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SEOUL LASER DIEBOARD SYSTEM CO. LTD.

UNITED STATES DISTRICT COURT

FOR THE SOUTHERN DISTRICT OF CALIFORNIA

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

Plaintiff,

v.

TAIPUSHENG TECHNOLOGY CO. LTD, a Chinese company limited,

Defendant.

Case No. **'16CV0519 MMAJMA**

COMPLAINT FOR:

(1) INFRINGEMENT OF U.S. PATENT NO. 6,128,940;
(2) INFRINGEMENT OF U.S. PATENT NO. 5,870,919;
(3) INFRINGEMENT OF U.S. PATENT NO. 6,405,574;
(4) INFRINGEMENT OF U.S. PATENT NO. 5,787,750;
(5) INFRINGEMENT OF U.S. PATENT NO. 7,694,543; AND
(6) INFRINGEMENT OF U.S. PATENT NO. 8,327,679.
(7) TRADEMARK INFRINGEMENT

DEMAND FOR JURY TRIAL

Plaintiff SEOUL LASER DIEBOARD SYSTEM CO. LTD ("SDS"), by and through its attorneys, for this Complaint against Defendant TAIPUSHENG TECHNOLOGY CO., LTD ("TPS"), alleges as follows:

I. NATURE OF THE ACTION

1. This is an action for: 1) patent infringement and 2) trademark

infringement.

2. Defendant TPS has infringed, continues to infringe, contribute to the infringement of, and/or actively induces others to infringe Seoul Laser Dieboard System Co. Ltd.'s US Patent No. 6,128,940 (the "'940 Patent"), US Patent No. 5,870,919 (the "'919 Patent"), US Patent No. 6,405,574 (the "'574 Patent"), US Patent No. 5,787,750 (the "'750 Patent"), US Patent No. 7,694,543 (the "'543 Patent") and US Patent No. 8,327,679 (the "'679 Patent") (collectively the patents-in-suit)

3. Defendant TPS has infringed, continues to infringe contribute to the infringement of, and/or actively induces others to infringe Seoul Laser Dieboard System Co. Ltd.'s trademarks for CHANNELBENDER, CHANNEL BENDER and SDS.

II. JURISDICTION

4. This action arises under the patent laws 35 U.S.C. §§ 271 *et seq.*, under the Lanham Act, 15 U.S.C. §§ 1121, 1116, 1125(a), and 1125(d), et seq., and related claims. Accordingly, this Court has jurisdiction of this civil action under and by virtue of 28 U.S.C. §§ 1331, 1338, 35 U.S.C. §§ 271 *et seq*. and pursuant to the doctrine of supplemental jurisdiction under 28 U.S. Code § 1367.

5. This Court also has jurisdiction pursuant to 28 U.S.C. § 1332 as there is complete diversity between Plaintiff SDS, a Korean entity and Defendant TPS, a Chinese entity, and the amount in controversy exceeds $75,000, exclusive of interest and costs.

III. VENUE

6. Venue is proper in this judicial district pursuant to 28 U.S.C. §§ 1391(b) and (c) and 1400 (b) because the Defendant TPS sells and is attempting to sell products and services to clients in the State of California and in this judicial district.

IV. THE PARTIES

7. 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 at 10035 Carroll Canyon Rd., San Diego, California 92131. SDS is registered to do business in California.

8. Plaintiff is informed and believes, and based thereon alleges, that Defendant TPS is, and all times herein mentioned was, a Chinese company limited duly organized and existing under and by virtue of the laws of the Country of China and conducts business in the United States through the internet which reaches California.

V. FACTS

9. 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.

10. With the sale of its machines including the ChannelBender, SDS has captured and maintained a large share of the U.S market for dieboard and channel letter bending machines. The SDS machines, including the ChannelBender and EasyBender machines are well-known in commerce. In light of this, Defendant TPS is very familiar with SDS's products and the patents which cover these products.

11. On April 8, 2015 SDS sent TPS a cease and desist letter. TPS responded to this letter via email on May 1, 2015 asking to take a license. SDS is not willing to grant a patent license to TPS.

12. On information and belief, Defendant TPS is, and at all times relevant to the matters alleged in this Complaint was also involved in the machine tooling business and makes, uses, sells and offers for sale certain machine tools for bending metallic material including the TPS-S8700, TPS-S8900 and TPS-S9700 machines and others listed on its website http://www.tps2008.com.

A. The SDS Patents

13. Since its inception in the Republic of Korea, SDS has become a leading company specializing in technologies relating to the bending and cutting of metal.

14. Since its inception, SDS has committed significant resources to innovation in technologies relating to the bending and cutting of metal. As a direct result of the exceptional creativity and the significant resources invested in research and development, SDS has attained a broad spectrum of patents in technologies related to the bending and cutting of metal, in the US and in other parts of the world. SDS is the owner or assignee of all rights, title, and interest in the six US patents involved in this action.

15. 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 present and past infringements. (Attached as Exhibit "1" is a true and correct copy of the '940 Patent and a related assignment)

16. 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 present and past infringements. (Attached as Exhibit "2" is a true and correct copy of the '919 Patent and a related assignment)

17. 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 present and past infringements. (Attached hereto as Exhibit "3" is a true and correct copy of the '574 Patent and a related assignment)

18. SDS is the current assignee of United States Letters Patent No. 5,787,750 (the "'750 Patent") entitled "Folding System for a Cutting Blade," which

issued to inventor Byung-Jun Song on August 4, 1998. SDS's rights in and to the '750 Patent include the right to sue for present and past infringements. (Attached as Exhibit "4" is a true and correct copy of the '750 Patent and a related assignment)

19. SDS is the current assignee of United States Letters Patent No. 7,694,543 (the "'543 Patent") entitled "Folding System" which issued to inventor Byung-Jun Song on April 13, 2010. SDS's rights in and to the '543 Patent include the right to sue for present and past infringements. (Attached as Exhibit "5" is a true and correct copy of the '543 Patent)

20. SDS is the current assignee of United States Letters Patent No. 8,327,679 (the "'679 Patent") entitled "Folding System for a Cutting Blade" which issued to inventor Byung-Jun Song on December 11, 2012. SDS's rights in and to the '679 Patent include the right to sue for present and past infringements. (Attached as Exhibit "6" is a true and correct copy of the '679 Patent)

21. 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, the '574 Patent, the '750 Patent, the '543 Patent, and the '679 Patents 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.

22. Due to its significant investment in research and development, as well as its vigilance in licensing and enforcing its intellectual property rights, SDS enjoys the benefits of its a growing intellectual property portfolio in the U.S. and other countries from the '940 Patent, the '919 Patent, the '574 Patent, the '750 Patent, the '543 Patent, and the '679 Patent, as well several additional issue and pending U.S. patents in the area of bending and cutting metal.

23. Without the ability to enforce its wide array of intellectual property rights, SDS would not be able to continue the research and development that has enabled SDS to stand as a leader in technologies relating to the bending and cutting

of metal, and they would not continue to contribute significantly to the development of the industry as a whole.

B. SDS TRADEMARKS

24. Since 1991, SDS KOREA has provided its Products to the consuming public. SDS KOREA has used the trademarks "SDS", "ChannelBender", and "Channel Bender" in United States commerce since 1993.

25. The SDS mark has the United States Patent and Trademark ("USPTO") registration of 3582411. (attached as Exhibit "7") SDS has used its trademark "SDS" to sell its patented machines in the United States since April 30, 1993. SDS sells high quality products which are recognized by the consuming public as SDS machines.

26. Since 2007, SDS has used the trademarks "Channel Bender" and "ChannelBender" in United States commerce. These marks have the United States Patent and Trademark ("USPTO") registration numbers of 4359831 and 4473284. (attached as Exhibit "8" and "9") The SDS products sold under the trademarks "Channel Bender" and "ChannelBender" are the first automated system which will both process and bend steel rule. ChannelBender is a high quality product and is recognized by the consuming public as such.

27. SDS has used its marks "SDS", "Channel Bender" and "ChannelBender" ("Trademarks") on its products, it has further created a unique website, prepared marketing material and press releases, for its products sold under these marks. SDS has also utilized these marks extensively in advertising including television segments, newspaper articles, on the radio, at awards ceremonies, in front of groups during talks at conventions, in PowerPoint presentations, on DVD's, in trade magazine articles and ads, and at charity events.

28. SDS KOREA has spent years promoting its Products under its Trademarks.

29. Defendant further has used the trademark "ChannelBender" on

numerous places on its website and third party websites. Defendants have no rights to utilize Plaintiff's trademarks.

B. TPS's Patent Infringement

30. Rather than innovate and develop its own unique technology that it can use to market and sell its products, Defendant TPS has devoted its efforts to copying SDS's technology, almost in its entirety and employing it in all of their machinery.

31. TPS's slavish imitation of SDS's patents provides TPS with the unique functionality and efficiency in their machinery, without TPS incurring the cost of research and development which SDS has already incurred to attain the same.

32. TPS has not obtained permission from SDS to use its inventions in the identified patents.

C. TPS's Trademark Infringement

33. Plaintiff believes that many of its customers, and potential customers, have been confused as to the difference between Plaintiff and Defendant's product.

34. The natural, probable and foreseeable result of Defendant's wrongful conduct has been to deprive, and it will continue to deprive, Plaintiff of the benefits of selling their products and to deprive Plaintiff of goodwill, and to injure Plaintiff's relations with present and prospective customers.

35. Plaintiff is informed and believes, and based thereon alleges, that they have lost, and will continue to lose, substantial revenues from Defendant's use of the name "ChannelBender." Plaintiff has lost further profits as a result of Defendant's use of the SDS USA name. Defendant's wrongful conduct will also deprive Plaintiff of the opportunity of expanding their goodwill.

36. Plaintiff is informed and believes, and based thereon alleges, that if unless enjoined by this Court, Defendant intends to continue their course of conduct and to wrongfully use, infringe upon, sell and otherwise profit from Plaintiff's tradename, likeness, and marketing strategy.

37. As a direct and proximate result of the acts alleged above, Plaintiff has

already suffered irreparable damage and has suffered lost profits. Plaintiff has no adequate remedy at law to redress all of the injuries that Defendant has caused and intend to cause by its conduct. Plaintiff will continue to suffer irreparable damage and sustain loss of profits until Defendant's actions alleged above are enjoined by this Court.

38. As a direct and proximate result of the acts alleged above, Plaintiff seeks damages to compensate them for lost profits and loss of goodwill that Defendant has caused.

FIRST CLAIM FOR RELIEF

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

39. SDS realleges and incorporates by reference paragraphs 1 through 38 herein above as though the same were set forth in full herein.

40. TPS 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 TPS's Products such as the TPS-S8700, TPS-S8900 and TPS-S9700 machine and other products depicted on TPS's website and sold on third party websites, all without authorization or license from SDS.

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

42. TPS has continued their infringement despite having notice of the '940 Patent. TPS has committed and is committing willful and deliberate patent infringement. On information and belief SDS alleges TPS'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.

43. SDS is informed and believes, and on that basis alleges, that TPS has gained profits by virtue of its infringement of the '940 Patent.

44. As a direct and proximate result of TPS's infringement of the '940 Patent, 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 TPS 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.

SECOND CLAIM FOR RELIEF

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

45. SDS realleges and incorporates by reference paragraphs 1 through 66 herein above as though the same were set forth in full herein.

46. TPS 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 TPS's Products such as the TPS-S8700, TPS-S8900 and TPS-S9700 machine and other products depicted on TPS's website and sold on third party websites, all without authorization or license from SDS.

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

48. TPS has continued their infringement despite having notice of the '940 Patent. TPS has committed and is committing willful and deliberate patent infringement. On information and belief SDS alleges TPS'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.

49. SDS is informed and believes, and on that basis alleges, that TPS has gained profits by virtue of its infringement of the '919 Patent.

50. As a direct and proximate result of TPS's infringement of the '919 Patent, 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 TPS 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.

THIRD CLAIM FOR RELIEF

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

51. SDS realleges and incorporates by reference paragraphs 1 through 72 herein above as though the same were set forth in full herein.

52. TPS 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 TPS's Products such as the TPS-5877, TPS-58900 and TPS-59700 machines and other products depicted on TPS's website and sold on third party websites, all without authorization or license from SDS.

53. On information and belief, SDS alleges Defendants have been, and are currently, infringing the '574 Patent in violation of 35 U.S.C. §271. TPS's acts of infringement include direct infringement and/or infringement under the doctrine of equivalents.

54. TPS has continued their infringement despite having notice of the '574 Patent. TPS has committed and is committing willful and deliberate patent infringement. On information and belief SDS alleges TPS'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.

55. SDS is informed and believes, and on that basis alleges, that TPS has gained profits by virtue of its infringement of the '574 Patent.

56. As a direct and proximate result of TPS's infringement of the '574 Patent, 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 Defendants are 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.

FOURTH CLAIM FOR RELIEF

(Infringement of U.S. Patent No. 5,787,750)

57. SDS realleges and incorporates by reference paragraphs 1 through 78 herein above as though the same were set forth in full herein.

58. TPS has infringed and continues to infringe one or more of the claims of the '750 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 TPS's Products such as the TPS-5877, TPS-58900 and TPS-59700 machines and other products depicted on TPS's website and sold on third party websites, all without authorization or license from SDS.

59. On information and belief, SDS alleges Defendants have been, and are currently, infringing the '574 Patent in violation of 35 U.S.C. §271. TPS's acts of infringement include direct infringement and/or infringement under the doctrine of equivalents.

60. TPS has committed and is committing willful and deliberate patent

infringement. On information and belief SDS alleges TPS'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.

61. SDS is informed and believes, and on that basis alleges, that TPS has gained profits by virtue of its infringement of the '750 Patent.

62. As a direct and proximate result of TPS's infringement of the '750 Patent, 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 Defendants are 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.

FIFTH CLAIM FOR RELIEF

(Infringement of U.S. Patent No. 7,694,543)

63. SDS realleges and incorporates by reference paragraphs 1 through 84 herein above as though the same were set forth in full herein.

64. TPS has infringed and continues to infringe one or more of the claims of the '543 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 TPS's Products such as the TPS-5877, TPS-58900 and TPS-59700 machines and other products depicted on TPS's website and sold on third party websites, all without authorization or license from SDS.

65. On information and belief, SDS alleges Defendants have been, and are currently, infringing the '543 Patent in violation of 35 U.S.C. §271. TPS's acts of infringement include direct infringement and/or infringement under the doctrine of equivalents.

66. TPS has committed and is committing willful and deliberate patent infringement. On information and belief SDS alleges TPS'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.

67. SDS is informed and believes, and on that basis alleges, that TPS has gained profits by virtue of its infringement of the '543 Patent.

68. As a direct and proximate result of TPS's infringement of the '543 Patent, 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 Defendants are enjoined by this Court from continuing its infringement of the '750 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.

SIXTH CLAIM FOR RELIEF

(Infringement of U.S. Patent No. 8,327,679)

69. SDS realleges and incorporates by reference paragraphs 1 through 90 herein above as though the same were set forth in full herein.

70. TPS 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 TPS's Products such as the TPS-5877, TPS-58900 and TPS-59700 machines and other products depicted on TPS's website and sold on third party websites, all without authorization or license from SDS.

71. On information and belief, SDS alleges Defendants have been, and are currently, infringing the '679 Patent in violation of 35 U.S.C. §271. TPS's acts of infringement include direct infringement and/or infringement under the doctrine of

equivalents.

72. TPS has committed and is committing willful and deliberate patent infringement. On information and belief SDS alleges TPS'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.

73. SDS is informed and believes, and on that basis alleges, that TPS has gained profits by virtue of its infringement of the '679 Patent.

74. As a direct and proximate result of TPS's infringement of the '679 Patent, 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 Defendants are enjoined by this Court from continuing its infringement of the '679 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.

SEVENTH CLAIM FOR RELIEF

(Federal Trademark Infringement [15 U.S.C. § 1114])

75. SDS hereby incorporates paragraphs 1 through 32 above by reference as though fully set forth herein.

76. The actions of Defendants described herein constitute infringement of the "Channel Bender", "ChannelBender", and "SDS". Trademarks in violation of section 32(b) of the Lanham Act, 15 U.S.C. § 1114(1).

77. Defendants' willful, deliberate and unauthorized use of the Trademarks has caused confusion and is likely to continue to cause confusion, mistake and deception in that consumers are likely to associate and believe Defendants' goods and services are associated with, connected to, affiliated with, authorized by, endorsed by, and/or sponsored by SDS, in violation of Section 32(b) of the Lanham Act, 15 U.S.C. § 1114(1).

78. As a direct and proximate result of Defendants' unauthorized use of the Trademarks, Defendants have damaged and will continue to damage SDS's goodwill and reputation, and has caused and is likely to continue to cause a loss of sales and profits for SDS. Defendants' actions have caused and will continue to cause irreparable harm to SDS and to the public, who is confused by Defendants' unauthorized use of the Trademarks, unless restrained and enjoined by this Court. SDS has no adequate remedy at law to prevent Defendants from continuing their infringing actions and from injuring SDS.

79. As a further direct and proximate result of Defendants' actions, SDS KOREA has been damaged and will continue to sustain damage and is entitled to receive compensation arising from its lost sales, lost profits, and efforts necessary to minimize and/or prevent customer confusion, in an amount to be proven at the time of trial. In addition, SDS KOREA is entitled to disgorge Defendants' profits, and is entitled to interest and to its attorney's fees and costs incurred bringing this action, all in an amount to be proven at the time of trial. SDS KOREA is further entitled to injunctive relief as set forth above, and to all other and further forms of relief this Court deems appropriate.

80. The damages sustained by SDS as a result of the conduct alleged herein should be trebled in accordance with 15 U.S.C. § 1117(b).

PRAYER FOR RELIEF

WHEREFORE, SDS prays for judgment against TPS as follows:

ON THE FIRST THROUGH SIXTH CAUSES OF ACTION:

1. That judgment be entered against TPS concluding that TPS is willfully infringing Plaintiff SDS's United States Letters Patent Nos. 5,870,919, 6,128,940, 6,405,574 , 5,787,750, 7,694,543 and 8,327,679.

2. That TPS, 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, 6,405,574 , 5,787,750, 7,694,543 and 8,327,679.

3. That judgment be entered for damages, together with prejudgment interest, to compensate Plaintiff SDS for TPS's infringement of United States Letters Patent Nos. 5,870,919, 6,128,940, 6,405,574 , 5,787,750, 7,694,543 and 8,327,679.

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 SDS;

6. That judgment be entered for costs to be awarded to Plaintiff SDS; and

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

ON THE SEVENTH CAUSE OF ACTION

1. For actual damages according to proof at trial;

2. For damages for lost profits and goodwill in a sum according to proof at trial pursuant to 15 U.S.C. § 1125;

3. For an injunction against TPS for the use of the trademarks "Channel Bender", "ChannelBender", and "SDS";

4. For attorney's fees for wrongful willful and deliberate action under 17 U.S.C. § 1051, et seq.;

5. For costs of suit incurred herein; and

6. For such other and further relief as the Court deems just and proper.

DATED: March 1, 2016

PROCOPIO, CORY, HARGREAVES & SAVITCH LLP

By: s/Lisel M. Ferguson
Lisel M. Ferguson
Attorneys for Plaintiff
SEOUL LASER DIEBOARD SYSTEM CO. LTD.

EXHIBIT “1”

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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Plaintiff s Reply to Defendant s First Amended Answer to Second Amended Complaint and Counterclaims, and Plaintiff s Counter–Counterclaims.

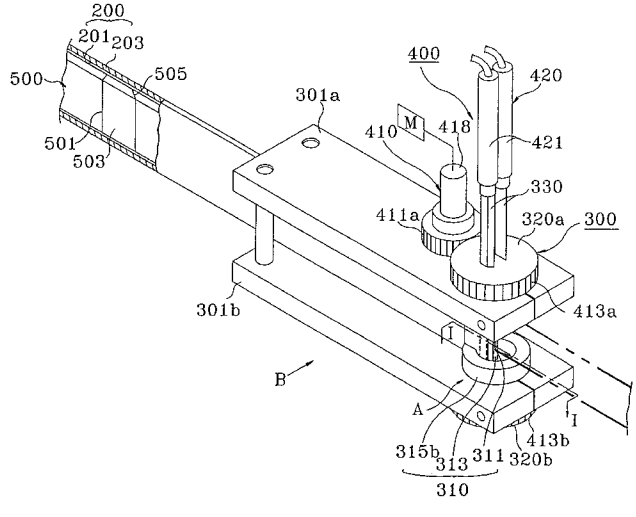
Primary Examiner—Daniel C. Crane

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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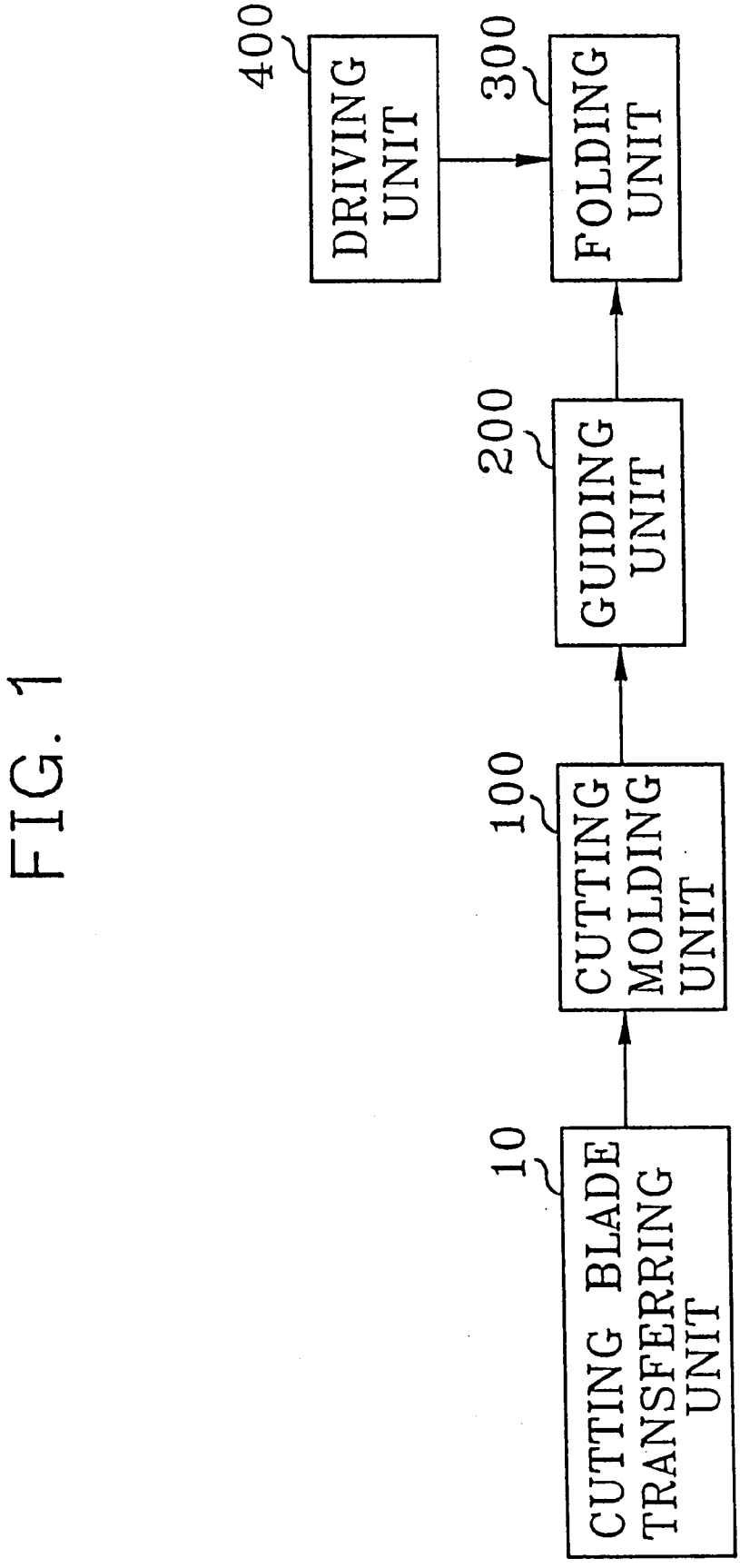

400
DRIVING UNIT
300
FOLDING UNIT
200
GUIDING UNIT
100
CUTTING MOLDING UNIT
10
CUTTING BLADE TRANSFERRING UNIT

FIG. 1

FIG. 2

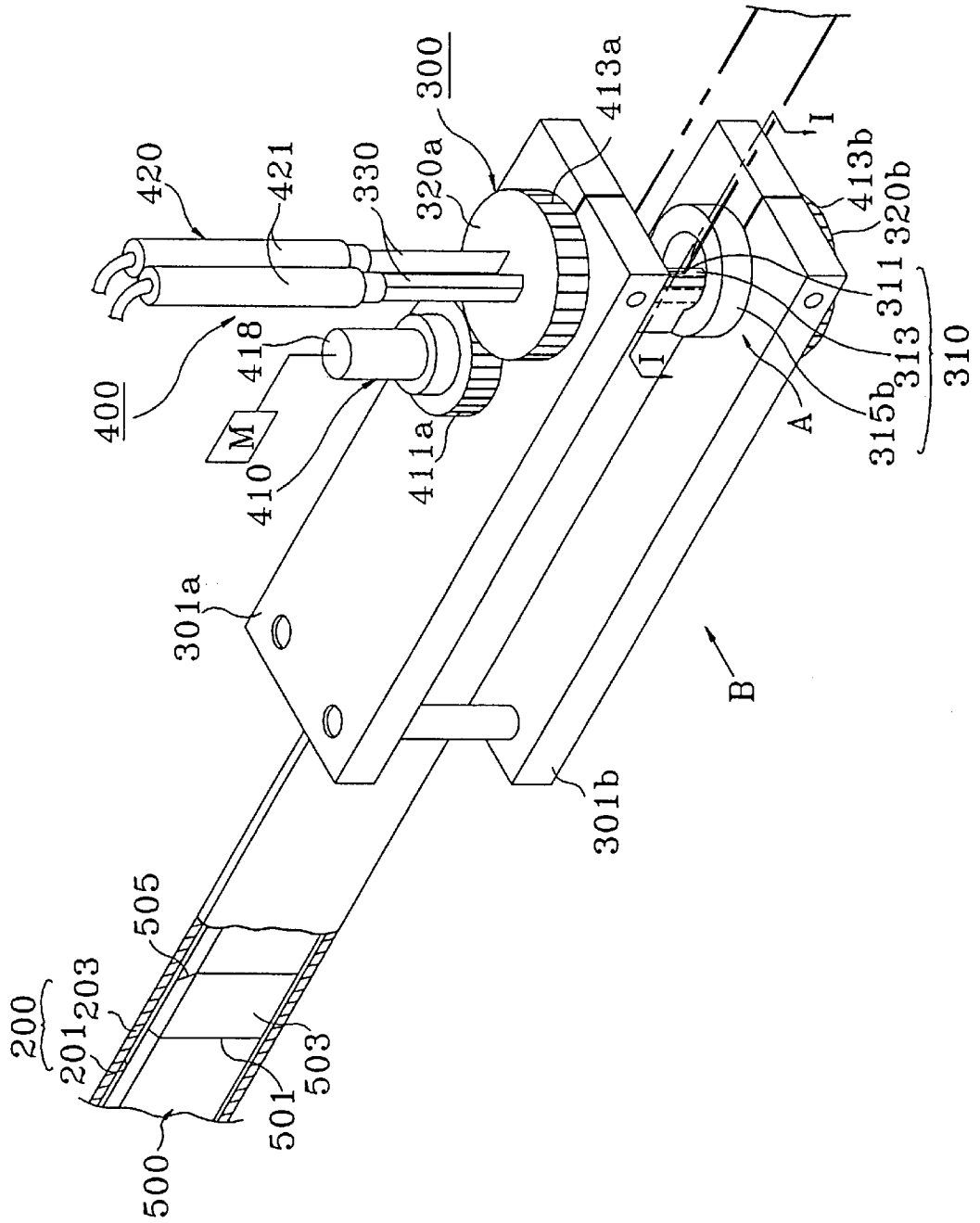

420
421
330
320a
300
413a
I
I
413b
320b
311
313
315b
310
A
400
418
M
410
411a
301a
B
301b
505
200
203
201
503
501
500

FIG. 3

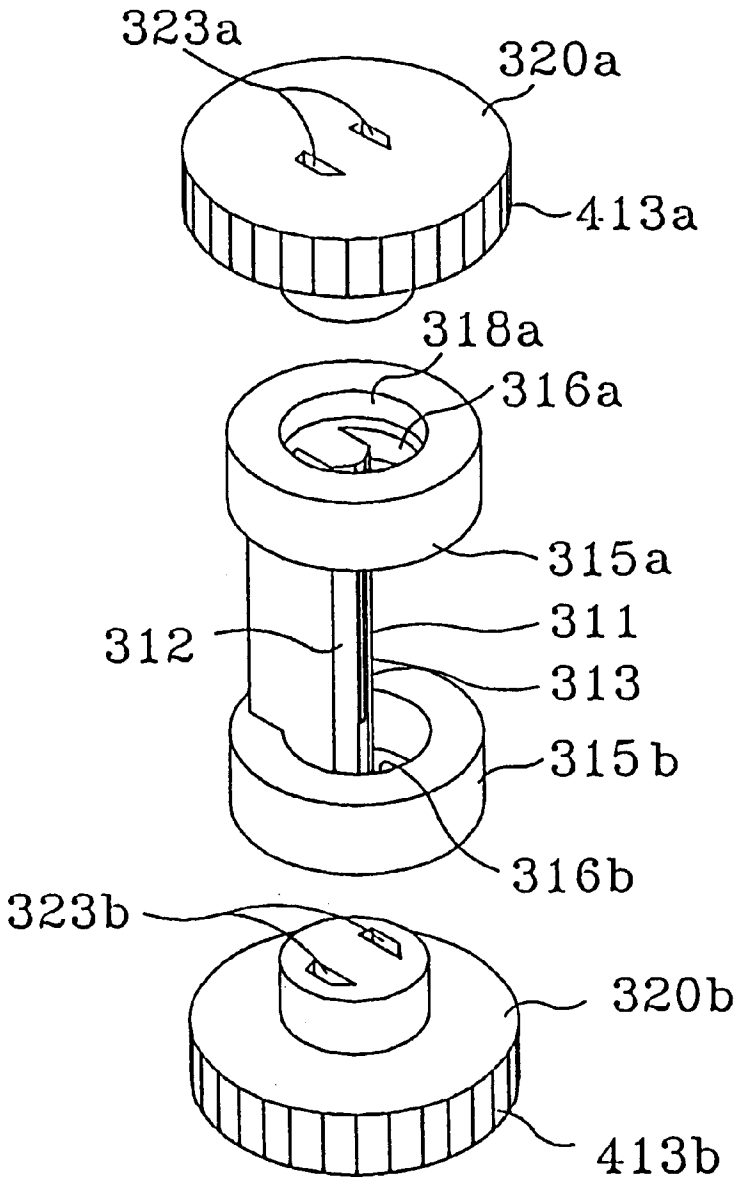

323a
320a
413a
318a
316a
315a
312
311
313
315b
316b
323b
320b
413b

FIG. 4

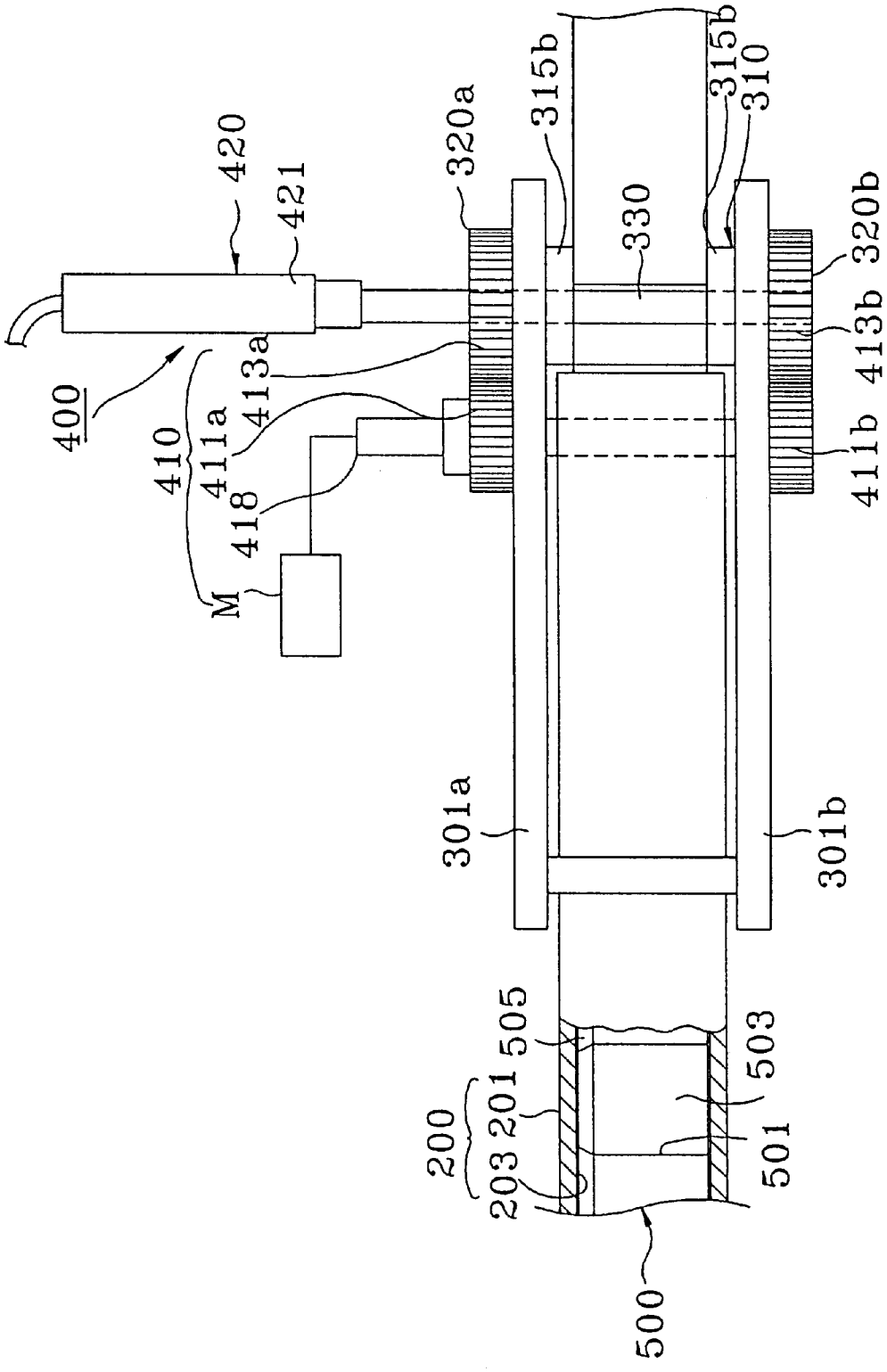

420
421
320a
315b
315b
310
330
320b
413b
411b
400
410
411a
413a
418
M
301a
301b
505
503
200
201
203
501
500

FIG. 6

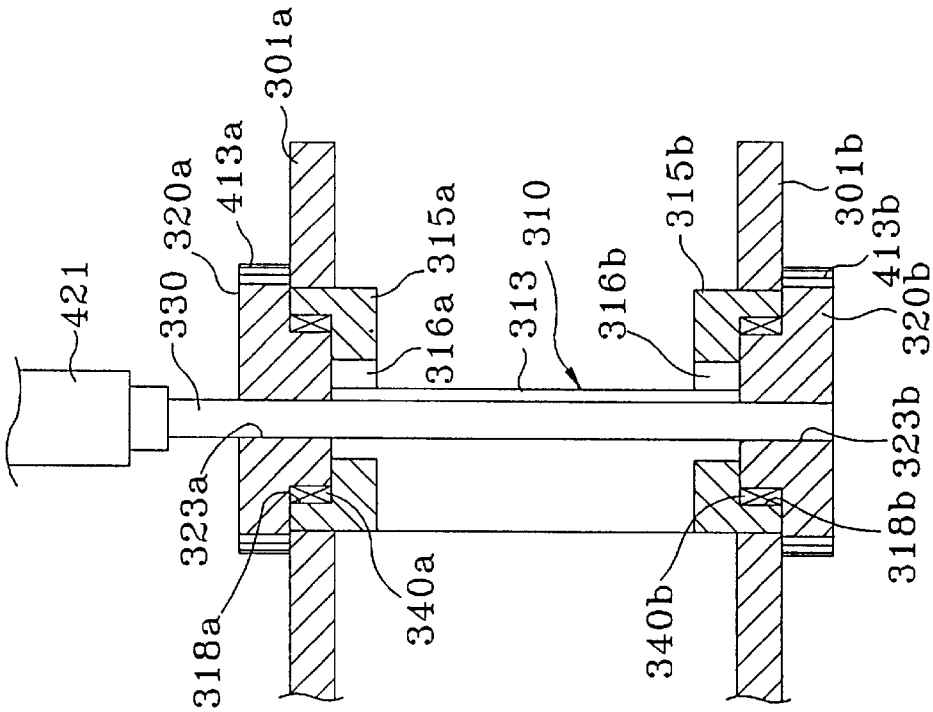
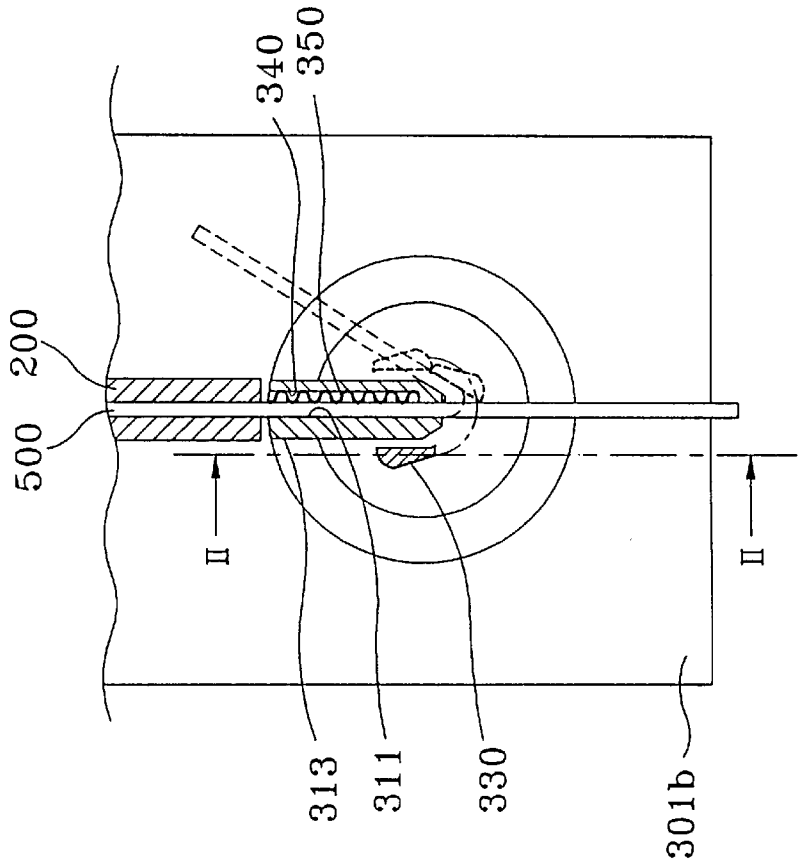

421
330
320a
413a
301a
316a
315a
313
310
316b
315b
301b
413b
320b
323a
323b
318a
318b
340a
340b

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.

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EXHIBIT “2”

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

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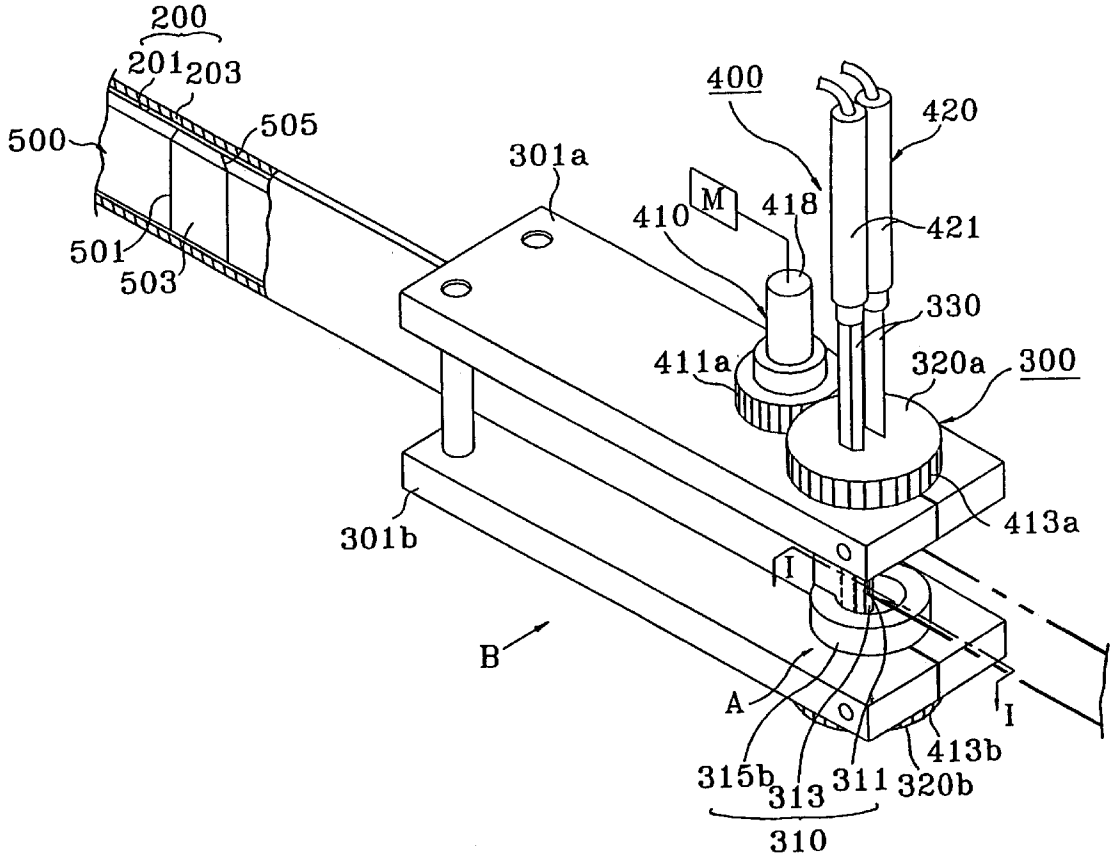
Primary Examiner—Daniel C. Crane

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.

12 Claims, 5 Drawing Sheets



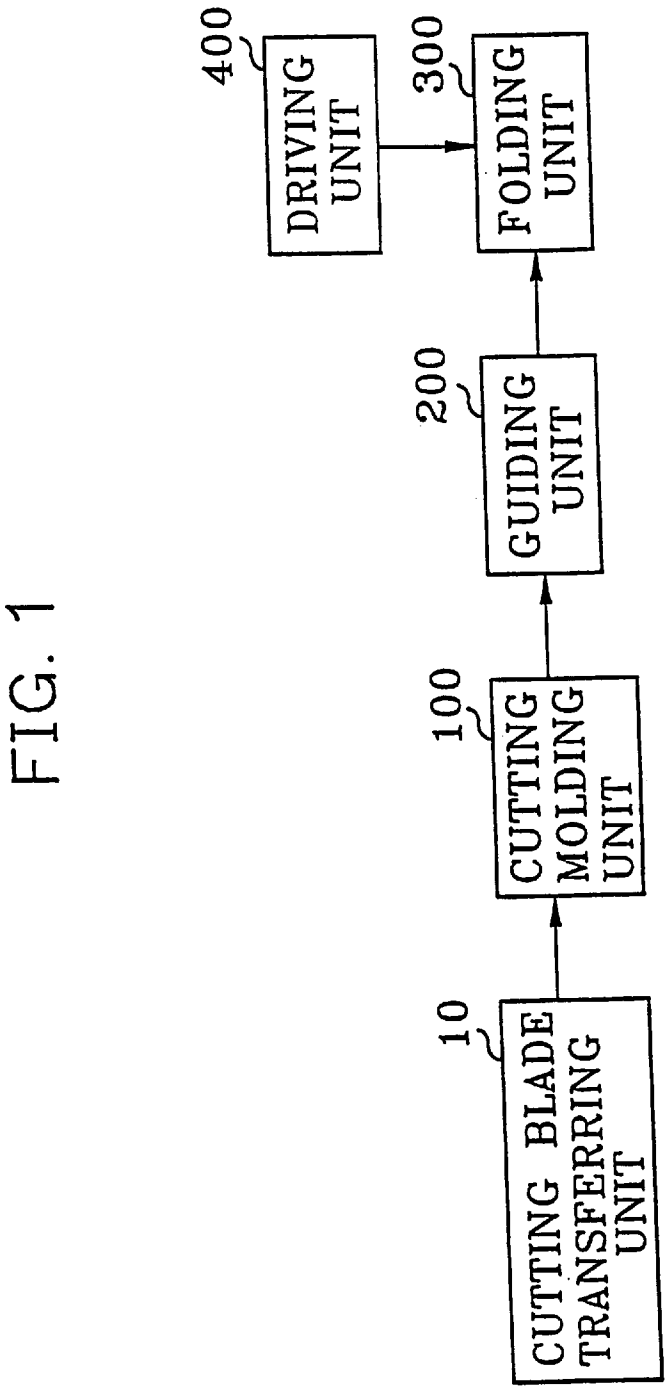

400
DRIVING UNIT
300
FOLDING UNIT
200
GUIDING UNIT
100
CUTTING MOLDING UNIT
10
CUTTING BLADE TRANSFERRING UNIT

FIG. 1

FIG. 2

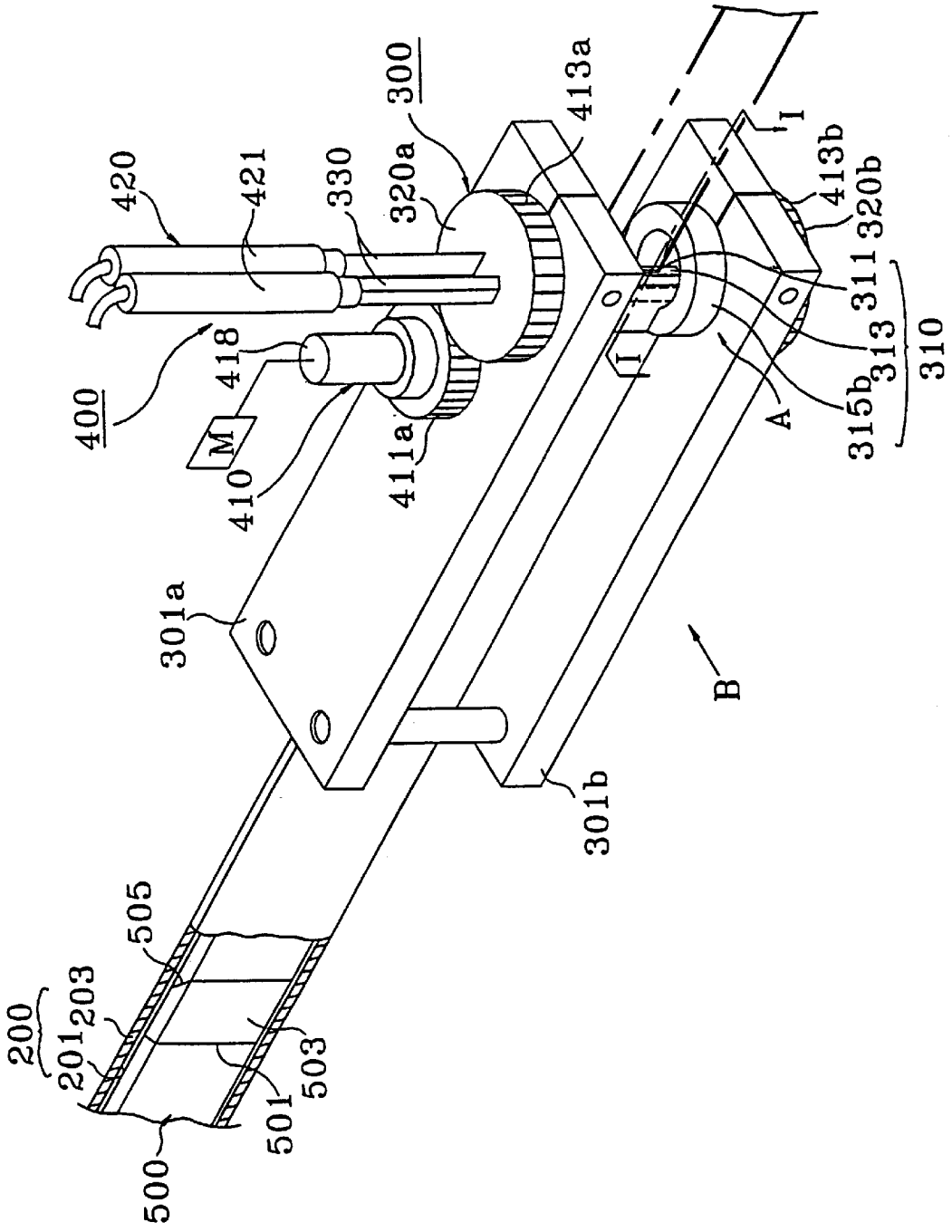

420
421
330
320a
300
413a
I
413b
320b
311
313
310
315b
A
400
418
M
410
411a
301a
B
301b
505
200
201
203
503
501
500

FIG. 3

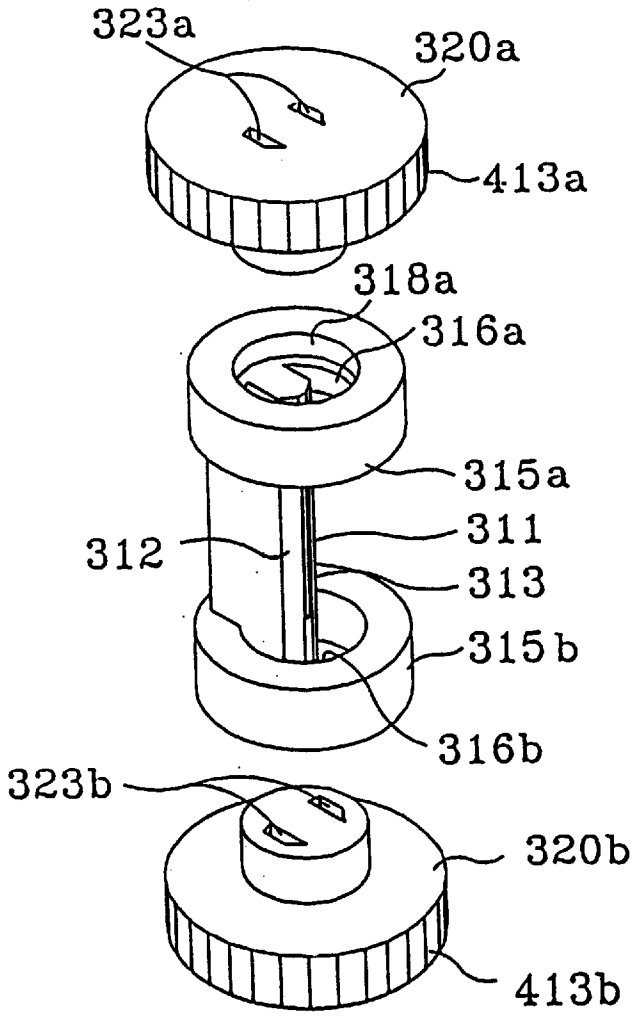

323a
320a
413a
318a
316a
315a
311
312
313
315b
316b
323b
320b
413b

FIG. 4

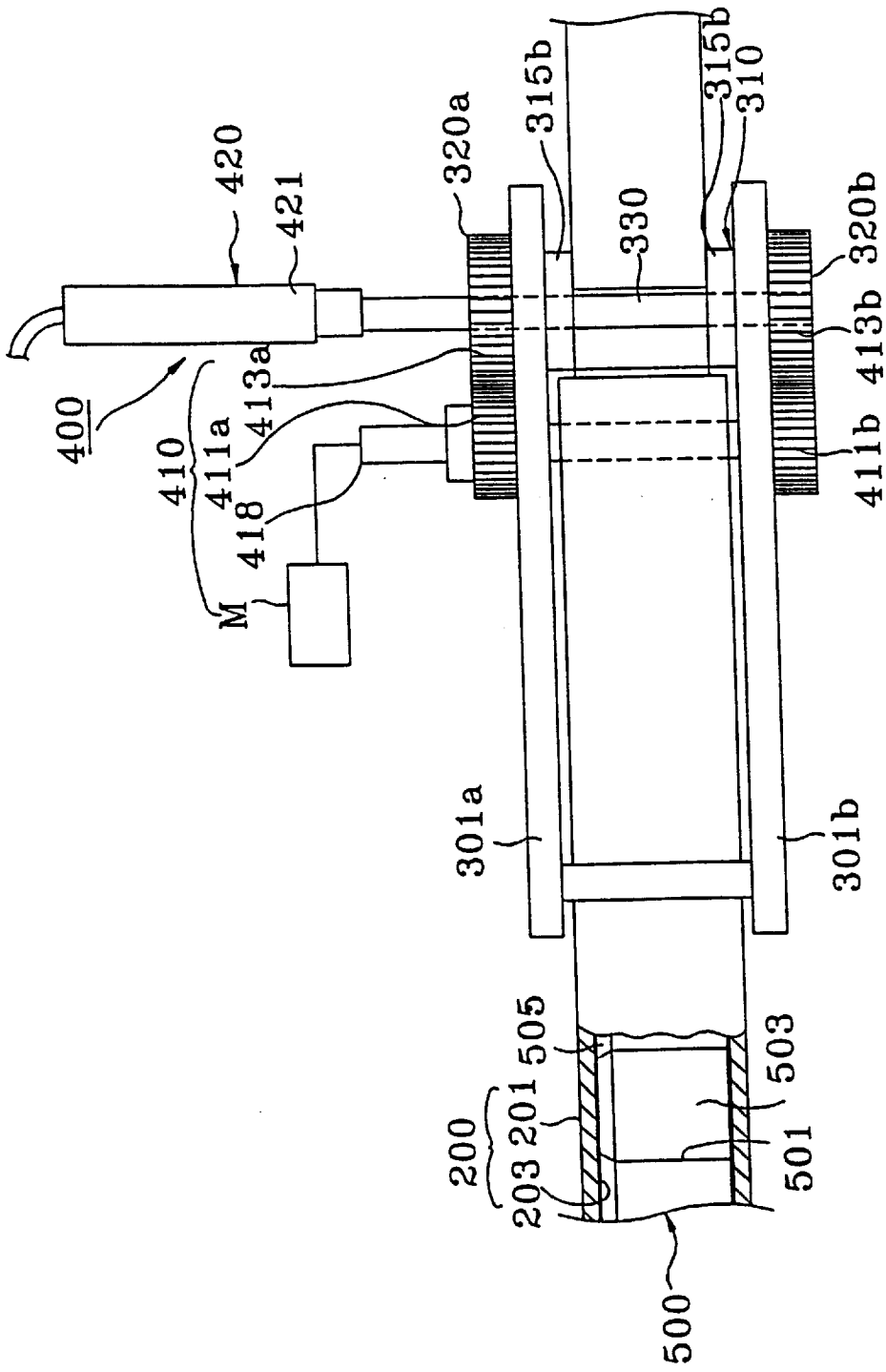

420
421
320a
315b
315b
310
330
320b
413b
411b
400
410
411a
413a
418
M
301a
301b
505
503
200
201
203
501
500

FIG. 6

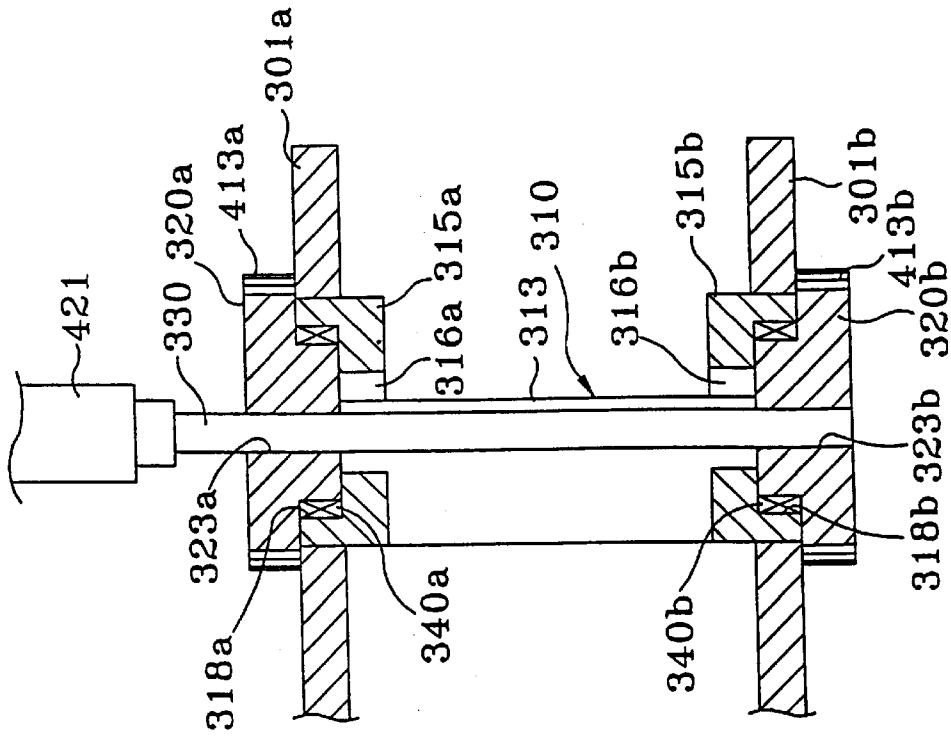
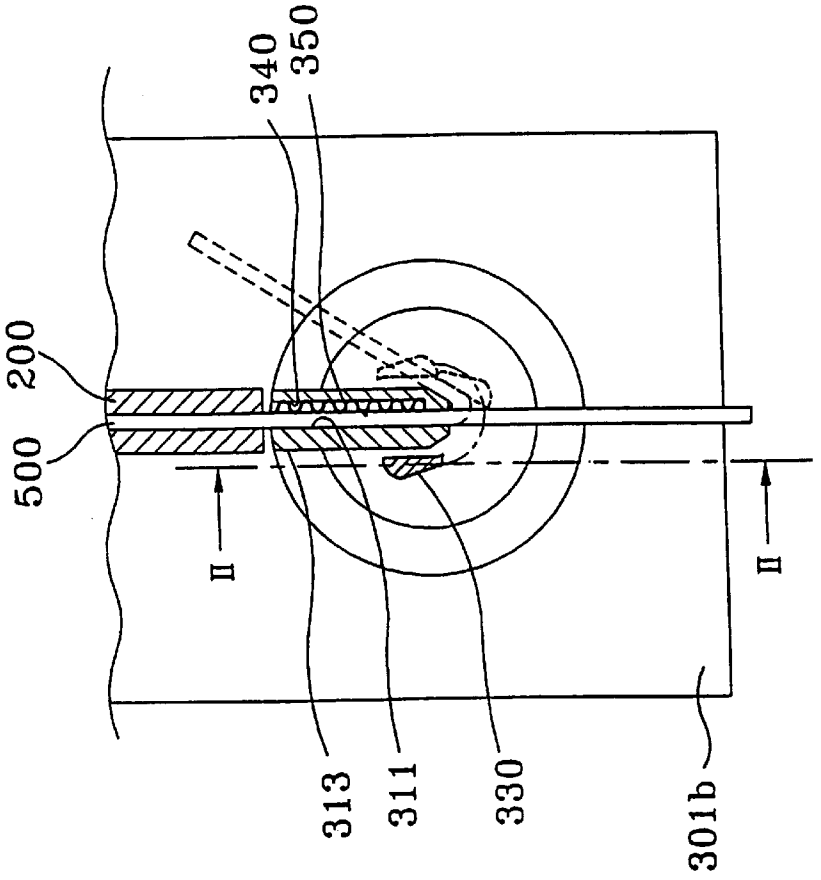

301a
413a
320a
330
421
316a
315a
313
310
316b
315b
301b
413b
320b
323b
318b
323a
318a
340a
340b

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. 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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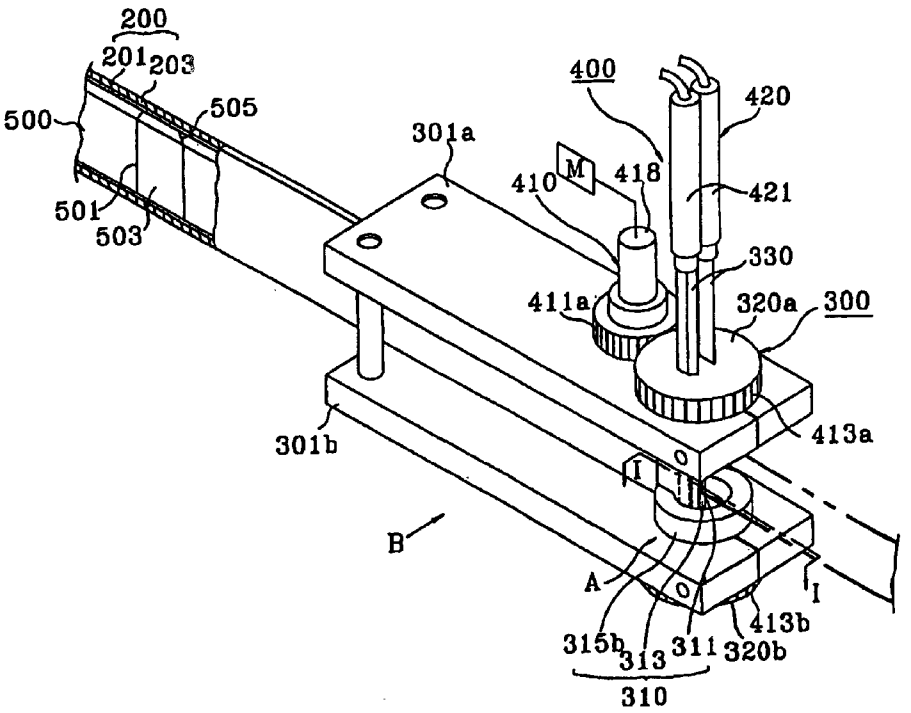
Primary Examiner—Lowell A. Larson

(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.

* * * * *

EXHIBIT “3”

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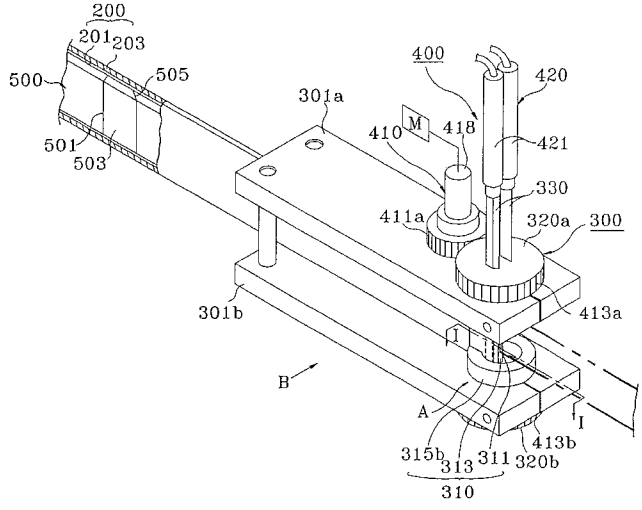
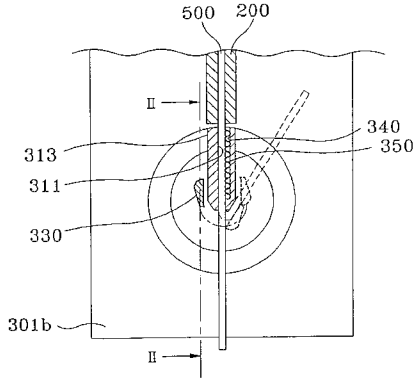
Primary Examiner—Daniel C. Crane
(74) *Attorney, Agent, or Firm*—F. Chau & Associates LLP

(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





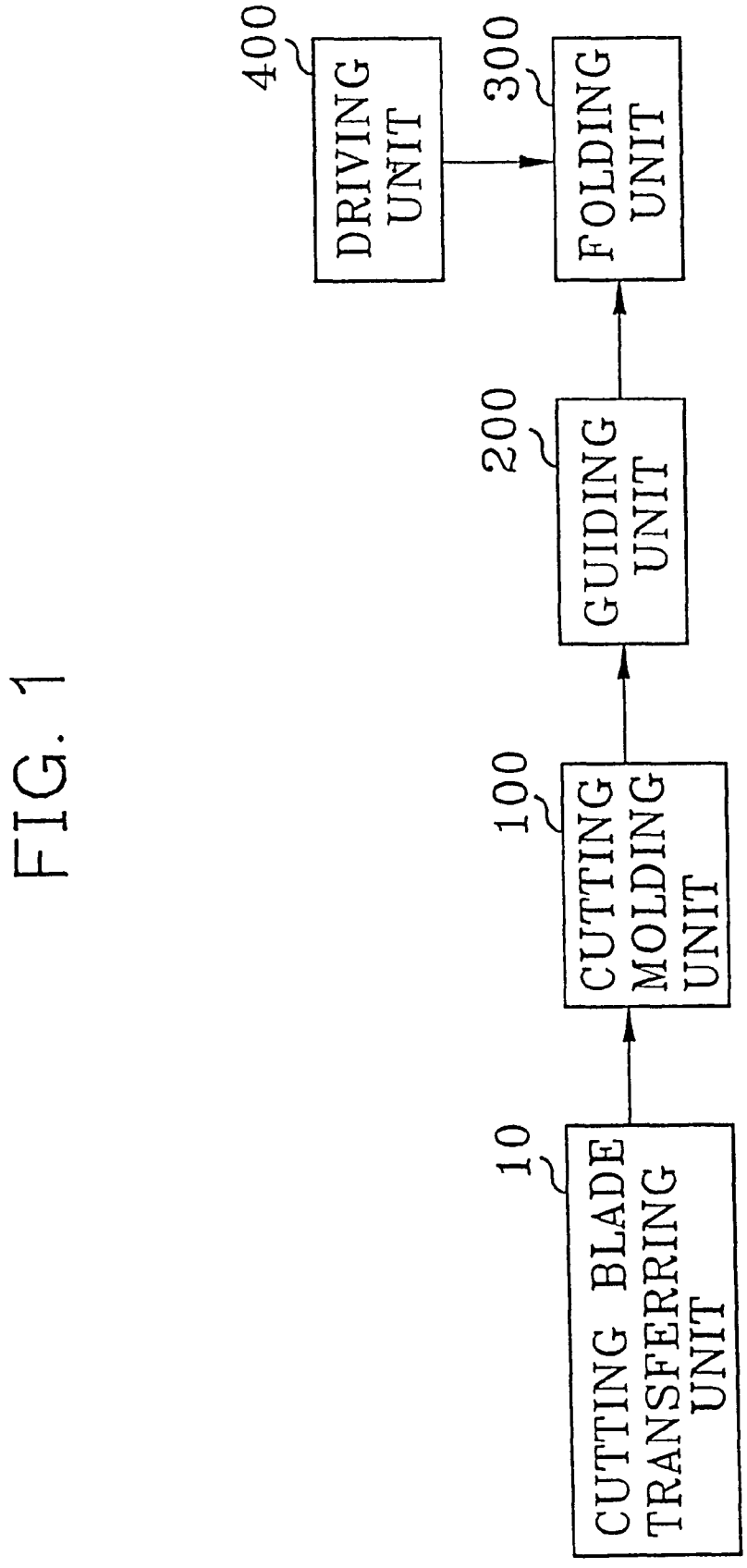

400
DRIVING UNIT
300
FOLDING UNIT
200
GUIDING UNIT
100
CUTTING MOLDING UNIT
10
CUTTING BLADE TRANSFERRING UNIT

FIG. 1

FIG. 2

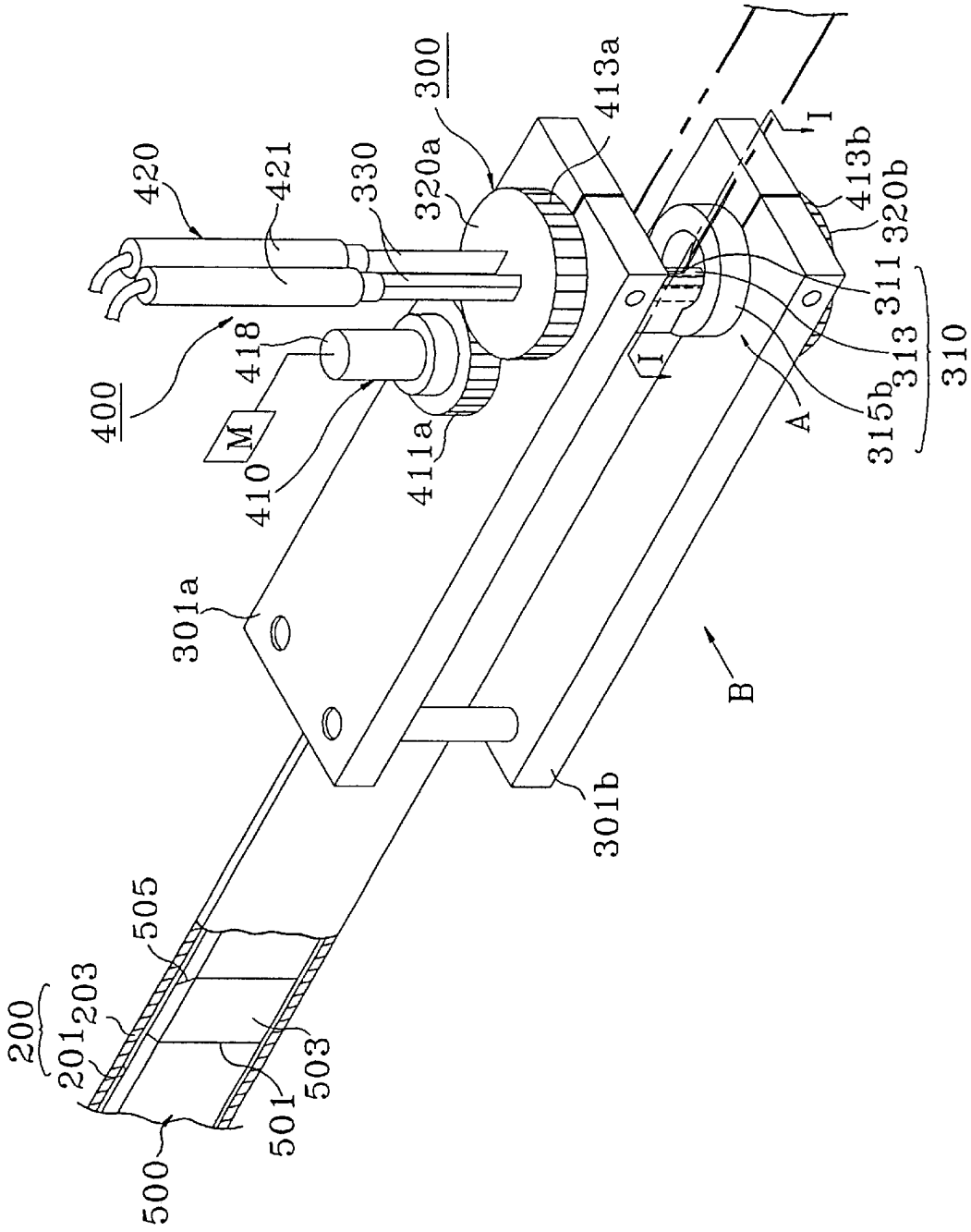

300
413a
420
421
330
320a
413b
320b
311
313
315b
310
400
418
M
410
411a
I
I
A
B
301a
301b
505
200
201
203
503
501
500

FIG. 3

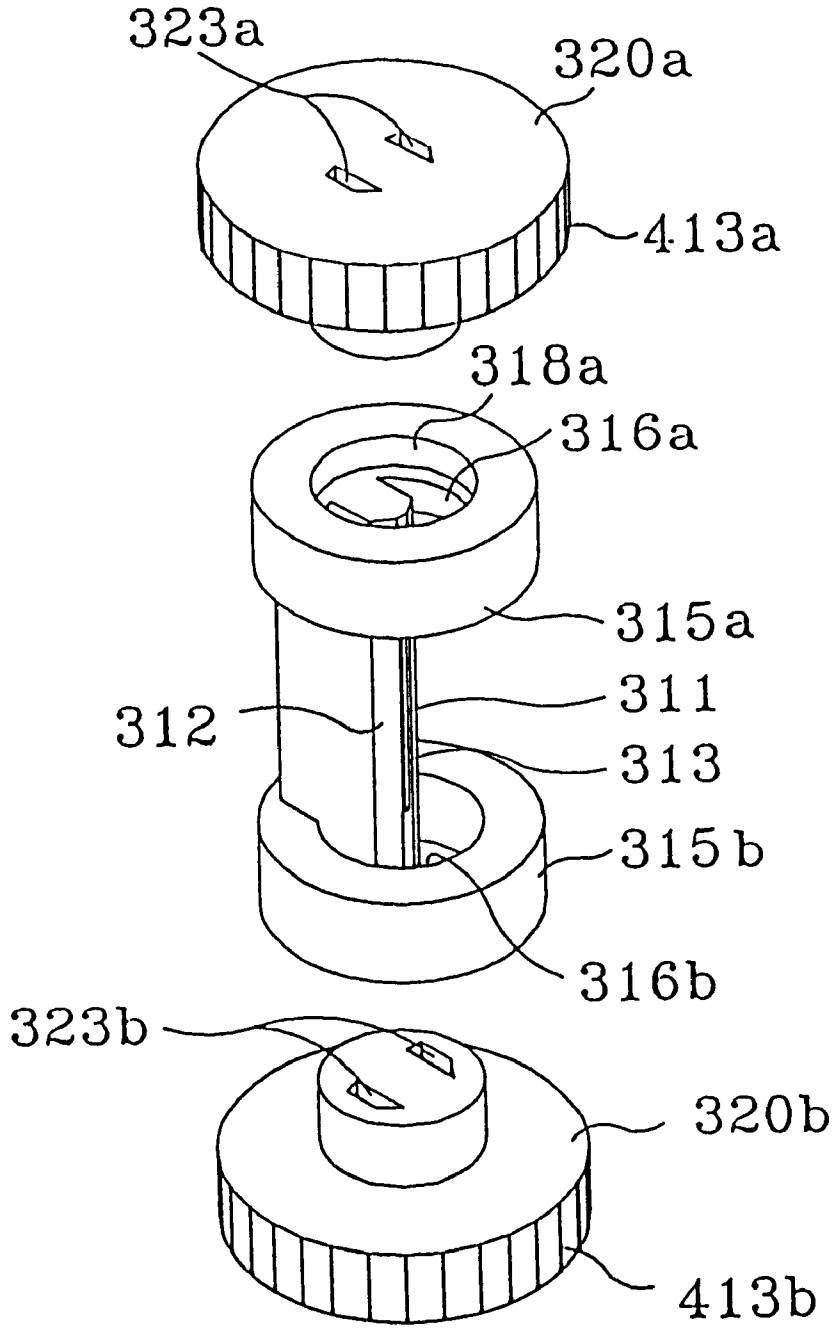

323a
320a
413a
318a
316a
315a
312
311
313
315b
316b
323b
320b
413b

FIG. 4

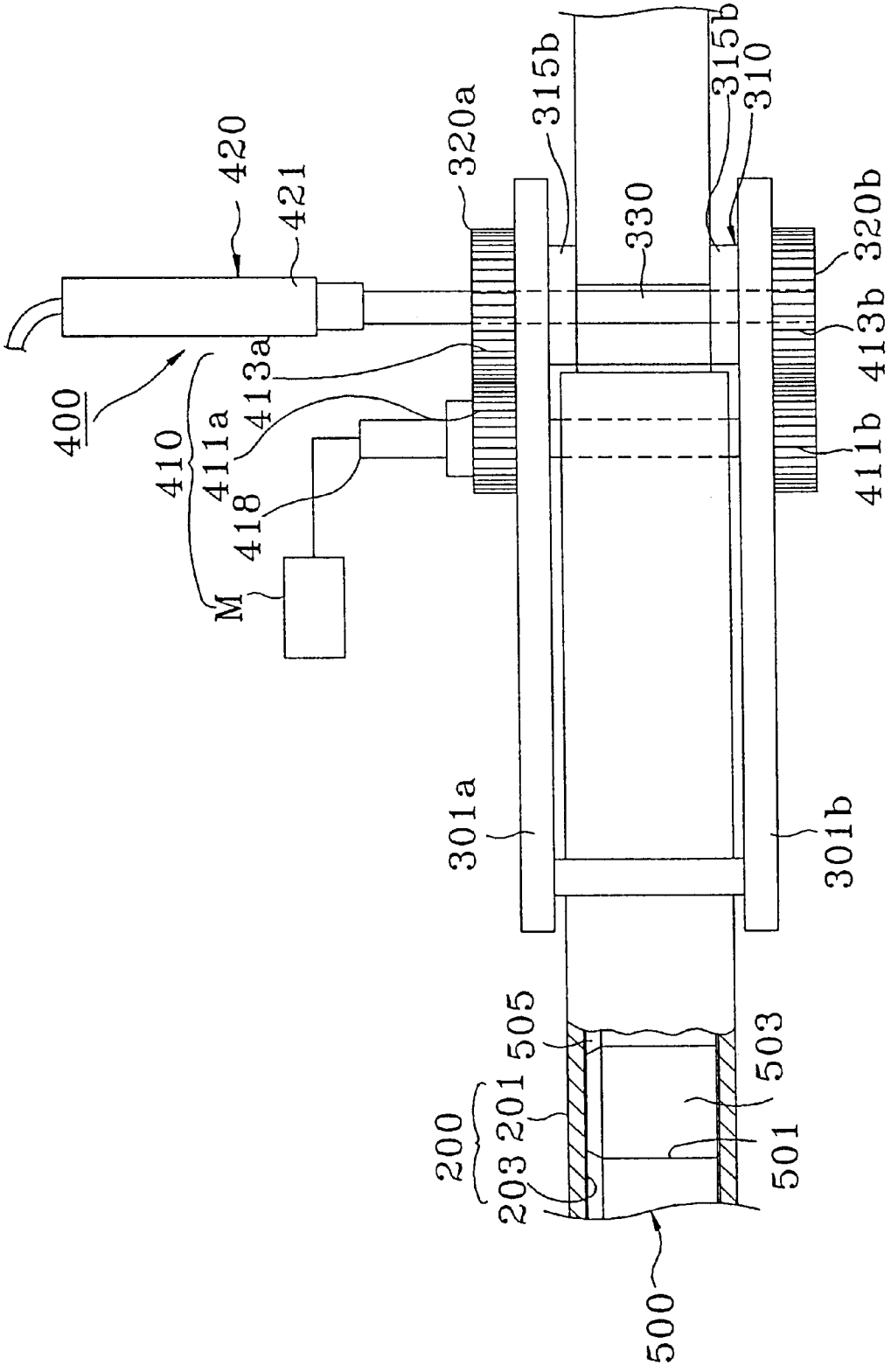

420
421
320a
315b
315b
310
330
320b
413b
411b
400
410
411a
413a
418
M
301a
301b
505
503
201
200
203
501
500

FIG. 6

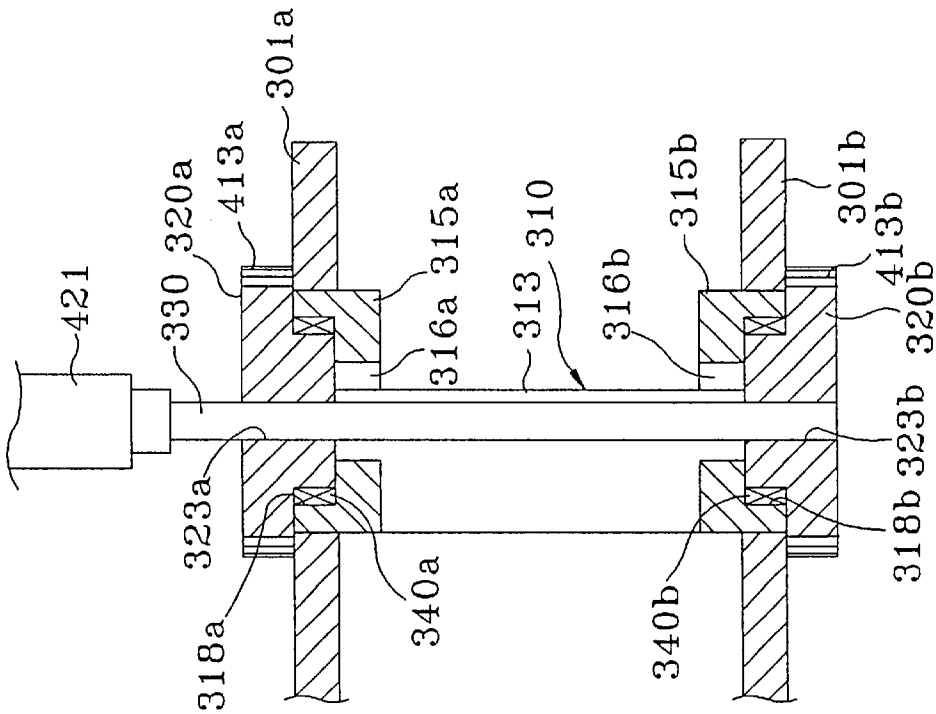
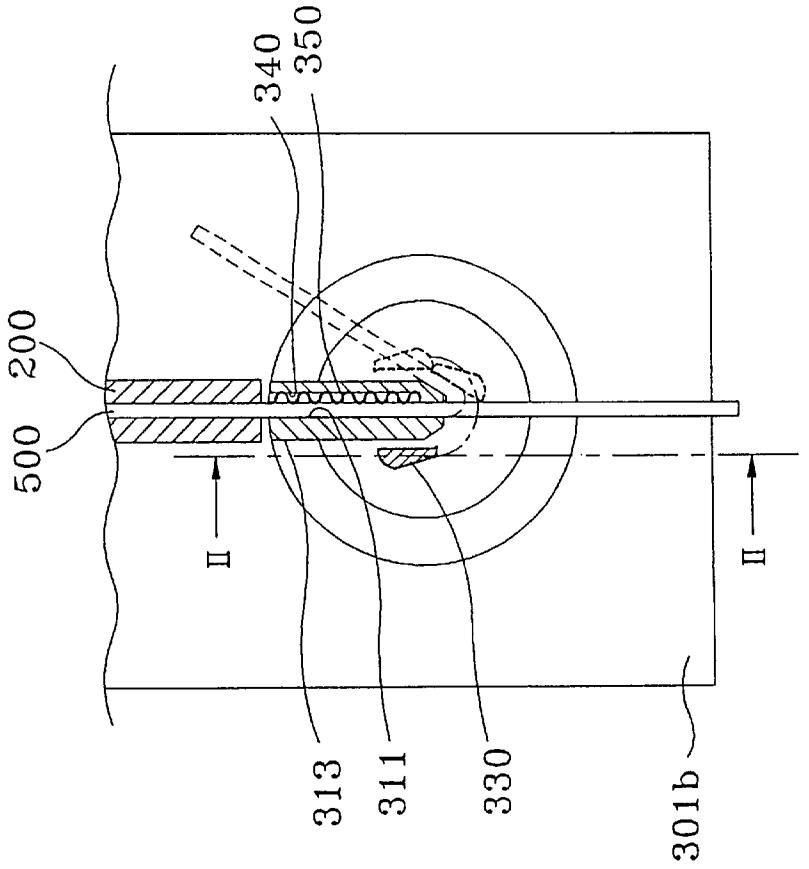

301a
413a
320a
330
421
315a
316a
313
310
316b
315b
301b
413b
320b
323a
318a
340a
340b
323b
318b

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 elongatc 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.

* * * * *

EXHIBIT “4”

US005787750A

United States Patent [19]

Song

[11] Patent Number: 5,787,750

[45] Date of Patent: Aug. 4, 1998

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

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[21] Appl. No.: **668,379**

[22] Filed: **Jun. 21, 1996**

[30] **Foreign Application Priority Data**

Jun. 22, 1995 [KR] Rep. of Korea 1995 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, 319, 72/388, 217, 218

[56] **References Cited**

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Primary Examiner—Daniel C. Crane

Attorney, Agent, or Firm—Dilworth & Barrese

[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 close-situated, 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.

9 Claims, 5 Drawing Sheets

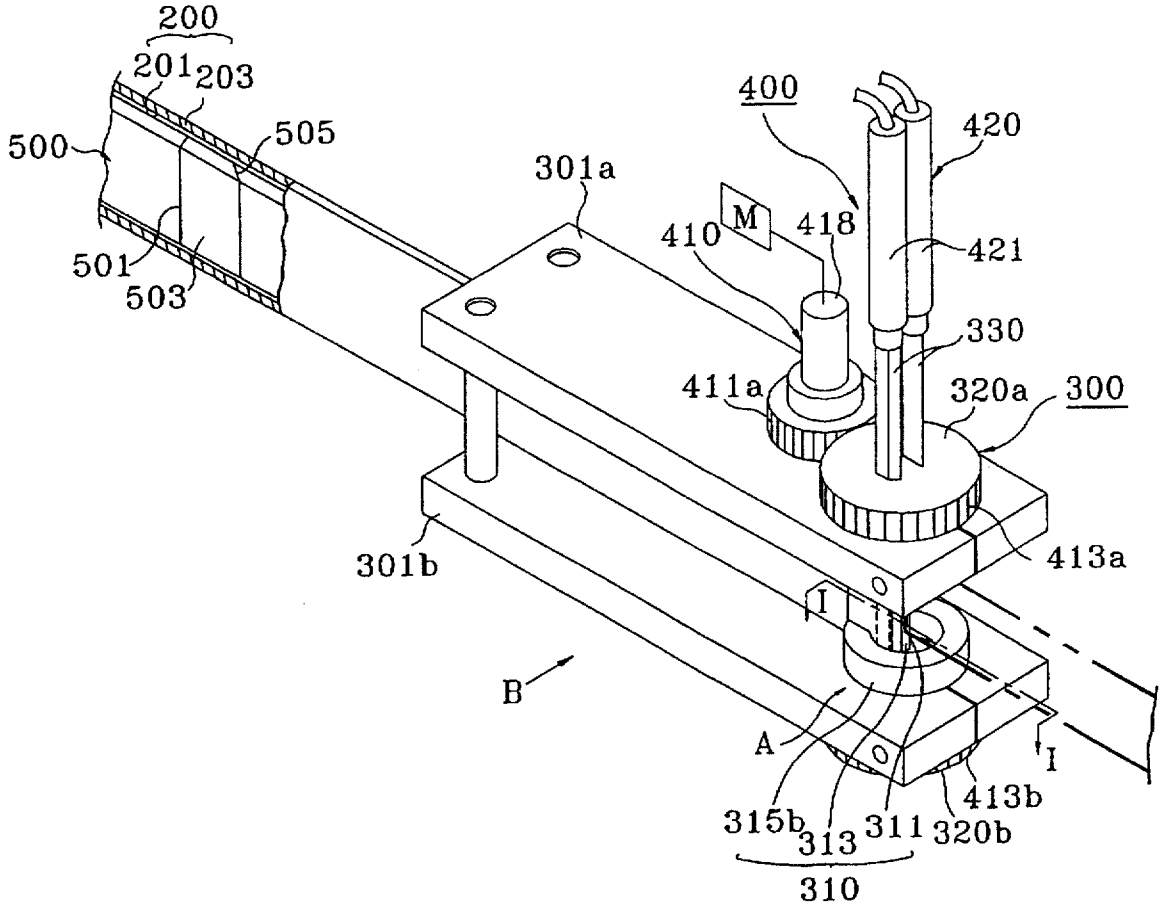


FIG. 1

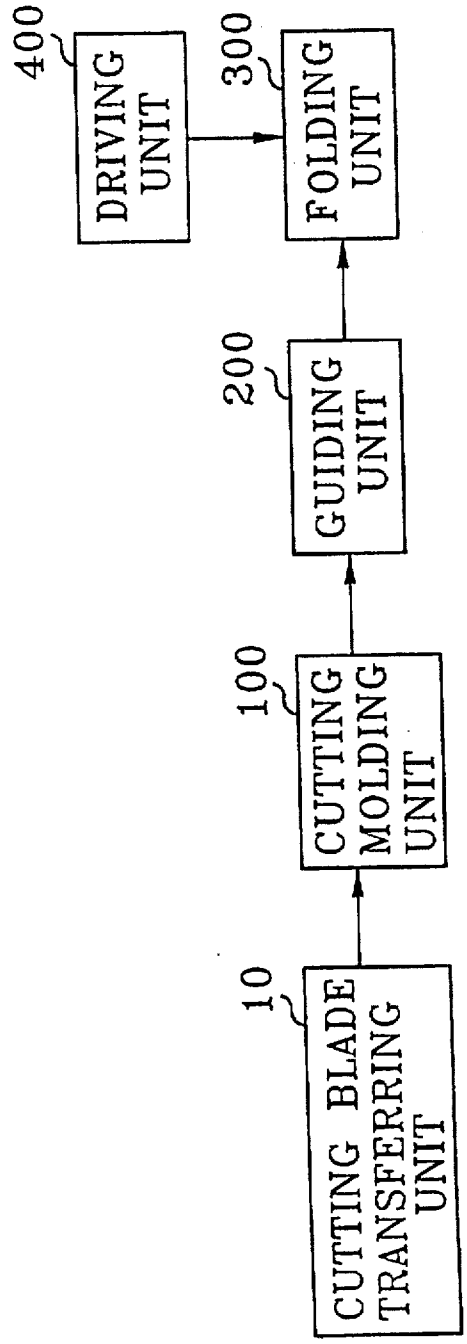

400
DRIVING UNIT
300
FOLDING UNIT
200
GUIDING UNIT
100
CUTTING MOLDING UNIT
10
CUTTING BLADE TRANSFERRING UNIT

FIG. 2

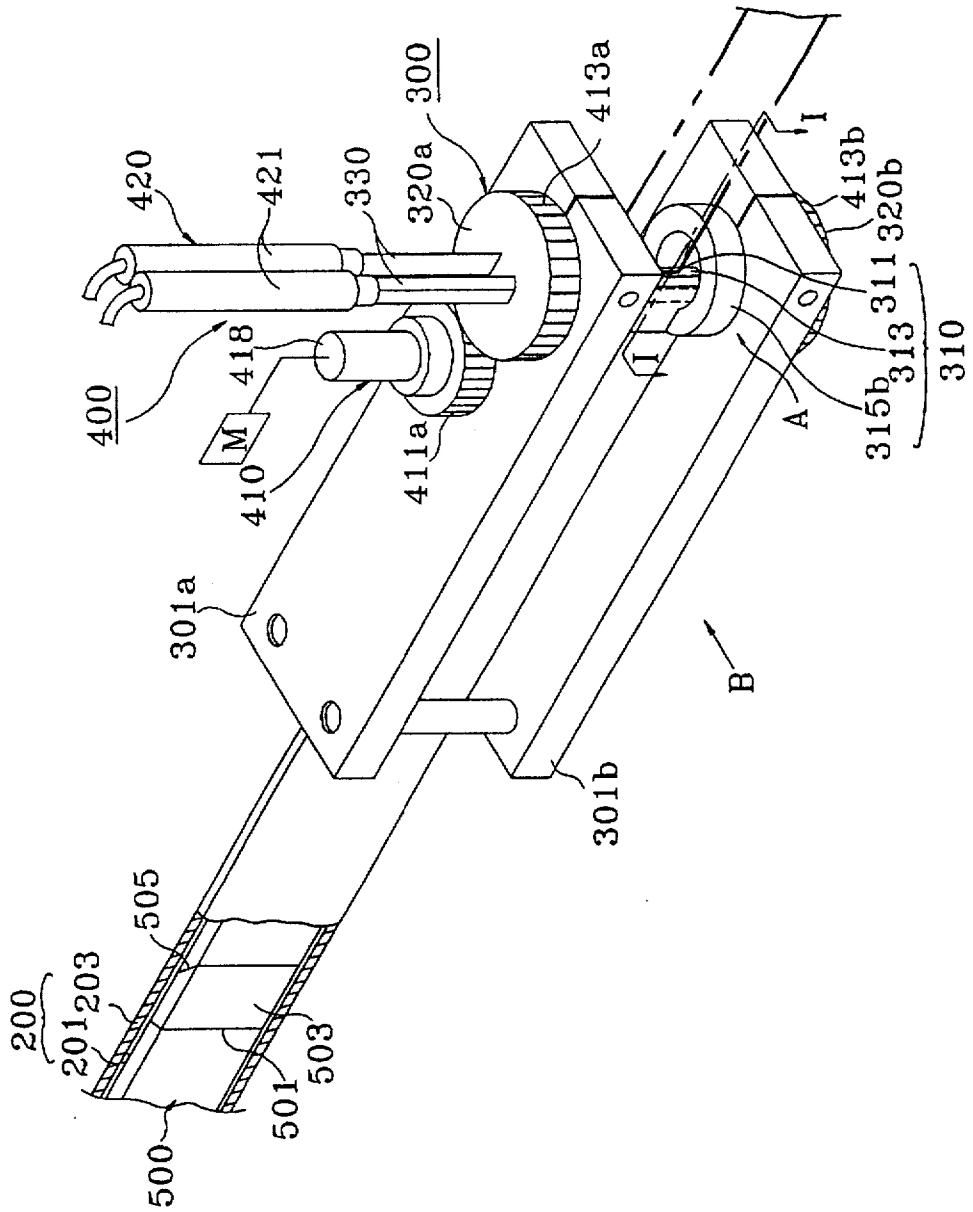

300
413a
420
421
330
320a
413b
320b
311
313
310
315b
A
I
I
400
418
M
410
411a
301a
301b
B
505
203
200
201
503
501
500

FIG. 3

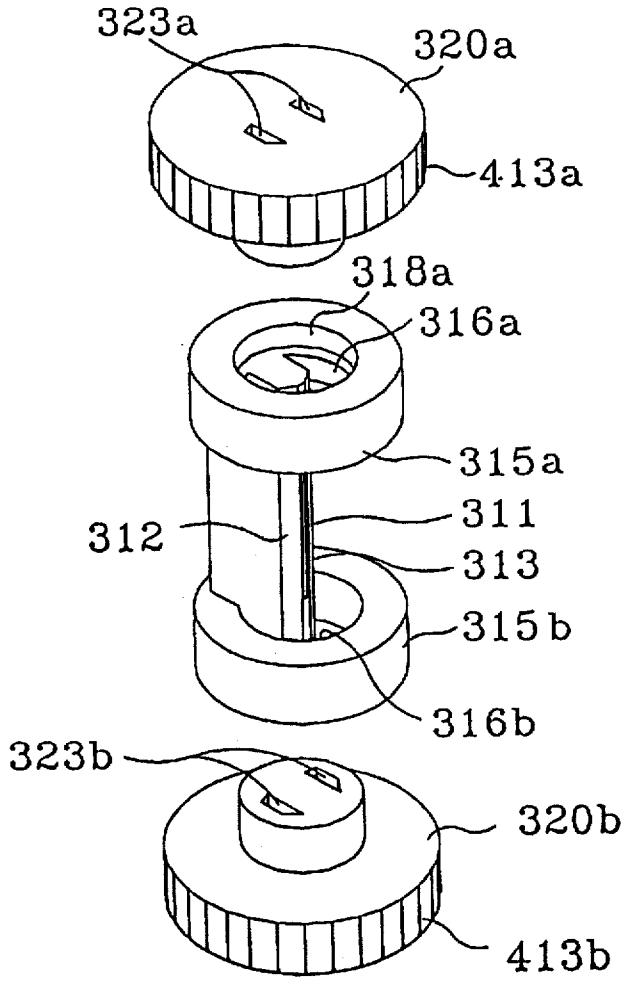

323a
320a
413a
318a
316a
315a
311
312
313
315b
316b
323b
320b
413b

FIG. 4

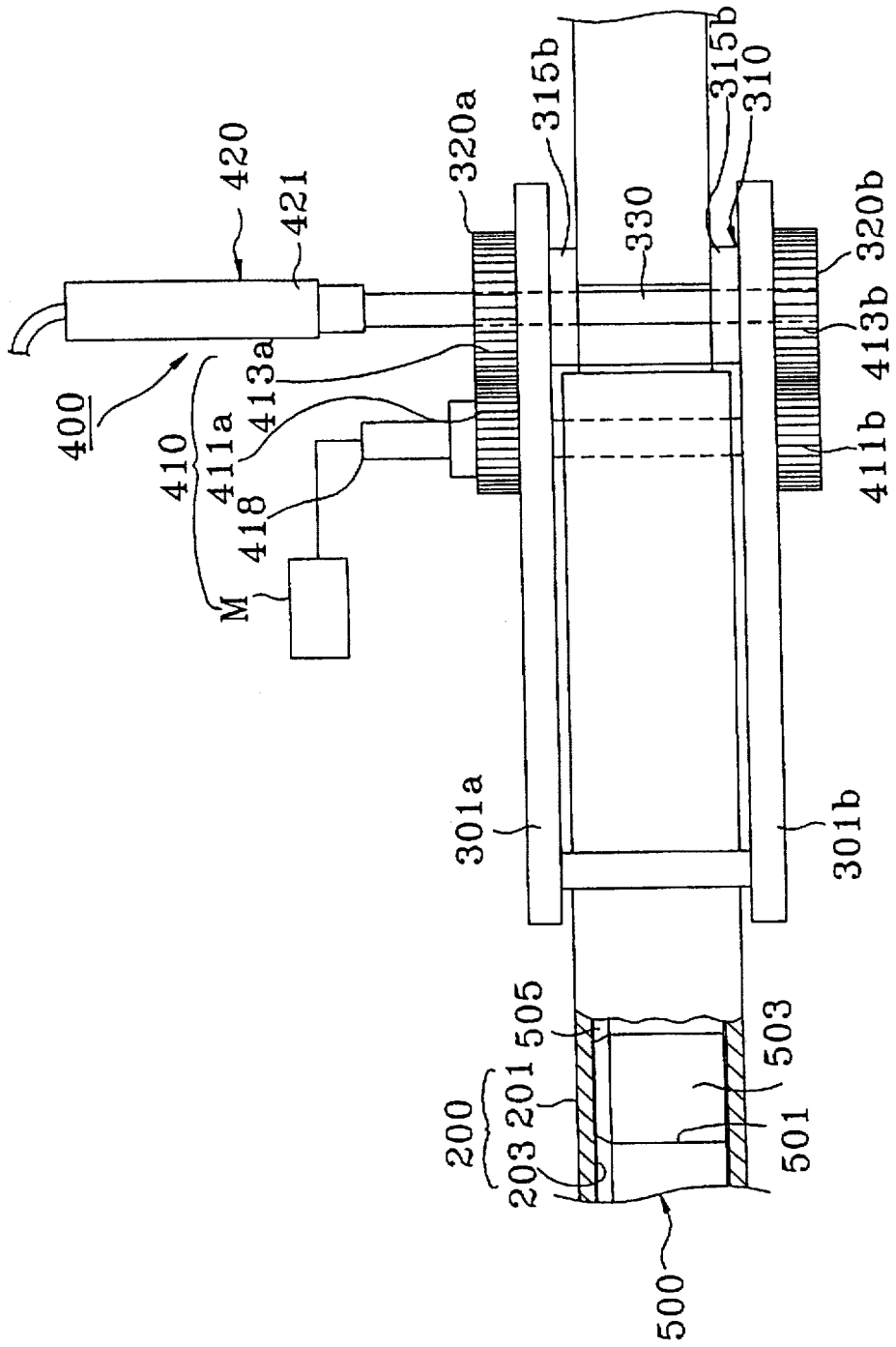

420
421
320a
315b
315b
310
330
320b
413b
411b
413a
400
410
411a
418
M
301a
301b
505
503
200
201
203
501
500

FIG. 6

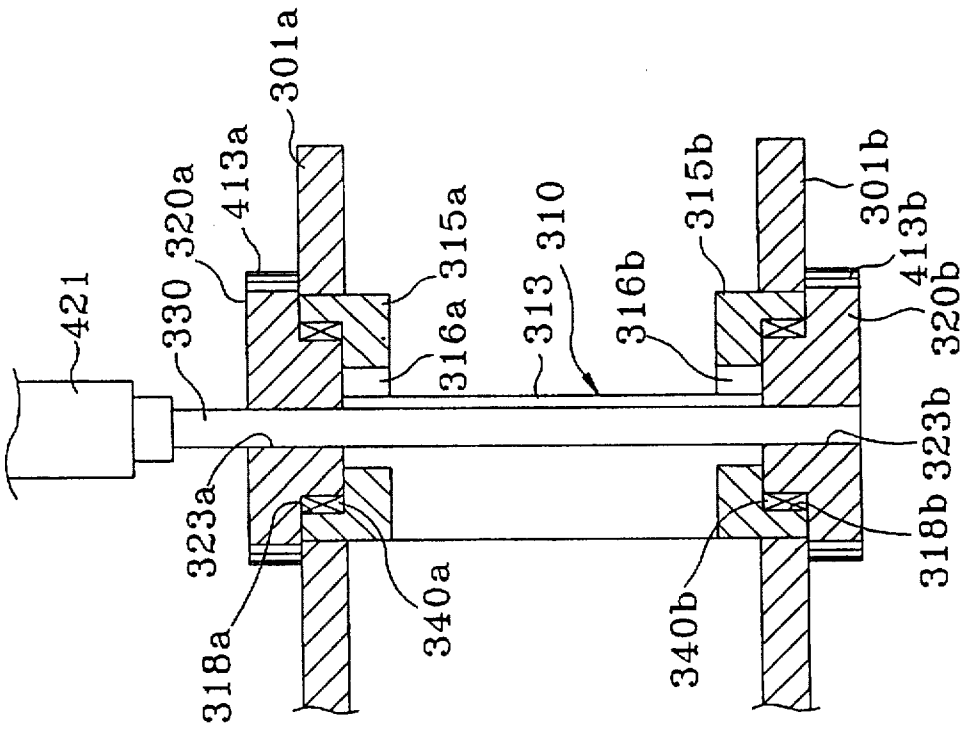
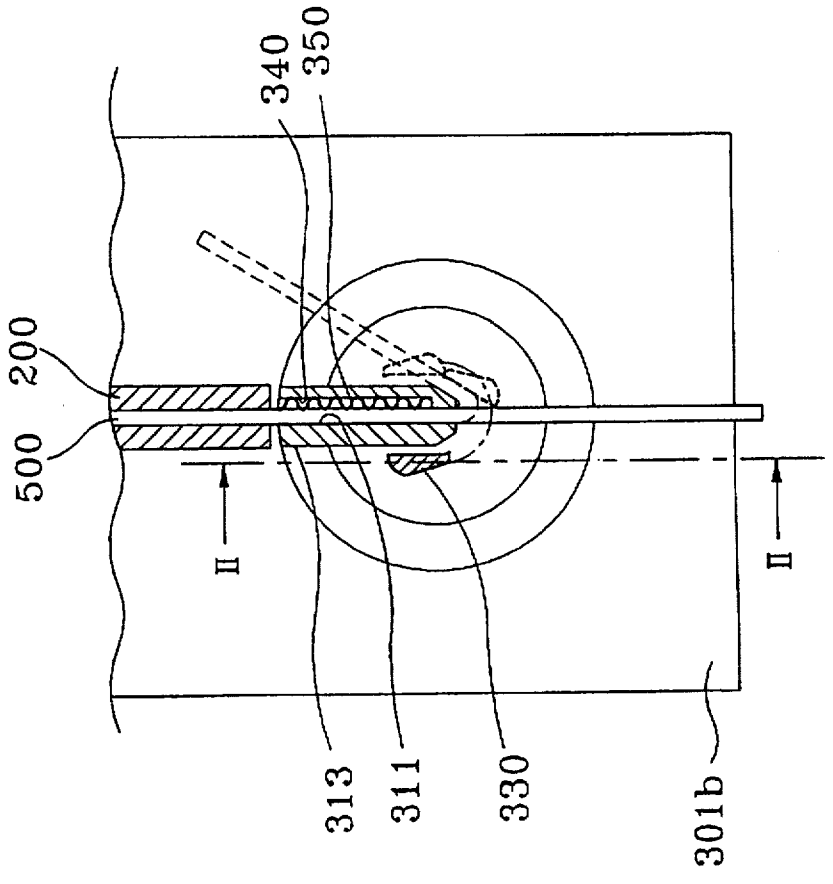

301a
413a
320a
330
421
315a
316a
313
310
316b
315b
301b
413b
320b
323a
318a
340a
340b
323b
318b

FIG. 5


340
350
200
500
II
II
313
311
330
301b

FOLDING SYSTEM FOR A CUTTING BLADE

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;

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 system for folding a cutting blade, which is used for sheet material molding, in a shape conforming to a desired sheet material molding configuration, the system comprising:

a transferring unit for transferring the cutting blade;

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

a guide member of a hollow shape, interposed said cutting means and a folding means and configured to connect said 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 for applying a force against the cutting blade passing through the guide member, the folding means positioned adjacent said 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 said folding means, for revolving and driving the folding means against the cutting blade; and

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

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 rotatable fixed to the supporting frame, the fixing body having a guide slot formed therein for insertably receiving a folding member; and a pair of rotary bodies,

rotatable connected to the ends of the fixing body for revolving the folding members, said pair of rotary bodies having a pair of guide holes formed therein for insertably receiving the folding members.

2. The system for folding a cutting blade as claimed in claim 1, wherein the at least two folding members having a substantially triangular cross-section.

3. The system for folding a cutting blade as claimed in claim 1, wherein said guide entrance further comprises supporting means for moving the cutting blade in a predetermined channel.

4. The system for folding a cutting blade as claimed in claim 3, wherein said supporting means comprises an elastic member.

5. The system for folding a cutting blade as claimed in claim 3, wherein said supporting means comprises a magnetic substance.

6. The system for folding a cutting blade as claimed in claim 1, 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.

7. The system for folding a cutting blade as claimed in claim 1, wherein said second driving means comprises a cylinder, direct-connected to the folding members for moving the folding member into and out of engagement with the pair of rotary bodies.

8. The system for folding a cutting blade as claimed in claim 1, wherein said cutting tip of the cutting blade is detached in a folding work process of the cutting blade.

9. The system for folding a cutting blade as claimed in claim 1, wherein the folding members are configured and dimensioned such that they are capable of 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.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO.: 5,787,750

DATED: August 4, 1998

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 53, change "JAPAN" to --KOREAN--.

Column 4, line 67, change "JAPAN" to --KOREAN--.

Signed and Sealed this

Sixteenth Day of November, 1999

Attest:

Attesting Officer

Q. TODD DICKINSON

Acting Commissioner of Patents and Trademarks

EXHIBIT “5”

US007694543B2

(12) **United States Patent**
Song

(10) **Patent No.: US 7,694,543 B2**
(45) **Date of Patent: *Apr. 13, 2010**

(54) **FOLDING SYSTEM**

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

(73) Assignees: **Seoul Laser Dieboard System Co.**, Anyang (KR); **Seoul Laser Dieboard System Co.**, San Diego, CA (US)

(*) Notice: 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.: **12/111,857**

(22) Filed: **Apr. 29, 2008**

(65) **Prior Publication Data**

US 2008/0202188 A1 Aug. 28, 2008

Related U.S. Application Data

(63) Continuation of application No. 11/558,316, filed on Nov. 9, 2006, which is a continuation of application No. 10/445,467, filed on May 27, 2003, now abandoned, which is a continuation of application No. 09/575,095, filed on May 19, 2000, now Pat. No. 6,405,574, which is a 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.**
B21D 11/00 (2006.01)

(52) **U.S. Cl.** **72/307**; 72/294; 72/319; 72/388

(58) **Field of Classification Search** 72/215, 72/216, 217, 294, 298, 303, 306, 307, 310, 72/311, 319, 379.2, 387, 388
See application file for complete search history.

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Primary Examiner—Edward Tolan
(74) *Attorney, Agent, or Firm*—Samuel S. Lee; Procopio, Cory, Hargreaves & Savitch LLP

(57) **ABSTRACT**

A system for folding a ribbon stock, the system including: a transferring unit; a guide member having a passage for guiding the ribbon stock, the passage defining a longitudinal axis; a folding means supported to revolve and move in a direction substantially transverse to the longitudinal axis for applying a force against the ribbon stock passing through the guide member; a driving means; a supporting frame; a fixing body having a predetermined length and a guide entrance operatively connected with the 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 the folding means; and a pair of rotary bodies rotatably connected to the ends of the fixing body for revolving the folding means, the pair of rotary bodies configured to insertably receive the folding means.

12 Claims, 5 Drawing Sheets

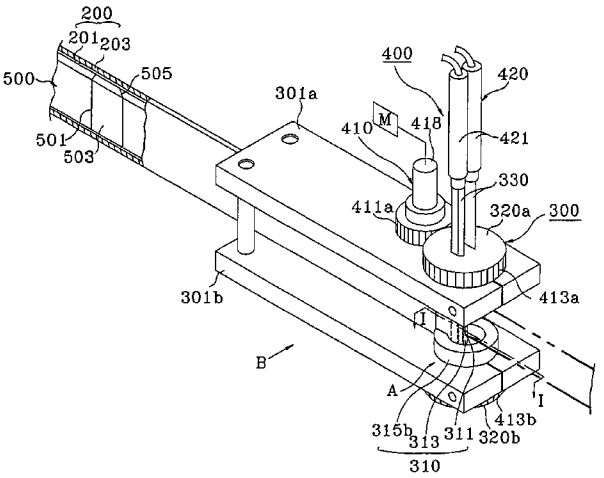

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FIG. 1

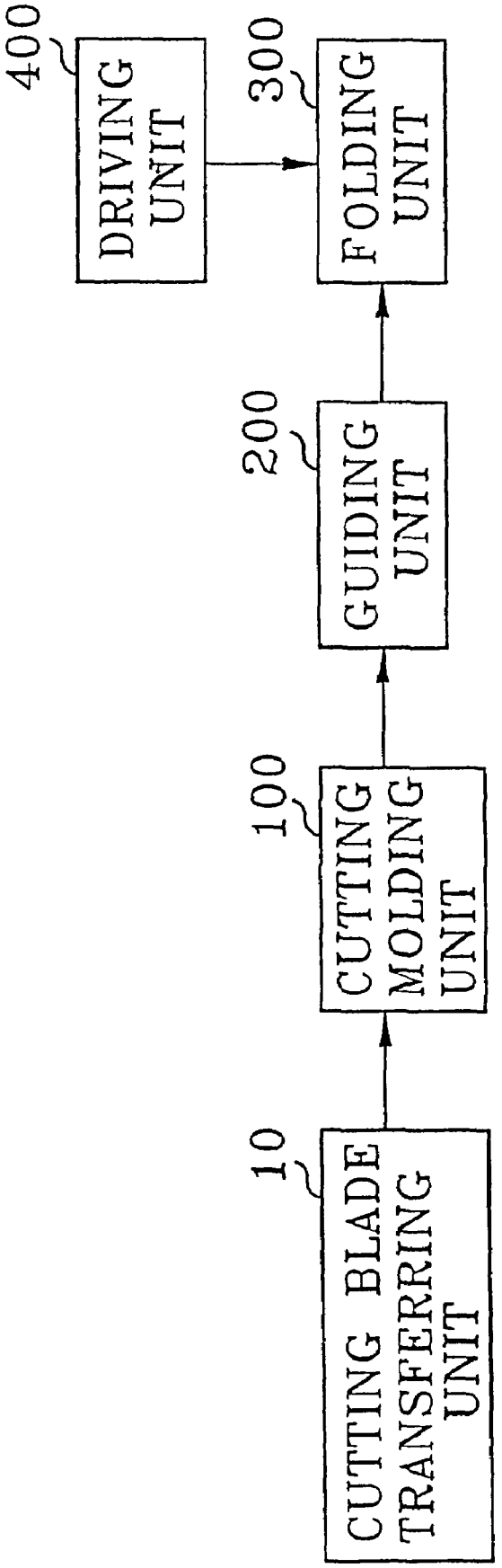

400
DRIVING UNIT
300
FOLDING UNIT
200
GUIDING UNIT
100
CUTTING MOLDING UNIT
10
CUTTING BLADE TRANSFERRING UNIT

FIG. 2

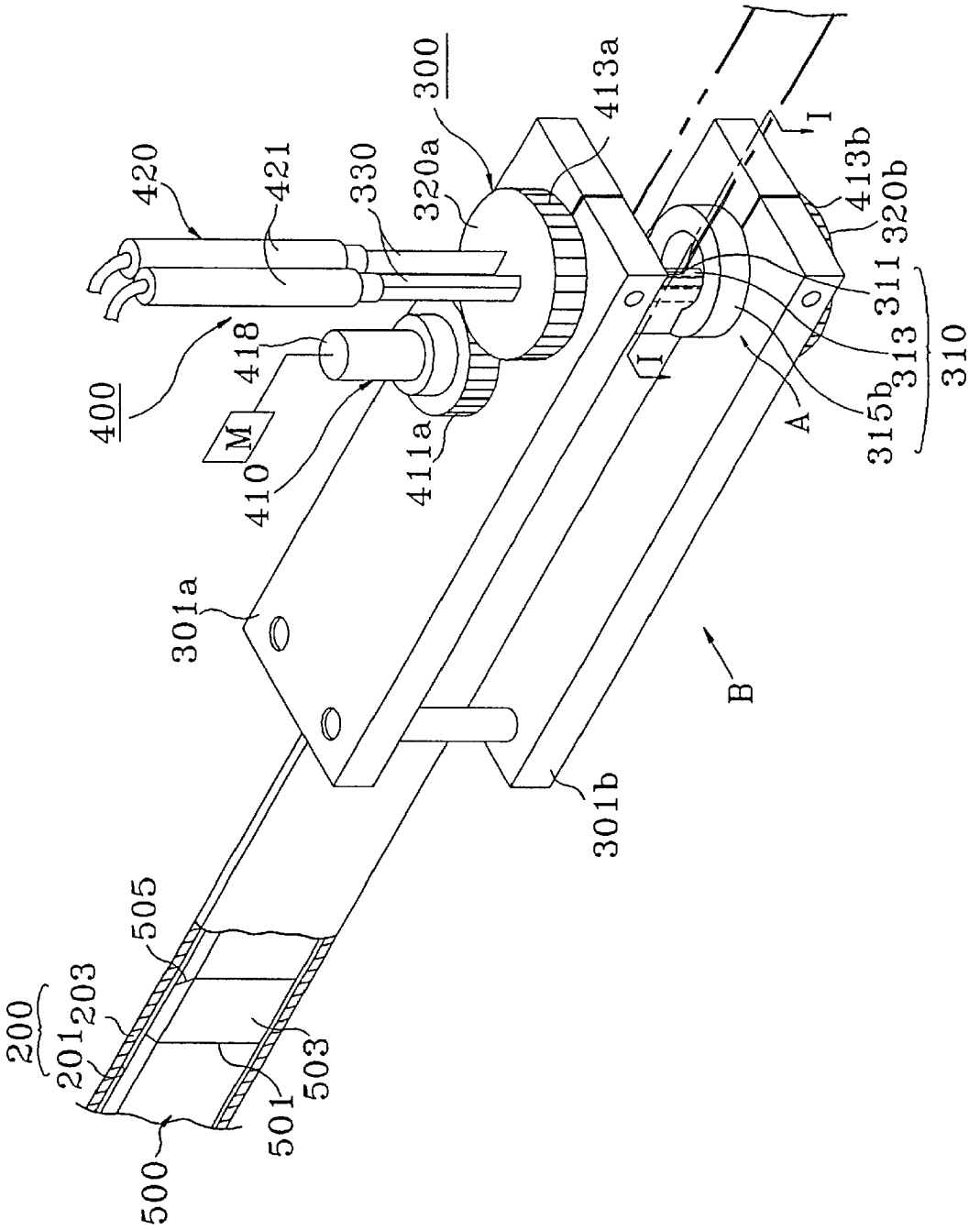

300
413a
I
420
421
330
320a
413b
320b
311
313
310
315b
A
400
418
M
410
411a
I
301a
B
301b
505
200
203
201
503
501
500

FIG. 3

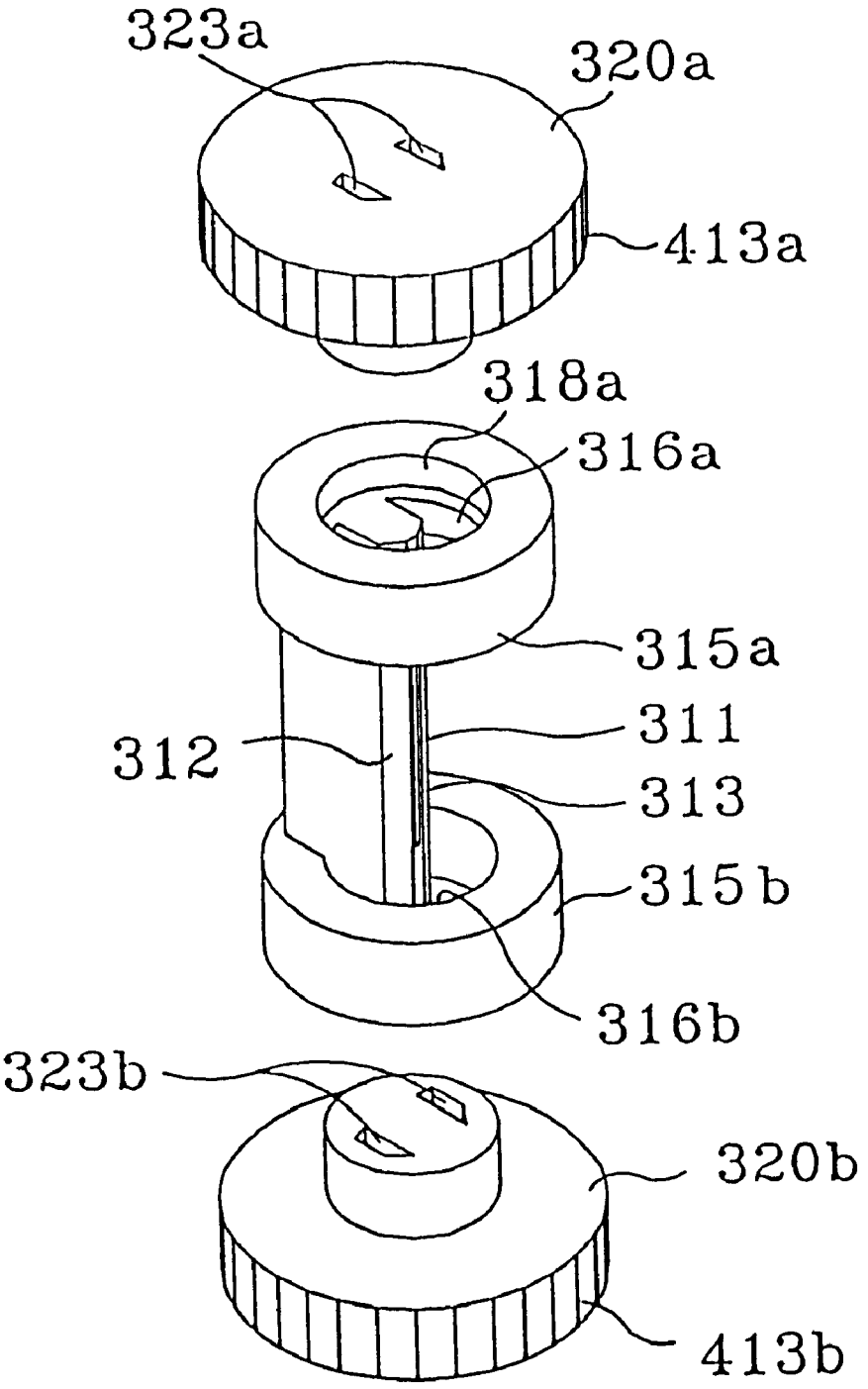

323a
320a
413a
318a
316a
315a
311
312
313
315b
316b
323b
320b
413b

FIG. 4

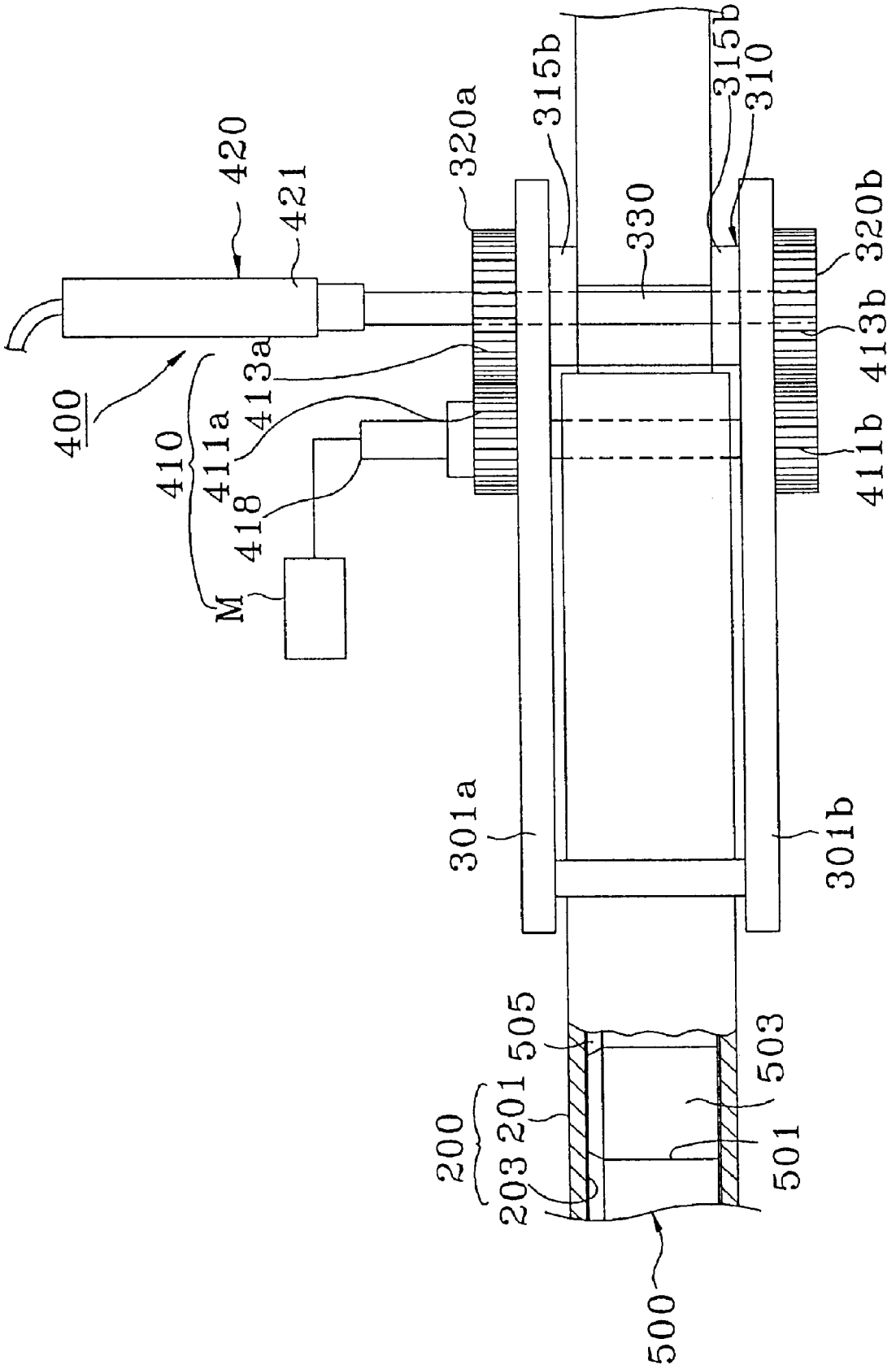

420
421
320a
315b
315b
310
330
320b
413b
411b
400
410
411a
413a
418
M
301a
301b
505
503
201
200
203
501
500

FIG. 6

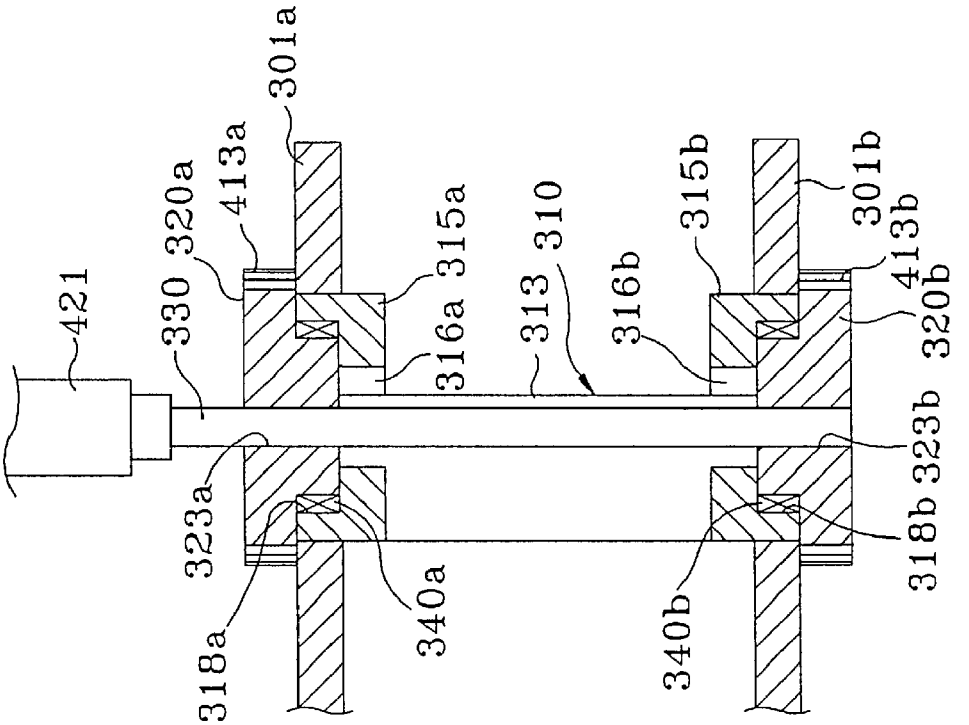
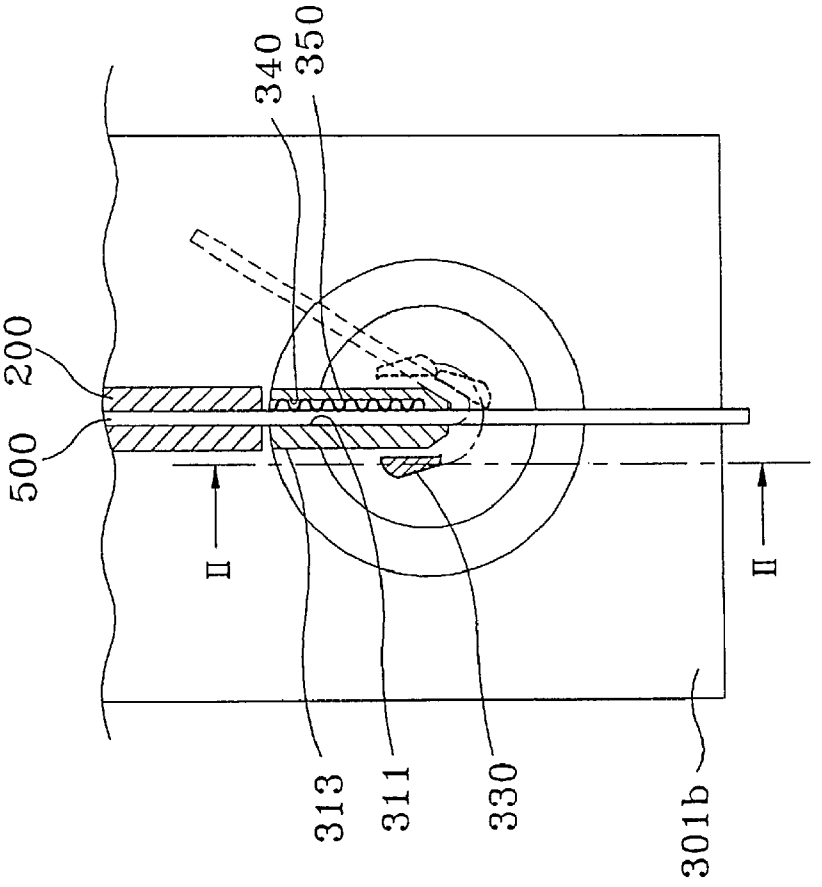

301a
413a
320a
330
421
315a
316a
313
310
316b
315b
301b
413b
320b
323b
318b
323a
318a
340a
340b

FIG. 5


340
350
200
500
II
II
313
311
330
301b

FOLDING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation application of co-pending U.S. patent application Ser. No. 11/558,316 filed on Nov. 9, 2006, which is a continuation of U.S. patent application Ser. No. 10/445,467 filed on May 27, 2003 (now abandoned), which is a continuation of Ser. No. 09/575,095 filed on May 19, 2000 (now U.S. Pat. No. 6,405,574), which is a continuation of U.S. patent application Ser. No. 09/247,408 filed on Feb. 10, 1999 (now U.S. Pat. No. 6,128,940), which is a continuation of U.S. patent application Ser. No. 09/049,391 filed on Mar. 27, 1998 (now U.S. Pat. No. 5,870,919), which is a continuation of U.S. patent application Ser. No. 08,668,379 filed on Jun. 21, 1996 (now U.S. Pat. No. 5,787,750), which claims priority benefit to Korean Application No. 1995-16975, filed 22 Jun. 1995.

BACKGROUND

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

Therefore, to address the above problem, embodiments of the present invention provide apparatus, method, and system for folding a cutting blade to improve work efficiency and 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 embodiment, a system for folding a ribbon stock is disclosed. The system including: 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, the passage defining a longitudinal axis; a folding means supported to revolve and move in a direction substantially transverse to the longitudinal axis for applying a force against the ribbon stock passing through the guide member, the folding means positioned adjacent the guide member, and for folding the ribbon stock to a predetermined angle; a driving means configured to engage the folding means, for revolving and moving the folding means against the ribbon stock; 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 the 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 the folding means; and a pair of rotary bodies rotatably connected to the ends of the fixing body for revolving the folding means, the pair of rotary bodies configured to insertably receive the folding means.

In another embodiment, a method of folding ribbon stock is disclosed. The method including: transferring ribbon stock through a passage formed by a guide, the passage defining a longitudinal axis; rotating at least one rotary assembly in an arcuate motion relative to the guide from a first position toward at least one second position to fold a portion of the ribbon stock; and coupling the at least one rotary assembly to a pair of elongate members such that rotating at least one rotary assembly causes the pair of elongate members to revolve and move in a direction substantially transverse to the longitudinal axis for applying a force against the portion of the ribbon stock, wherein the at least one rotary assembly includes first and second rotary bodies spaced to receive the ribbon stock therebetween, and wherein the pair of elongate members engages the first and second rotary bodies.

In another embodiment, an apparatus for folding a metallic ribbon stock is disclosed. The apparatus including: 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 the guide member, and for folding the ribbon stock to a predetermined angle; driving means configured to engage the folding means, for revolving and driving the folding means against the ribbon stock; 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 the 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 the folding means; and a pair of rotary bodies, rotatably connected to the ends of the fixing body for revolving the folding means, the pair of rotary bodies configured to insertably receive the folding 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

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 **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 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 system for folding a ribbon stock, 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 said transferring unit, the passage defining a longitudinal axis;

a folding means supported to revolve and move in a direction substantially transverse to the longitudinal axis for applying a force against the ribbon stock passing through said guide member said folding means positioned adjacent said guide member, and for folding the ribbon stock to a predetermined angle;

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

a supporting frame comprised of at least two plate shaped members, said 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 said fixing body are rotatably fixed to said supporting frame, said 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 configured to insertably receive the folding means.

2. The system of claim **1**, wherein said folding means comprises at least one elongate member.

3. The system of claim **2**, wherein said at least one elongate member has a substantially triangular cross-section.

4. The system of claim **1**, wherein said guide entrance further comprises

an elastic support means for moving the ribbon stock in a predetermined channel.

5. The system of claim **1**, wherein said driving means comprises:

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

a second toothed portion set on a rotating shaft installed on said supporting frame, said second toothed portion configured to mesh with said first toothed portion; and

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

6. The system of claim **1**, further comprising

a cutting means for cutting the ribbon stock supplied from said transferring unit in a length substantially corresponding to the sheet material molding configuration.

7. The system of claim **1**, wherein the folding means are configured and dimensioned for connecting said pair of rotary bodies to each other through guide holes of said pair of rotary bodies and the guide slot of said fixing body.

8. A method of folding ribbon stock, comprising:

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

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

coupling the at least one rotary assembly to a pair of elongate members such that said rotating at least one rotary assembly causes the pair of elongate members to revolve and move in a direction substantially transverse to the longitudinal axis for applying a force against the portion of the ribbon stock,

wherein the at least one rotary assembly includes first and second rotary bodies spaced to receive the ribbon stock therebetween,

wherein the pair of elongate members engages the first and second rotary bodies, and

wherein the pair of elongate members engages the first and second rotary bodies by inserting the pair of elongate members into the first and second rotary bodies for mutual connection of the first and second rotary bodies.

9. The method of claim **8** wherein said rotating the at least one rotary assembly in an arcuate motion includes

revolving the pair of elongate members by rotating together the pair of rotary bodies mutually connected by the pair of elongate members.

10. An apparatus for folding a metallic ribbon stock, the apparatus 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;

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

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 configured to insertably receive the folding means.

11. The apparatus of claim **10**, wherein said fixing body further includes:

a folding body; and

annular support portions configured to fixedly attach said folding body to said supporting frame,

wherein the guide slot configured for insertably receiving said folding means is formed on said annular support portions.

12. The apparatus of claim **10**, wherein said pair of rotary bodies includes

guide holes to insertably receive the folding means.

* * * * *

EXHIBIT “6”

US008327679B2

(12) **United States Patent**
Song

(10) **Patent No.: US 8,327,679 B2**
(45) **Date of Patent: *Dec. 11, 2012**

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

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

(73) Assignees: **Seoul Laser Dieboard System Co., Ltd.**, Anyang (KR); **Seoul Laser Dieboard Co., Ltd.**, San Diego, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 704 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **11/558,316**

(22) Filed: **Nov. 9, 2006**

(65) **Prior Publication Data**

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Related U.S. Application Data

(63) Continuation of application No. 10/445,467, filed on May 27, 2003, now abandoned, which is a continuation of application No. 09/575,095, filed on May 19, 2000, now Pat. No. 6,405,574, which is a 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.**
B21D 11/00 (2006.01)
B21D 5/16 (2006.01)

(52) **U.S. Cl.** **72/307**; 72/294; 72/387

(58) **Field of Classification Search** 72/306, 72/307, 388, 387, 215–217, 294, 298, 303, 72/310, 311, 319
See application file for complete search history.

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Primary Examiner — Debra Sullivan
(74) *Attorney, Agent, or Firm* — Samuel S. Lee; Procopio, Cory, Hargreaves & Savitch LLP

(57) **ABSTRACT**

A bending apparatus including: a transferring unit for transferring a metallic rule through a passage formed by a guide, the passage defining a longitudinal axis; a folding unit having first and second rotary bodies spaced to receive the metallic rule; and a pair of bending fingers including a first bending finger and a second bending finger, the pair of bending fingers supported to revolve and move in a direction substantially transverse to the longitudinal axis for applying force against the metallic rule passing through the guide, the pair of bending fingers positioned adjacent to the guide, and for bending the metallic rule to desired angles, wherein the first bending finger is revolved by the first rotary body and the second bending finger is revolved by the second rotary body, wherein each finger of the pair of bending fingers is each configured for arcuate motion relative to the guide from a first position toward at least one second position to bend a portion of the metallic rule.

5 Claims, 5 Drawing Sheets

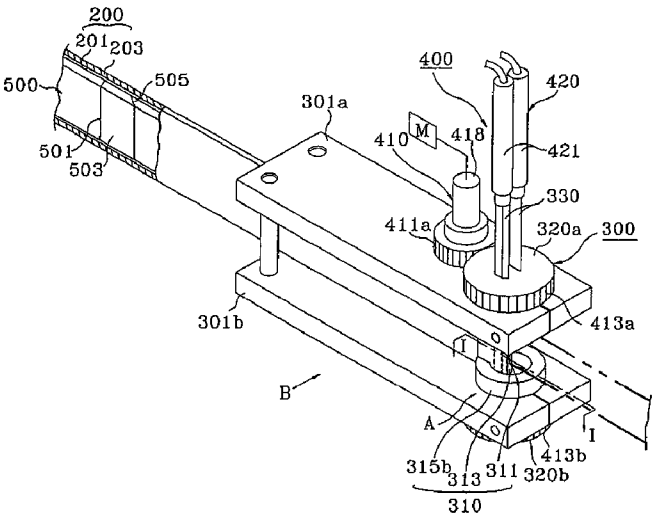

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FIG. 1

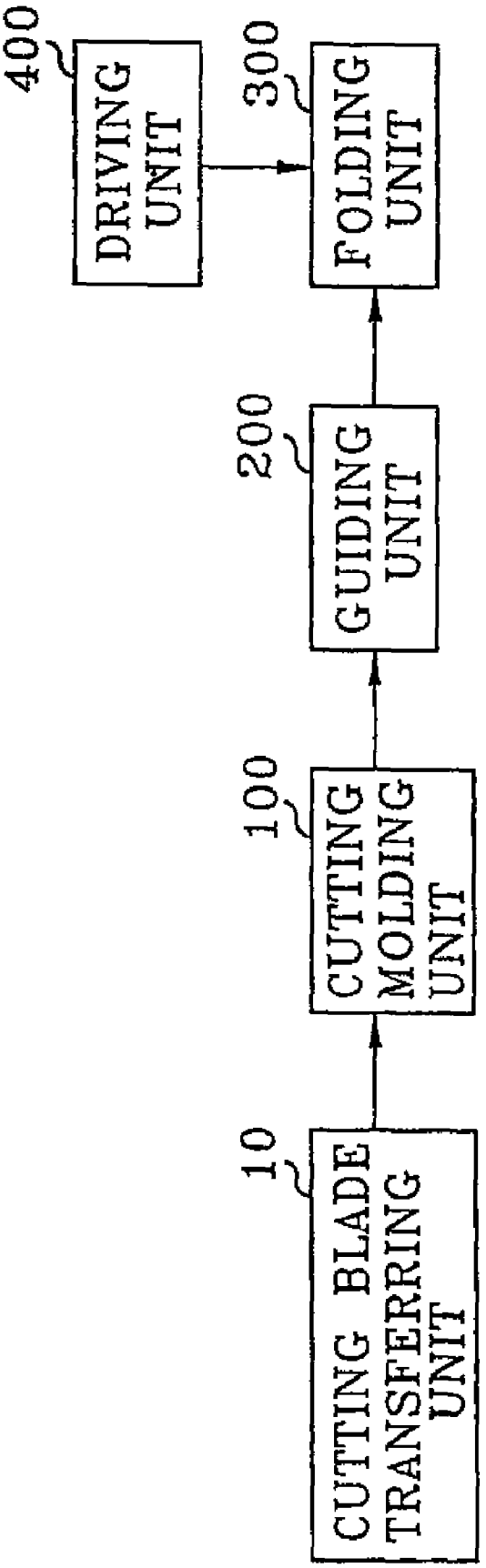

400
DRIVING UNIT
300
FOLDING UNIT
200
GUIDING UNIT
100
CUTTING MOLDING UNIT
10
CUTTING BLADE TRANSFERRING UNIT

FIG. 2

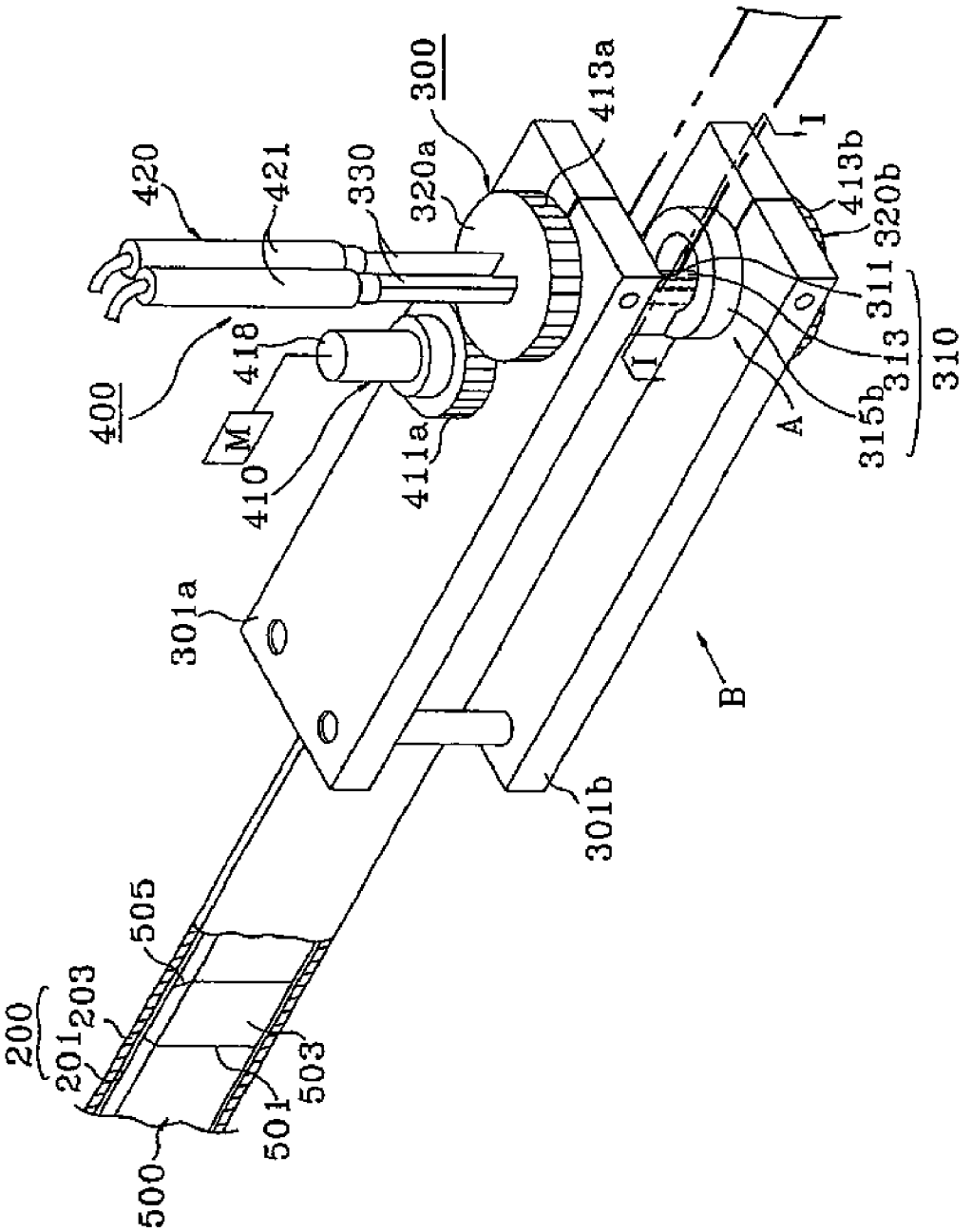

300
413a
I
I
420
421
330
320a
413b
320b
311
313
310
315b
A
400
418
M
410
411a
301a
B
301b
505
200
201
203
503
501
500

FIG. 3

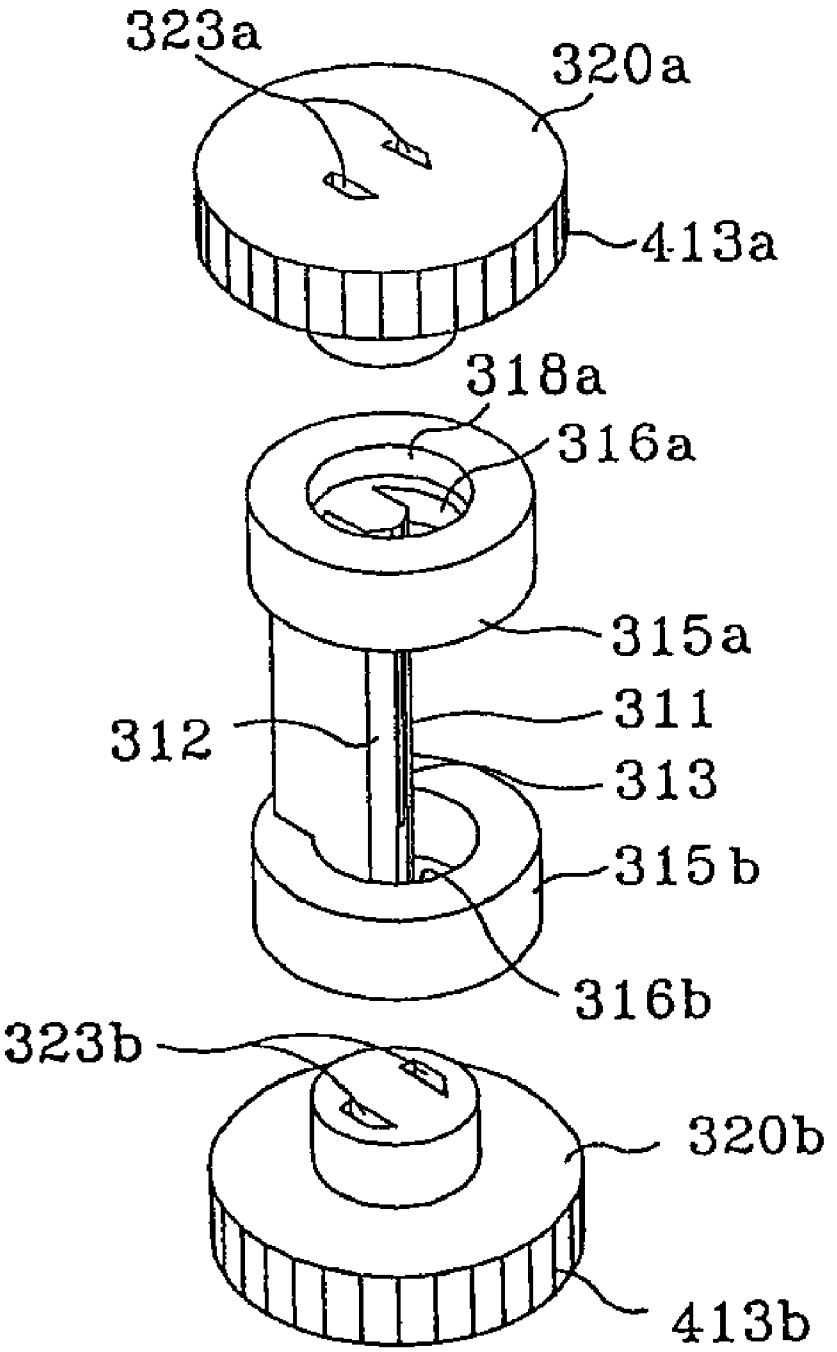

323a
320a
413a
318a
316a
315a
311
312
313
315b
316b
323b
320b
413b

FIG. 4

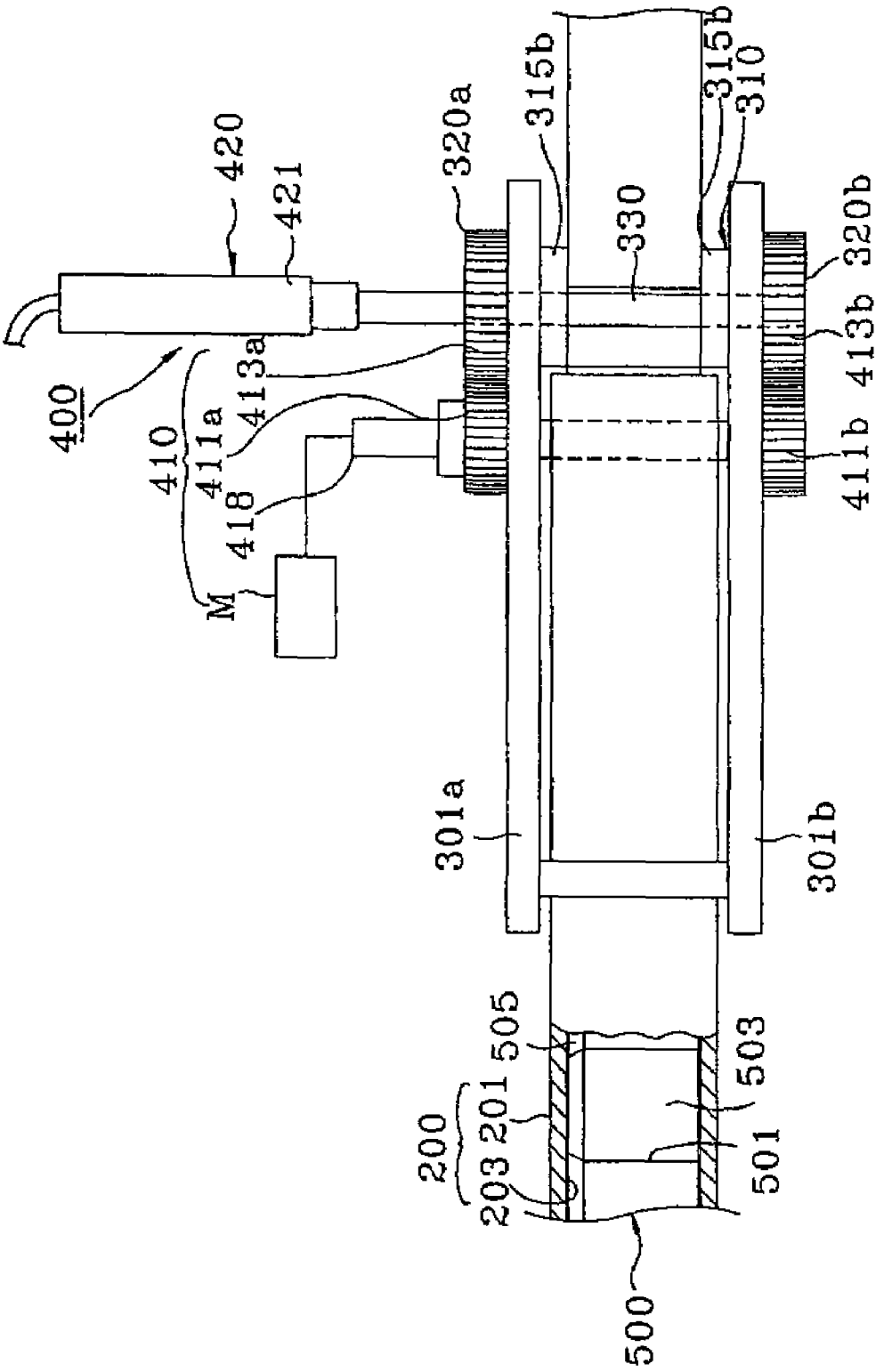

420
421
320a
315b
315b
310
330
320b
413b
411b
400
410
411a
413a
418
M
301a
301b
505
503
201
200
203
501
500

FIG. 6

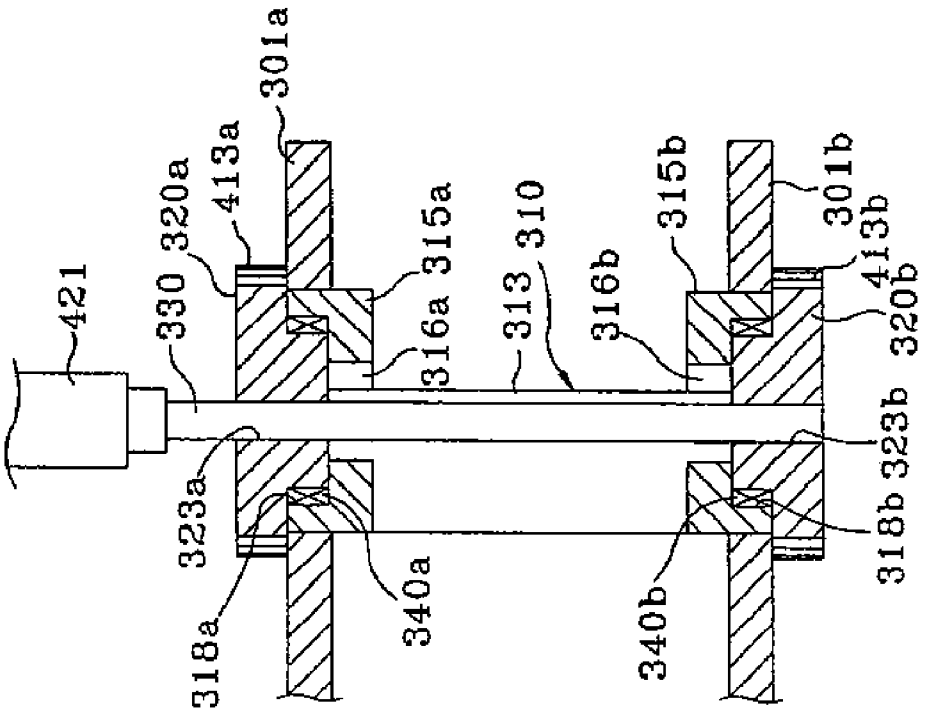
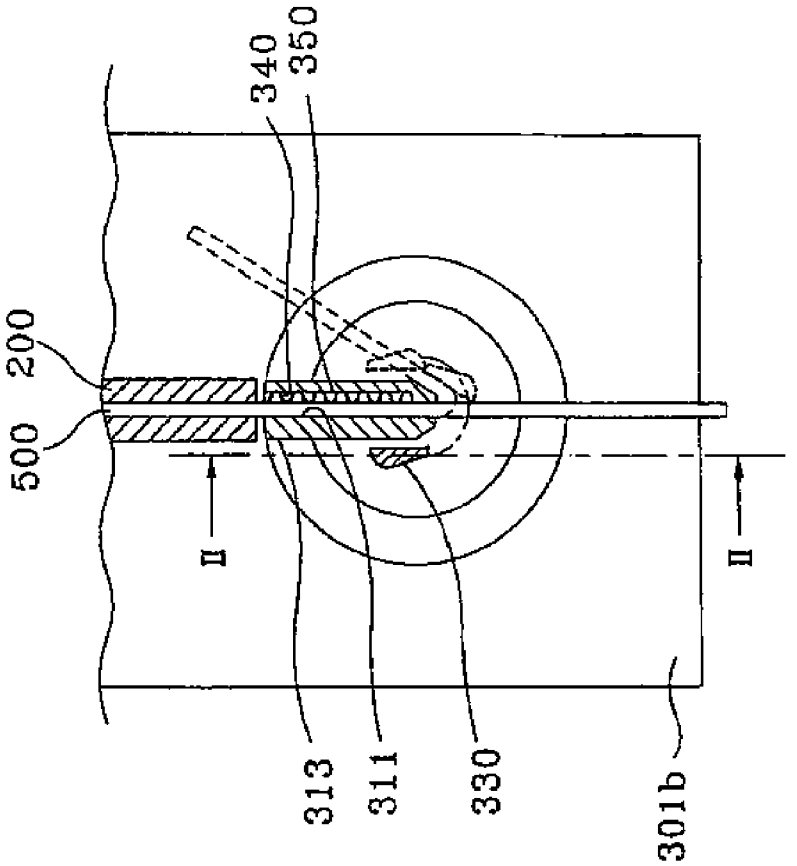

421
330
320a
413a
301a
315a
316a
313
310
316b
315b
301b
413b
320b
323b
318b
323a
318a
340a
340b

FIG. 5


340
350
200
500
II
II
313
311
330
301b

FOLDING SYSTEM FOR A CUTTING BLADE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation application of U.S. application Ser. No. 10/445,467 filed on May 27, 2003 which is a continuation of Ser. No. 09/575,095 filed on May 19, 2000 now U.S. Pat. No. 6,405,574, which is a continuation of U.S. application Ser. No. 09/247,408 filed on Feb. 10, 1999 now U.S. Pat. No. 6,128,940, which is a continuation of U.S. application Ser. No. 09/049,391 filed on 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 on Jun. 21, 1996 now U.S. Pat. No. 5,787,750, which claims priority benefit to Korean Application No. 1995-16975, filed 22 Jun. 1995.

BACKGROUND

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.

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

Therefore, to address the above problem, embodiments of the present invention provide apparatus, method, and system for folding a cutting blade to improve work efficiency and 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 embodiment, the metallic ribbon stock folding apparatus comprises: a transferring unit to transfer ribbon stock through a passage formed by a guide, the 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, the elongate member mounted for movement between a retracted position where the elongate member is disengaged from at least one of the rotary bodies and an extended position where the elongate member engages both the first and second rotary bodies; and the rotary assembly configured for arcuate motion centered about the longitudinal axis from a first position on a first side of the longitudinal axis toward at least one second position on a second side opposite the first side relative to the longitudinal axis to fold a first portion of the ribbon stock by engaging the ribbon stock against the guide with the elongate member, and from a third position on the second side of the longitudinal axis toward a fourth position on the first side of the longitudinal axis to fold a second portion of the ribbon stock.

In another embodiment, the method of folding metallic ribbon stock comprises: transferring ribbon stock through a passage formed by a guide, the 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 the elongate member between a retracted position where the elongate member is disengaged from at least one of the rotary bodies to an extended position to engage both first and second rotary bodies with the elongate member; and rotating the rotary assembly in an arcuate motion centered about the longitudinal axis from a first position on a first side of the longitudinal axis toward at least one second position on a second side opposite the first side relative to the longitudinal axis to fold a first portion of the ribbon stock by engaging the ribbon stock against the guide with the elongate member, and from a third position on the second side of the longitudinal axis toward a fourth position on the first side of the longitudinal axis to fold a second portion of the ribbon stock.

In another embodiment, a system of folding metallic ribbon stock comprises; a supply of ribbon stock; a frame; a guide mounted in the frame, the guide having a passage therein, the passage defining a longitudinal axis; a transferring unit for controlled transfer of the ribbon stock through the passage in the guide; a cutter for cutting the 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, the elongate member mounted for movement between a retracted position where the elongate member is disengaged from at least one of the rotary bodies, and an extended position where the elongate member engages both the first and second rotary bodies; and the rotary assembly configured for arcuate motion centered about the longitudinal axis to move the elongate member integrally with both first and second rotary bodies from a first position on a first side of the longitudinal axis toward at least one second position on a second side opposite the first side relative to the longitudinal axis to fold a first portion of the ribbon stock by engaging the ribbon stock against the guide with the elongate member, and from a third position on the second side of the longitudinal axis toward a fourth position on the first side of the longitudinal axis to fold a second portion of the ribbon stock.

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

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.

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*.

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 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 bending apparatus comprising:

a transferring unit for transferring a metallic rule through a passage formed by a guide, said passage defining a longitudinal axis;

a folding unit having first and second rotary bodies spaced to receive said metallic rule therebetween; and

a pair of bending fingers including a first bending finger and a second bending finger, said pair of bending fingers supported to revolve and move in a direction substantially transverse to the longitudinal axis for applying force against the metallic rule passing through the guide, said pair of bending fingers positioned adjacent to the guide, and for bending the metallic rule to desired angles, wherein each finger of said pair of bending fingers is each configured for arcuate rotational motion relative to said guide from a first position toward at least one second position to bend a portion of said metallic rule, and

wherein each of said pair of bending fingers separately rotates about a single rotational axis relative to said guide.

2. The bending apparatus of claim **1**, wherein said pair of bending fingers has a substantially trapezoidal cross-section.

3. The bending apparatus of claim **2**, wherein said pair of bending fingers has a rule engaging edge formed by the intersection of at least two sides of the substantially trapezoidal cross-section.

4. A method of bending metallic rule comprising:

transferring the rule through a passage formed by a guide, said passage defining a longitudinal axis;

providing a pair of bending fingers;

providing at least one folding unit having first and second rotary bodies spaced to receive said metallic rule therebetween;

moving said pair of bending fingers including a first bending finger and a second bending finger, said pair of bending fingers supported to revolve and move in a direction substantially transverse to the longitudinal axis for applying force against the metallic rule passing through the guide, said pair of bending fingers positioned adjacent to the guide, and for bending the metallic rule to desired angles; and

separately rotating each finger of the pair of bending fingers in an arcuate motion relative to said guide from a first position toward at least one second position to bend a portion of said metallic rule,

wherein each of said pair of bending fingers separately rotates about a single rotational axis relative to said guide.

5. The method of bending metallic rule of claim **4**, further comprising

cutting said metallic rule at a predetermined length.

* * * * *

EXHIBIT “7”

Int. Cl.: 7

Prior U.S. Cls.: 13, 19, 21, 23, 31, 34 and 35

United States Patent and Trademark Office

Reg. No. 3,582,411
Registered Mar. 3, 2009

TRADEMARK
PRINCIPAL REGISTER

SDS

SEOUL LASER DIEBOARD SYSTEM CO., LTD. (REPUBLIC OF KOREA CORPORATION)
10035 CARROLL CANYON BLVD. #E
SAN DIEGO, CA 92131

FOR: COMPUTERIZED BENDING MACHINE FOR INDUSTRIAL APPLICATIONS, NAMELY, BENDING OR FOLDING RIGID MATERIAL SUCH AS METAL RULE OR STRIP , IN CLASS 7 (U.S. CLS. 13, 19, 21, 23, 31, 34 AND 35).

FIRST USE 4-30-1993; IN COMMERCE 4-30-1993.

THE MARK CONSISTS OF STANDARD CHARACTERS WITHOUT CLAIM TO ANY PARTICULAR FONT, STYLE, SIZE, OR COLOR.

SER. NO. 77-382,158, FILED 1-28-2008.

FRED MANDIR, EXAMINING ATTORNEY

EXHIBIT “8”

United States of America
United States Patent and Trademark Office

channel bender

Reg. No. 4,359,831

Registered July 2, 2013

Int. Cl.: 7

TRADEMARK

PRINCIPAL REGISTER

SEOUL LASER DIEBOARD SYSTEM CO., LTD. (CALIFORNIA CORPORATION)
10035 CARROLL CANYON BLVD. #B
SAN DIEGO, CA 92131

FOR: COMPUTERIZED BENDING MACHINE FOR INDUSTRIAL APPLICATIONS, NAMELY, BENDING RIGID MATERIAL, IN CLASS 7 (U.S. CLS. 13, 19, 21, 23, 31, 34 AND 35).

FIRST USE 12-10-2006; IN COMMERCE 5-10-2007.

THE MARK CONSISTS OF STANDARD CHARACTERS WITHOUT CLAIM TO ANY PARTICULAR FONT, STYLE, SIZE, OR COLOR.

SEC. 2(F).

SER. NO. 85-436,846, FILED 9-30-2011.

JOHN DWYER, EXAMINING ATTORNEY

UNITED STATES PATENT AND TRADEMARK OFFICE · DEPARTMENT OF COMMERCE

Acting Director of the United States Patent and Trademark Office

REQUIREMENTS TO MAINTAIN YOUR FEDERAL TRADEMARK REGISTRATION

WARNING: YOUR REGISTRATION WILL BE CANCELLED IF YOU DO NOT FILE THE DOCUMENTS BELOW DURING THE SPECIFIED TIME PERIODS.

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EXHIBIT “9”

United States of America
United States Patent and Trademark Office

ChannelBender

Reg. No. 4,473,284

Registered Jan. 28, 2014

Int. Cl.: 7

TRADEMARK

PRINCIPAL REGISTER

SEOUL LASER DIEBOARD SYSTEM CO., LTD. (CALIFORNIA CORPORATION)
10035 CARROLL CANYON BLVD. #B
SAN DIEGO, CA 92131

FOR: COMPUTERIZED BENDING MACHINE FOR INDUSTRIAL APPLICATIONS, NAMELY, BENDING RIGID MATERIAL, IN CLASS 7 (U.S. CLS. 13, 19, 21, 23, 31, 34 AND 35).

FIRST USE 12-10-2006; IN COMMERCE 5-1-2007.

THE MARK CONSISTS OF STANDARD CHARACTERS WITHOUT CLAIM TO ANY PARTICULAR FONT, STYLE, SIZE, OR COLOR.

OWNER OF U.S. REG. NOS. 3,405,475 AND 3,609,992.

SEC. 2(F).

SER. NO. 85-461,496, FILED 11-1-2011.

JOHN DWYER, EXAMINING ATTORNEY

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Michelle K. Lee

Deputy Director of the United States Patent and Trademark Office

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Second Filing Deadline: You must file a Declaration of Use (or Excusable Nonuse) **and** an Application for Renewal between the 9th and 10th years after the registration date.* *See* 15 U.S.C. §1059.

Requirements in Successive Ten-Year Periods*
What and When to File:

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NOTE: Fees and requirements for maintaining registrations are subject to change. Please check the USPTO website for further information. With the exception of renewal applications for registered extensions of protection, you can file the registration maintenance documents referenced above online at http://www.uspto.gov.

JS 44 (Rev. 12/12)

CIVIL COVER SHEET

The JS 44 civil cover sheet and the information contained herein neither replace nor supplement the filing and service of pleadings or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. *(SEE INSTRUCTIONS ON NEXT PAGE OF THIS FORM.)*

I. (a) PLAINTIFFS

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

(b) County of Residence of First Listed Plaintiff Republic of Korea
(EXCEPT IN U.S. PLAINTIFF CASES)

(c) Attorneys *(Firm Name, Address, and Telephone Number)*

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DEFENDANTS

TAIPUSHENG TECHNOLOGY CO. LTD, a Chinese company limited,

County of Residence of First Listed Defendant China
(IN U.S. PLAINTIFF CASES ONLY)

NOTE: IN LAND CONDEMNATION CASES, USE THE LOCATION OF THE TRACT OF LAND INVOLVED.

Attorneys *(If Known)*

'16CV0519 MMAJMA

II. BASIS OF JURISDICTION *(Place an "X" in One Box Only)*

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- ☐ 290 All Other Real Property

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- ☐ 315 Airplane Product Liability
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- ☐ 340 Marine
- ☐ 345 Marine Product Liability
- ☐ 350 Motor Vehicle
- ☐ 355 Motor Vehicle Product Liability
- ☐ 360 Other Personal Injury
- ☐ 362 Personal Injury - Medical Malpractice

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- ☐ 367 Health Care/ Pharmaceutical Personal Injury Product Liability
- ☐ 368 Asbestos Personal Injury Product Liability

PERSONAL PROPERTY
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- ☐ 371 Truth in Lending
- ☐ 380 Other Personal Property Damage
- ☐ 385 Property Damage Product Liability

CIVIL RIGHTS
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- ☐ 441 Voting
- ☐ 442 Employment
- ☐ 443 Housing/ Accommodations
- ☐ 445 Amer. w/Disabilities - Employment
- ☐ 446 Amer. w/Disabilities - Other
- ☐ 448 Education

PRISONER PETITIONS

Habeas Corpus:
- ☐ 463 Alien Detainee
- ☐ 510 Motions to Vacate Sentence
- ☐ 530 General
- ☐ 535 Death Penalty

Other:
- ☐ 540 Mandamus & Other
- ☐ 550 Civil Rights
- ☐ 555 Prison Condition
- ☐ 560 Civil Detainee - Conditions of Confinement

FORFEITURE/PENALTY
- ☐ 625 Drug Related Seizure of Property 21 USC 881
- ☐ 690 Other

LABOR
- ☐ 710 Fair Labor Standards Act
- ☐ 720 Labor/Management. Relations
- ☐ 740 Railway Labor Act
- ☐ 751 Family and Medical Leave Act
- ☐ 790 Other Labor Litigation
- ☐ 791 Employee Retirement Income Security Act

IMMIGRATION
- ☐ 462 Naturalization Application
- ☐ 465 Other Immigration Actions

BANKRUPTCY
- ☐ 422 Appeal 28 USC 158
- ☐ 423 Withdrawal 28 USC 157

PROPERTY RIGHTS
- ☐ 820 Copyrights
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SOCIAL SECURITY
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- ☐ 862 Black Lung (923)
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- ☐ 864 SSID Title XVI
- ☐ 865 RSI (405(g))

FEDERAL TAX SUITS
- ☐ 870 Taxes (U.S. Plaintiff or Defendant)
- ☐ 871 IRS—Third Party 26 USC 7609

OTHER STATUTES
- ☐ 375 False Claims Act
- ☐ 400 State Reapportionment
- ☐ 410 Antitrust
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- ☐ 890 Other Statutory Actions
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- ☐ 896 Arbitration
- ☐ 899 Administrative Procedure Act/Review or Appeal of Agency Decision
- ☐ 950 Constitutionality of State Statutes

V. ORIGIN *(Place an "X" in One Box Only)*

☒ 1 Original Proceeding ☐ 2 Removed from State Court ☐ 3 Remanded from Appellate Court ☐ 4 Reinstated or Reopened ☐ 5 Transferred from Another District *(specify)* ☐ 6 Multidistrict Litigation

VI. CAUSE OF ACTION

Cite the U.S. Civil Statute under which you are filing ***(Do not cite jurisdictional statutes unless diversity)***: 35 U.S.C. §§ 271 et seq., under the Lanham Act, 15 U.S.C. §§ 1121, 1116, 1125(a), and 1125(d), et seq., and related claims.

Brief description of cause: Patent Infringement; Trademark Infringement

VII. REQUESTED IN COMPLAINT:

☐ CHECK IF THIS IS A **CLASS ACTION** UNDER RULE 23, F.R.Cv.P. **DEMAND $**

CHECK YES only if demanded in complaint: **JURY DEMAND:** ☒ Yes ☐ No

VIII. RELATED CASE(S) IF ANY

(See instructions): JUDGE _____ DOCKET NUMBER _____

DATE March 1, 2016

SIGNATURE OF ATTORNEY OF RECORD s/Lisel M. Ferguson

FOR OFFICE USE ONLY

RECEIPT # _____ AMOUNT _____ APPLYING IFP _____ JUDGE _____ MAG. JUDGE _____