after the folding work, then moving it into a cutting device one by one, and then the cutting work is performed, additional time and labor are required, and the overall efficiency of the process decreases.

SUMMARY OF THE INVENTION

Therefore, to solve the above problem, it is an object of the present invention to provide a system for folding a cutting blade to improve a work efficiency and a productivity, by continuously performing all work elements needed in the cutting and folding works of the cutting blade provided in a sheet matter molding, in one work line, the system comprising:

a transferring unit for transferring the cutting blade;

Cutting means, situated between the transferring unit and a guide nozzle, for cutting the cutting blade, which is supplied from the transferring unit, in a length substantially corresponding to the sheet material molding configuration, wherein a cutting tip is formed on the cutting blade;

a guide member of a hollow shape, interposed the cutting means and a folding means and configured to connect the cutting means and the folding means, said guide member having a passage for guiding the cutting blade through the cutting means to the folding means;

folding means, supported such that it may be revolved and moved in a straight line direction to apply a force against the cutting blade passing through the guide member, the folding means positioned adjacent the guide member, and for folding the cutting blade to a predetermined angle, the folding means including at least two folding members;

first driving means configured to engage the folding means, for revolving and driving the folding means against the cutting blade; and

second driving means configured to engage the folding means and move at least one of the folding members of the folding means to a position adjacent the cutting blade, prior to driving the first driving means.

BRIEF DESCRIPTION OF THE DRAWINGS

The preferred embodiments are described with reference to the drawings wherein:

FIG. **1** is a block diagram for a folding system of a cutting blade according to the present invention;

FIG. **2** is a detailed perspective view showing a guiding unit and a folding unit of the cutting blade shown in FIG. **1**;

FIG. **3** is a separated perspective view showing a unit "A" separated from FIG. **2**;

FIG. **4** is a side view shown from a direction "B" of an arrow marking of FIG. **2**;

FIG. **5** is a cross-sectional view taken along a line I—I of FIG. **2**; and

FIG. **6** is a longitudinal sectional view taken along a line II—II of FIG. **5**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention will be described below in more detail with reference to the accompanying drawings.

FIG. **1** shows a block diagram of a folding system according to the present invention. In FIG. **1**, the folding system of the cutting blade comprises a transferring unit **10** for transferring the cutting blade of a roll shape, a cutting molding unit **100** for cutting and processing the transferred cutting blade in a length suitable to a sheet material molding (not shown), a guiding unit **200**, positioned between the cutting molding unit **100** and a folding unit **300** for the cutting blade so as to be connected mutually, for stably guiding the cutting blade which is passed through cutting molding unit **100** to folding unit **300**, the folding unit **300** positioned adjacent to the guiding unit **200**, for folding the cutting blade transferred through the guiding unit **200** with a predetermined angle, and a driving unit **400** for driving the folding unit **300**; and thus a process work of the cutting blade provided to a sheet material molding is performed in succession. The detailed construction and operation of the above embodiment are explained below. The above cutting molding unit **100** is applied from Korean Patent No. 80607 entitled "Multi-purpose Cutter of a Cutting Blade for Die Cutter" filed by the present applicant on Dec. 11, 1991 and incorporated by reference herein. A detailed explanation for the cutting molding unit is therefore omitted below.

FIG. **2** is a detailed perspective view showing only a portion of the guiding unit associated with the cutting blade and the folding unit, shown schematically in FIG. **1**. FIG. **3** is an exploded perspective view showing only a unit "A" separated from FIG. **2**. FIG. **4** is a side view shown from a direction "B" of an arrow marking of FIG. **2**. The guiding unit **200** is constructed by a guide nozzle **201** of a hollow structure configured and dimensioned to stably transfer a cutting blade **500** passed through the cutting molding unit to the folding unit **300**.

Referring now to FIG. **2**, guide nozzle **201** has a guiding passage **203** of a size such that cutting blade **500** can pass through freely, and two openings situated near the cutting molding unit **100** and the folding unit **300**, respectively. The guide nozzle **201** is configured so that the cutting blade **500** may be moved together with a cutting tip **503** of a cutting portion **501**.

Referring now to,FIG. **3**, folding unit **300** includes a fixing body **310** connected to folding and rotary bodies **320***a* and **320***b* for the folding, which are set on substantially rectangular shaped supporting frames **301***a* and **301***b*. The supporting frames **301***a* and **301***b* are situated spaced apart with an interval therebetween wherein the guide nozzle **201** can be situated. The fixing body **310** for the folding function is constructed by a folding body **313** having a guiding entrance **311** of a size through which the cutting blade **500** can be passed, and by annular support portions **315***a* and **315***b* formed on both ends of the folding body **313**. The guiding entrance **311** of the folding body **313** is connected with the guiding passage **203** of the guide nozzle **201** such that the cutting blade **500** may enter inside the guiding entrance **311** freely. An end side portion of the guiding entrance **311** is preferably a slant side **312** to enhance the folding of the cutting blade **500**.

The annular support portions **315***a* and **315***b* are provided to fixedly attach the folding body **313** to supporting frames **301***a* and **301***b*. As described later in FIG. **6** in detail, the annular support portions **315***a* and **315***b* include guiding slots **316***a* and **316***b* of a round shape, and round housing units **318***a* and **318***b* for housing rotary bodies **320***a* and **320***b* which may be rotated to facilitate the folding function. The rotary bodies **320***a* and **320***b* are configured to be rotatably housed within the round housing units **318***a* and **318***b* arranged on both sides of the fixing body **310**. For a smooth revolving operation of the rotary bodies **320***a* and **320***b*, it is preferable to set bearings **340***a* and **340***b* on the inside circumference portion of the housing units **318***a* and **318***b*, as shown in FIG. **6**. The rotary bodies **320***a* and **320***b* have guide holes **323***a* and **323***b* pierced therein and are configured to contact with the guide slots **316***a* and **316***b*.

The guide holes **323***a* and **323***b* are provided to insertably receive a folding member **330** to facilitate movement thereof, and are configured and dimensioned corresponding to a cross-sectional shape of the folding member **330**. Although an example of the guide holes **323***a* and **323***b* is shown in the figures wherein each guide hole has a folding member set therein, it is preferable that only one folding member is set at a given time during operation. Referring now to FIG. **6**, the folding member **330** is dimensioned to connect the rotary bodies **320***a* and **320***b* to each other while being positioned on the outer sides of supporting frames **301***a* and **301***b*. Accordingly, the folding member **330** is inserted through guide hole **323***a* of rotary body **320***a*, passes through a lateral side of the fixing body **310**, and is inserted into guide hole **323***b* inside of rotary body **320***b* and is capable of being moved upwards and downwards. The folding member **330** inserted for mutual connection of rotary bodies **320***a* and **320***b* is provided for the folding work of the cutting blade **500**, revolving together with the rotary bodies **320***a* and **320***b*. When the folding work is not being performed, the folding member **330** is completely apart from folding body **313** and is moved towards an upper side. These operations are performed by the driving unit **400** mentioned later.

Although two folding members **330** are shown in the drawings, for exemplary purposes, only one can be set.

Referring now to FIGS. **2** and **4**, driving unit **400** includes a first driving unit **410** provided to revolve the rotary bodies **320***a* and **320***b* and a second driving unit **420** provided to move folding member **330** upwards and downwards from the folding body **313**. The first driving unit **410** includes first toothed portions **411***a* and **411***b* which are fixed at both ends of a rotating shaft **418** which is rotatably within the supporting frames **301***a* and **301***b*. Second toothed portions **413***a* and **413***b* which are set on the outer circumference surface of the revolving bodies **320***a* and **320***b* are configured to mesh with the first toothed portions **411***a* and **411***b*. A servo motor M is operatively connected to the rotating shaft **418**. The second driving unit **420** is a cylinder **421** connected to one end of the folding member **330** to be moved upwards and downwards for the purpose of performing an expansion operation. As an operating source of the cylinder **421** any one of either oil-hydraulic pressure or air pressure can be used.

FIG. **5** is a cross-sectional view taken along a line I—I of FIG. **2**. FIG. **6** is a longitudinal sectional view taken along a line II—II of FIG. **5**. Folding member **330** has a substantially triangular shape, which enables the cutting blade **500** to be folded easily even without applying an immoderate force. To fold the cutting blade **500** easily, an application of any other shape excepting the triangulate shape does matter. On any one side of the guiding entrance **311** of the fixing body **313**, which is supported to enable passing of the cutting blade **500**, a fixation hole **340** is set. In the inside of the fixation hole **340**, a steel wire spring **350** is set with one portion jutting out to a center position of the guiding entrance **311** through which the cutting blade **500** passes.

The steel wire spring **350** elastically supports the cutting blade **500** as it passes through the guiding entrance **311**, and moves the cutting blade **500** within a predetermined channel, thereby heightening a precision of the folding work. Also, by setting a magnetic substance instead of the steel wire spring **350**, the same effect as the steel wire spring can be achieved.

Though FIG. **5** shows, as an example, a structure in which the steel wire spring **350** is set on any one side of the guiding entrance **311**, it is contemplated that it may be positioned on both sides. As shown in FIG. **6**, the folding member **330** is extended when the cylinder **421** is driven, and is inserted into the guide holes **323***a* and **323***b* inside rotary bodies **320***a* and **320***b*, which are formed in the housing units **318***a* and **318***b* of the round shape of the fixing body **310** for rotational movement therein. When the rotary bodies **320***a* and **320***b* are rotated, the folding member **330** is integrally rotated along the guide slots **316***a* and **316***b* together with the folding member **330**.

An operation embodiment of the folding system and an effect according to the present invention with the construction as above-mentioned are re-explained in detail referring to FIGS. **1** to **6**.

The cutting blade **500** wound in a roll shape is transferred to the folding unit **300**, which performs the folding work, by the transferring unit **10**, having a transfer roller, through the

cutting molding unit **100** and the guide nozzle **201**. At this time, the cutting molding unit **100** performs a cutting work for cutting the cutting blade **500**, passing through the cutting molding unit **100**, in the length necessary for the sheet matter molding. Herewith, the cutting tip **503** is kept and maintained on the cutting blade **500** without detachment from the cutting portion **501** of the cutting blade **500**. This is to prevent damage to blade unit **505** which may be caused by a collision during a transfer of the cutting blade **500** through the guide nozzle **201**. The cutting molding unit **100** is applied from Korean Patent No. 80607 issued to the present applicant, and, therefore, the detailed operating description thereof is omitted.

Even if the cutting tip **503**, formed on the cutting blade **500**, is detached from the cutting molding unit **100**, the cutting tip **503** passes through the guide nozzle **201** continuously and thereby there is no cause for its detachment. As shown in FIGS. **2** and **4**, the cutting blade **500** passed through the guide nozzle **201** pierces through the guiding entrance **311** of the fixing body **313**, and then goes out to the outer side of the supporting frames **301***a* and **301***b*.

The cutting blade **500** passing through the guiding entrance **311** contacts with the steel wire spring **350** as shown in FIG. **5**, but the steel wire spring **350** has an elastic force, so it doesn't become an obstacle to pass the cutting blade **500** at all. The steel wire spring **350** is provided to support the cutting blade **500** with the elastic force to dampen or prevent a fluctuation in the cutting blade **500** which may be caused by a sudden stop of the transfer roller **10**. The cutting blade **500** passed through the guiding entrance **311** is then folded in the shape suitable to a molding of the sheet material. In folding the cutting blade **500**, the transfer roller **10** stops and the transferring work of the cutting blade **500** is temporarily in a stopped state. At the same time as the stop of the transfer roller **10**, the second driving unit **420** between the driving units **400** operates first.

If only one cylinder **421** out of the second driving unit **420** falls in the operation, the second driving unit **420** remains situated in a position as shown in FIG. **2**. The folding member **330** of one body with the cylinder **421** is inserted into the guide holes **323***a* and **323***b* inside of the rotary bodies **320***a* and **320***b* as shown in FIGS. **4** and **6**, and is also situated on any one side of the fixing body **313** adjacent to the cutting blade **500**. The guide holes **323***a* and **323***b* are formed on the same position, therefore the folding member **330** is inserted naturally when the cylinder **421** performs the falling operation. When the folding member **330** moved and is completed in moving to the position adjacent the cutting blade **500**, the first driving unit **410** operates. The first driving unit **410** is rotated by driving the servo motor M. By driving the servo motor M, the first toothed portions **411***a* and **411***b* are simultaneously rotated by means of the rotating shaft **418**. By a meshing operation between the first toothed portions **411***a* and **411***b* and the second toothed portions **413***a* and **413***b*, the revolving bodies **320***a* and **320***b* are rotated about a supporting point of the fixing body **310**. When the revolving bodies **320***a* and **320***b* are rotated, the folding member **330** is also rotated. That is, the folding member **330** is rotated and move round a periphery of the fixing body **313** along the guide slot **316***b* from any one side of the fixing body **313** for the folding operation as shown in FIG. **5**. At this time, the moved folding member **330** contacts with the cutting blade **500** which extends through the guiding entrance **311**, thereby the cutting blade **500** is naturally folded by a rotating force of the folding member **330** along a slant face **312** of the fixing body **313**. Meanwhile, the cutting tip **503** put on the cutting blade **500** is automatically separated by a tare and is collected when the cutting blade **500** extends through the outside of the guiding entrance **311**.

Since the servo motor M stops the operation when the cutting blade **500** completes the folding, an immoderate rotation force of the rotary bodies **320***a* and **320***b* connected with the folding member **330** is not required. When the folding work of the cutting blade **500** is completed, the folding member **330** returns to an original position by an operation of the cylinder **421** of the second driving unit **420** as shown in FIG. **2**. When the transfer roller **10** begins to operate again, the cutting blade **500** moves to the outer side of the guiding entrance **311** of the fixing body **313**. While in that position, if a need exists to fold a predetermined unit of the cutting blade **500** in a direction opposite that which was described above, an operation of the transfer roller **10** stops, and at the same time the other folding member **330** falls and moves, and then the same steps as discussed above are repeated. As long as the cutting blade **500** is supplied, it may continuously be formed into any desired configuration. In the above-mentioned embodiment, though each step is explained separately for the understanding of the step for the folding work of the cutting blade, all processes such as a supply, a cutting, a folding work of the cutting blade, etc. can be performed by an automation controlled by a computer, etc.

As afore-mentioned, according to the present invention, all works necessary for the rutting and the folding of the cutting blade in the shape corresponding to the sheet material molding are performed in succession by one process with a unified construction, thereby resulting in an improvement of the cutting and folding works of the cutting blade and a productivity increase.

While only certain embodiments of the invention have been specifically described herein, it will apparent that numerous modifications may be made thereto without departing from the spirit and scope of the invention.

What is claimed is:

1. A metallic rule folding apparatus comprising:

a transferring unit for transfer of metallic rule through a passage formed by a guide, said passage defining a path of travel of the metallic rule, said guide having an edge defined by two intersecting surfaces;

a rotary assembly having first and second rotary bodies spaced to receive metallic rule therebetween, and one or more elongate member mounted for movement between a stowed position where said one or more elongate member is disposed to not cross the path of travel of said metallic rule and a deployed position where said one or more elongate member is disposed to cross the path of travel of said metallic rule; and

said rotary assembly configured for arcuate motion relative to said edge of said guide, to concomitantly move the first and second rotary bodies and the deployed one or more elongate member from a first position toward at least one second position to engage a portion of the metallic rule against said edge of said guide, wherein the one or more elongate member and said edge of said guide cause the folding of the portion of the metallic rule.

2. The apparatus as in claim **1**, comprising two elongate members.

3. The apparatus as in claim **1**, wherein the first rotary body and the second rotary body are coupled to the one or more elongate member to move in concert around the guide and cause the folding of a portion of said metallic rule.

4. The apparatus as in claim 1, wherein the one or more elongate member, when deployed and moved from the first position toward the second position, includes a first portion coupled to the first rotary body to contact a top portion of the metallic rule and a second portion coupled to the second rotary body to contact a bottom portion of the metallic rule to fold the metallic rule.

5. The apparatus as in claim 1, wherein said metallic rule is a cutting blade.

6. The apparatus as in claim 1, wherein said one or more elongate member has an edge formed by an intersection of at least two sides for engaging the edge against the metallic rule.

7. The apparatus as in claim 1, further including a drive member having a shaft and first and second toothed members coupled to the shaft, said first and second toothed members being connected to the first and second rotary bodies so that rotation of the drive member causes corresponding rotation of the first and second tooth members and the first and second rotary bodies.

8. A method of folding metallic rule, comprising the steps of:

transferring metallic rule through a passage formed by a guide, said passage defining a longitudinal axis, said guide having an edge defined by two intersecting surfaces;

providing a rotary assembly having first and second rotary bodies spaced to receive metallic rule therebetween, and one or more elongate member mounted for movement between a stowed position and a deployed position; and

rotating said rotary assembly including said first and second rotary bodies and said one or more elongate member in an arcuate motion relative to and around said edge of said guide from a first position toward at least one second position to engage a portion of the metallic rule with the one or more elongate member in the deployed position, wherein the one or more elongate member and said edge of said guide cause the folding of the portion of the metallic rule.

9. The method according to claim 8, wherein said step of rotating said rotary assembly includes rotating two elongate members from the first position on one side of said guide toward the second position on another side opposite said one side of said guide.

10. The method according to claim 8, wherein the one or more elongate member is coupled to the first and second rotary bodies to concomitantly rotate with the first and second rotary bodies from a first common position to a second common position to fold the portion of the metallic rule.

11. The method according to claim 8, wherein during the step of rotating said rotary assembly and the one or more elongated member being in the deployed position, the first rotary body rotates to effect folding a top portion of the metallic rule and the second rotary body rotates to effect the folding of a bottom portion of said metallic rule.

12. The method according to claim 8, wherein an edge portion of said one or more elongate member formed by an intersection of at least two sides engages the metallic rule against the guide to fold the metallic rule.

13. A folding apparatus for folding metallic rule, comprising:

a guide having a passage for passing metallic rule and an edge portion defined by two intersecting surfaces, said passage defining a longitudinal plane;

one or more elongate member mounted for movement between a retracted position and an extended position; and

a rotary assembly having first and second rotary bodies spaced to receive metallic rule therebetween, said one or more elongate member being disposed to cross the longitudinal plane and to contact the metallic rule when in the extended position and when said rotary assembly moves in an arcuate motion relative to and around said edge portion of said guide to move said one or more elongate member concomitantly with the first and second rotary bodies from a first position toward at least one second position, wherein the one or more elongate member and said edge of said guide cause the folding of said metallic rule.

14. The apparatus as in claim 13, wherein when said one or more elongate member is in a retracted position, said one or more elongate member is disposed clear of the longitudinal plane so that said one or more elongate member cannot contact the metallic rule.

15. The apparatus as in claim 13, wherein the one or more elongate member is coupled to the first and second rotary bodies to concomitantly rotate with the first and second rotary bodies from a first common position to a second common position to fold the portion of the metallic rule.

16. The apparatus as in claim 13, wherein said one or more elongate member is coupled to the first rotary body and the second rotary body to effect folding of a top portion of said metallic rule when the first rotary body rotates and to effect folding of a bottom portion of said metallic rule when the second rotary body rotates.

17. The apparatus as in claim 13, wherein said one or more elongate member has an edge formed by an intersection of at least two sides for engaging the metallic rule against the guide.

18. The apparatus as in claim 13, wherein said metallic rule is a cutting blade.

19. The apparatus as in claim 13, further including a drive motor coupled to a shaft which in turn is coupled to first and second rotary toothed members, said first and second rotary toothed members being connected to the first and second rotary bodies so that rotation of the drive member causes corresponding rotation of the first and second tooth members and the first and second rotary bodies.

20. A folding apparatus for folding metallic rule, comprising:

a guide having a passage for passing metallic rule and an edge portion defined by two intersecting surfaces, said passage defining a longitudinal plane;

one or more elongate member mounted for movement between a reacted position and an extended position; and

a rotary assembly having first and second rotary bodies spaced to receive metallic rule therebetween, said one or more elongate member being coupled to the first rotary body to effect folding of a top portion of the metallic rule proximal to the first rotary body and coupled to the second rotary body to effect folding of a bottom portion of the metallic rule proximal to the second rotary body when said rotary assembly moves in an arcuate motion relative to and around said edge portion of guide to move said one or more elongate member in concert with the first and second rotary bodies from a first position toward at least one second position, wherein the one or more elongate member and said edge of said guide cause the folding of said metallic.

21. The folding apparatus as in claim **20**, wherein the edge portion of the guide against which the metallic rule contacts when the metallic rule is being folded is shaped to form an angle greater than 90 degrees relative to the longitudinal plane.

22. The folding apparatus as in claim **20**, wherein the edge portion of the guide against which the metallic rule contacts when the metallic rule is being folded is shaped to produce a V-shaped folded metallic rule.

23. The apparatus as in claim **20**, further including a drive motor coupled to a shaft which in turn is coupled to first and second rotary toothed members, said first and second rotary toothed members being connected to the first and second rotary bodies so that rotation of the drive member causes corresponding rotation of the first and second tooth members and the first and second rotary bodies.

* * * * *