

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
19 February 2004 (19.02.2004)

PCT

(10) International Publication Number
WO 2004/014589 A1

(51) International Patent Classification⁷: B23C 1/08, 3/13

(74) Agents: LEE, Sang-Yong et al.; 4F, Byukcheon Bldg., 1597-5, Seocho-dong, Seocho-gu, Seoul 137-876 (KR).

(21) International Application Number:

PCT/KR2003/001450

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(22) International Filing Date: 22 July 2003 (22.07.2003)

(25) Filing Language: Korean

(26) Publication Language: English

(30) Priority Data:

20-2002-0023745 8 August 2002 (08.08.2002) KR

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(71) Applicant (*for all designated States except US*): SINJIN SM CO., LTD. [KR/KR]; 822-25 Jinan-ri, Taeon-eup, Hwaseong-si, Gyeonggi-do 445-972 (KR).

(72) Inventors; and

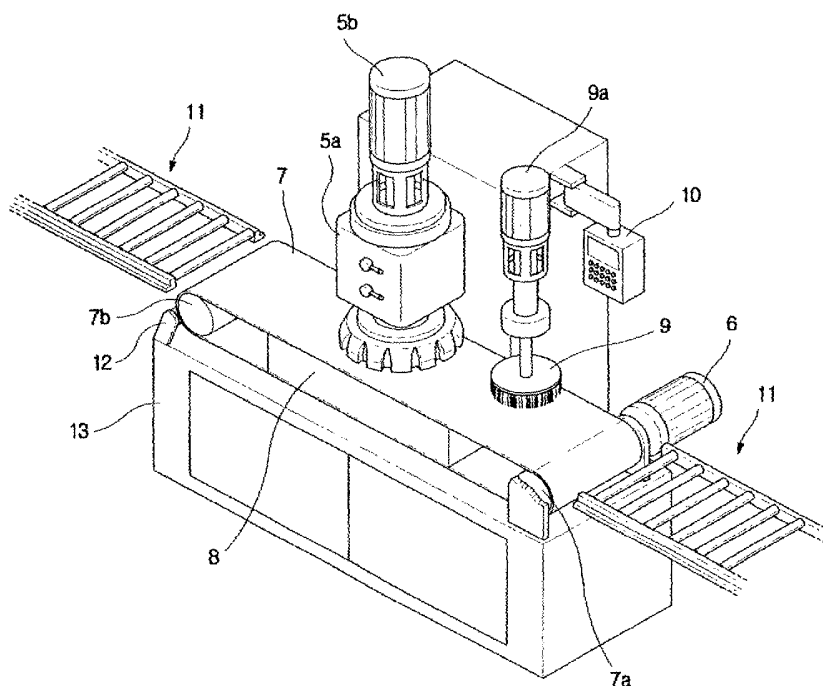
(75) Inventors/Applicants (*for US only*): KIM, Hong-Ki [KR/KR]; 822-25, Jinan-ri, Taeon-eup, Hwaseong-si, Gyeonggi-do 445-972 (KR). LEE, Byoung-Han [KR/KR]; #101 Changbu Villa, 906-5 Dang-dong, Gunpo-si, Gyeonggi-do 435-010 (KR).

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: MILLING MACHINE HAVING MAGNETIC BELT CONVEYOR FOR STEEL PLATE PROCESSING



(57) Abstract: Disclosed is a milling machine for planar processing of a steel plate, which includes a drive source, a conveyor belt which travels by the force of the drive source, a magnetic body installed in contact with a lower surface of the conveyor belt for fixing the steel plate supplied upon the conveyor belt by a magnetic force, and a milling cutter installed above the conveyor belt to move up and down for milling the surface of the steel plate.

MILLING MACHINE HAVING MAGNETIC BELT CONVEYOR FOR STEEL PLATE PROCESSING

TECHNICAL FIELD

5 The present invention relates to a milling machine for planar processing of a steel plate and more particularly to a milling machine with a magnetic belt conveyor for milling a steel plate in a state of fixing the steel plate supplied upon the conveyor belt by a magnetic force.

10 BACKGROUND ART

 In these days, a milling machine for milling a steel plate as shown in FIG. 1 is commonly used to mill the surface of a steel plate at a specific thickness. A workpiece, i.e., a steel plate 1 is gripped by a vice 3 mounted on a movement station 2 of the milling machine, and then the surface of the steel plate is milled by a rotating milling cutter 4
15 located above the movement station 2 while being horizontally moved by the movement station 2.

 However, in this case, it is required that each workpiece to be milled in turn must be gripped in the vice 3 manually for machining.

 In order to overcome the above problem, a milling machine including an electro-
20 magnetizable movement station 2 as shown FIG. 2 is proposed. The steel plate 1 on a movement station 2 is fixed by electro-magnetizing the movement station 2, and then machined by a milling cutter 4 above the movement station 2 while being horizontally moved.

However, in this machine, it is required to load steel plates and then apply a magnetic force to the movement station 2 for each machining.

DISCLOSURE OF INVENTION

5 The present invention is designed to overcome such problems of the prior art. An object of the invention is to provide an improved milling machine for steel plates, which can continuously supply steel plates below a milling cutter by a conveyor belt and fix the steel plates on the conveyor belt by a magnetic force.

10 In order to accomplish the above object, the present invention provides a milling machine, which includes a drive source, a conveyor belt which is rotatable by the drive source, a magnetic body installed in contact with a lower surface of the upper portion of the conveyor belt for fixing the steel plate supplied upon the conveyor belt by use of a magnetic force, and a milling cutter installed above the conveyor belt for cutting a plane of the steel plate which is moved in a state of being fixed on the conveyor belt by the
15 magnetic body.

Preferably, the present invention further includes a brush installed above the conveyor belt at the downstream of the milling cutter for brushing the steel plate.

20 In addition, the present invention may include a carrier roller units installed on front and rear ends of the conveyor belt to have a height identical to the belt for supplying and drawing the steel plate.

Preferably, the present invention includes a cleaning roller installed in contact with a surface of the conveyor belt for removing waste material on the belt.

It is desirable that the magnetic body consists of electromagnet which can be

magnetized selectively in accordance with power supply, and a magnetic field of the magnetic body is specified in a range of 5000~8000G.

BRIEF DESCRIPTION OF THE DRAWINGS

5 These and other features, aspects, and advantages of preferred embodiments of the present invention will be more fully described in the following detailed description, taken accompanying drawings. In the drawings:

FIG. 1 is a schematic view showing an example of a milling machine according to the prior art;

10 FIG. 2 is a schematic view showing another example of a milling machine according to the prior art;

FIG. 3 is a perspective view showing a milling machine according to a preferred embodiment of the present invention; and

15 FIG. 4 is a partially sectional view showing a combination between a conveyor belt and a magnetic body in FIG. 3.

BEST MODES FOR CARRYING OUT THE INVENTION

Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings.

20 FIG. 3 depicts a structure of a milling machine for a steel plate according to a preferred embodiment of the present invention. Referring to FIG. 3, the milling machine of the present invention includes a drive source 6 such as a motor, a conveyor belt 7 which can be rotated by a drive force of the drive source 6, a milling cutter 5

installed above the conveyor belt 7, and a magnetic body for fixing a workpiece on the conveyor belt 7 by a magnetic force.

Both ends of the conveyor belt 7 are respectively connected to a driving roller 7a and a driven roller 7b in a common way, and the belt 7 travels around the rollers 7a and 7b in the longitudinal direction thereof when the driving roller 7a rotates by means of the drive source 6. Here, the drive source 6, the driving roller 7a, and the driven roller 7b are mounted on a body frame 13.

Preferably, carrier roller units 11 are installed to front and rear ends of the conveyor belt 7 at the same height as the conveyor belt 7 for easy supply and discharge of a steel plate.

The milling cutter 5 is installed above the conveyor belt 7 to move up and down by means of a well-known lifting device 5a. Preferably, the milling cutter 5 has a plurality of cutting blades and machines an upper surface of a workpiece, i.e., the steel plate, by receiving a rotational force from a drive motor 5b. In addition, the lifting device 5a may include a sensor (not shown) for sensing a vertical location of the milling cutter 5 and a drive unit (not shown) for sliding vertically the milling cutter in order to control a cutting thickness of the steel plate in accordance with user's operation.

While the milling cutter 5 performs milling of the steel plate, burrs are frequently occurred on an edge of the steel plate and chips produced during the machining may cause scratches on the surface of the steel plate.

Accordingly, in order to prevent such defects, it is desirable to install a brush 9 driven by a driving motor 9a for brushing the steel plate at the downstream of the milling cutter 5 with respect to the advance direction of the conveyor belt 7.

As schematically shown in FIG. 4, the magnetic body 8 is fixed to the body frame 13 while its upper surface is in contact with a lower surface of the conveyor belt 7, and hauls the steel plate 1 supplied on the conveyor belt 7 by a magnetic force. At this time, it is desirable to make contacting surfaces of the belt and the magnetic body smooth so that the belt may smoothly move upon the magnetic body 8 when the conveyor belt 7 rotates.

The magnetic body 8 may be configured with electromagnet which is selectively magnetized in accordance with power supply. In this case, a magnetic field of the magnetic body 8 may be properly set in accordance with a thickness or a width of the steel plate. Considering that a rotational speed of the milling cutter 5 is generally set about 500rpm (revolutions per minute), a magnetic field of the magnetic body 8 for a steel plate in thickness of 6~35mm is preferably set in the range of 5000~8000G. Here, if the magnetic field is too weak less than 5000G, the steel plate may be derailed from the conveyor belt 7 when the milling cutter 8 contacts. If the field is too strong more than 8000G, release of the steel plate or rotation of the conveyor belt 7 may be interrupted. Proper magnetic fields according to a size of the steel plate for stably milling the steel plate are introduced through the experiment executed by the present inventor as shown in Table. 1.

20 TABLE 1

Width (mm) Thickness(t)	15~35	36~50	51~75	76~ 100	101~ 125	126~ 150	151~ 180	181~ 220	221~ 260	261~ 300
6~11	8000	7900	7600			7400			7200	
12~17	8000		7900	7700	7500	7200	7000	6800	6500	
18~23	8000		7900	7600	7200	7000	6700	6500	6300	6000

24~29	8000	7900	7700	7400	7200	6900	6600	6200	6000	5600
30~35	8000	7900	7600	7300	7000	6600	6200	5700	5400	5000

Preferably, it is possible to configure a control module 10 to the milling machine of the present invention so that a vertical location of the milling cutter 5 or a magnetic field of the magnetic body 8 may be controlled according to a size of a workpiece, i.e.,
5 the steel plate.

In the present invention, the conveyor belt 7 may be made of various materials. If the conveyor belt 7 is made of magnetizable materials, metal pieces produced during the cutting process are adhered to the surface of the conveyor belt and transferred together.

10 Accordingly, a cleaning roller 12 may be additionally installed to be in contact with an edge surface of the conveyor belt and mounted to one side of the body frame 13 so as to remove waste materials such as metal pieces adhered to the belt while working together with the rotation of the conveyor belt 7. Preferably, the cleaning roller 12 is installed in contact with an edge of the conveyor belt 7 where the steel plate is supplied
15 so that a surface of the conveyor belt 7 is cleaned just before the steel plate is supplied.

Hereinafter, operations of the milling machine for planar processing of a steel plate according to the present invention including components described as above will be described.

First, a workpiece, i.e., a steel plate, is loaded on the front carrier roller unit 11 to
20 be in contact with the conveyor belt 7, and then the steel plate is moved below the milling cutter 5 by the rotation of the conveyor belt 7.

In this case, the steel plate is fixed on the conveyor belt 7 by a magnetic force

from the magnetic body 8 installed in contact with the lower surface of the conveyor belt 7.

On the other hand, a vertical location of the milling cutter 5 is determined by the lifting device 5a in accordance with a cutting thickness of the steel plate set by a user.

5 This milling cutter 5 rotates by receiving a rotational force from the drive motor 5b and then mills the surface of the steel plate transferred upon the conveyor belt 7.

After passing through the milling cutter 5, the steel plate continuously moves below the brush 9, and then the surface of the steel plate is brushed by the brush 9.

After that, the steel plate is drawn toward the carrier roller unit 11 at the rear of the

10 conveyor belt 7.

INDUSTRIAL APPLICABILITY

The milling machine according to the present invention has an advantage of increasing a milling speed as much as about 5 times compared to the conventional
15 vice-type milling machine as shown FIG. 1, since it is possible to continuously transfer steel plates in a state that the steel plates are fixed on the conveyor belt by a magnetic force.

Moreover, the present invention may prevent the steel plate from vertically canting since the magnetic body is installed in contact with the lower surface of the
20 conveyor belt, thereby preventing a tolerance in the thickness processing of a steel plate.

The present invention has been described in detail. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since

various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

What is claimed is:

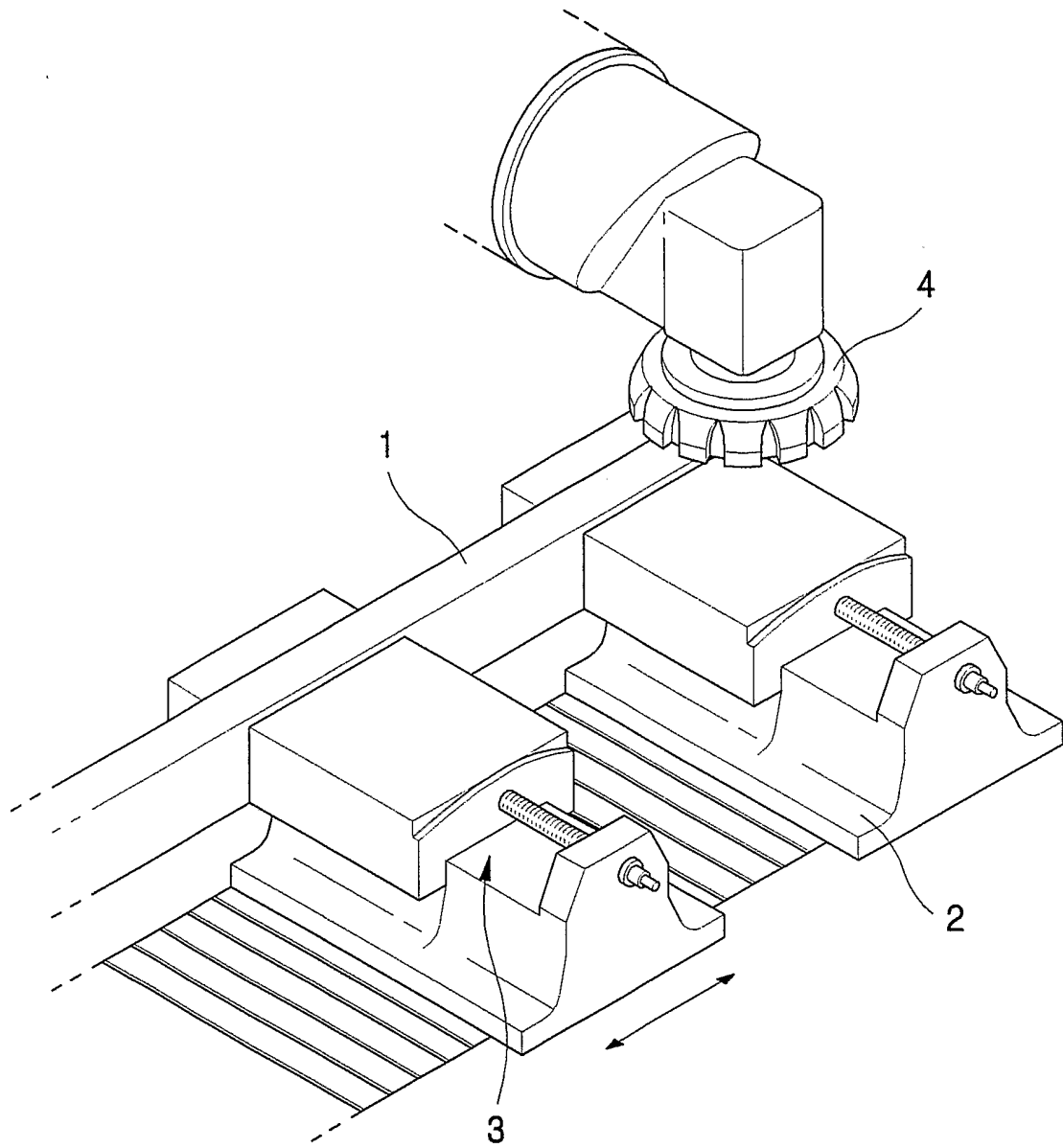
1. A milling machine for milling a surface of a steel plate, comprising
a drive source;
5 a conveyor belt which travels by the force of the drive source;
a magnetic body installed in contact with a lower surface of the conveyor belt for
fixing the steel plate supplied upon the conveyor belt by a magnetic force; and
a milling cutter installed above the conveyor belt to move up and down, the
milling cutter milling the surface of the steel plate.
10
2. A milling machine according to claim 1, further comprising:
a brush installed above the conveyor belt at the downstream of the milling cutter
for brushing the steel plate.
- 15 3. A milling machine according to claim 1, further comprising:
carrier roller units installed on front and rear ends of the conveyor belt at the
same height as the belt for supplying and discharging the steel plate.
4. A milling machine according to claim 1, further comprising:
20 a cleaning roller installed in contact with the surface of the conveyor belt for
removing waste materials on the belt.
5. A milling machine according to claim 1,

wherein the magnetic body includes electromagnets which are magnetized selectively in accordance with power supply.

6. A milling machine according to one of claims 1 to 5,
- 5 wherein the magnetic field of the magnetic body is set in the range of 5000~8000G for the steel plate having thickness of 6~35mm.

1/4

FIG. 1



2/4

FIG. 2

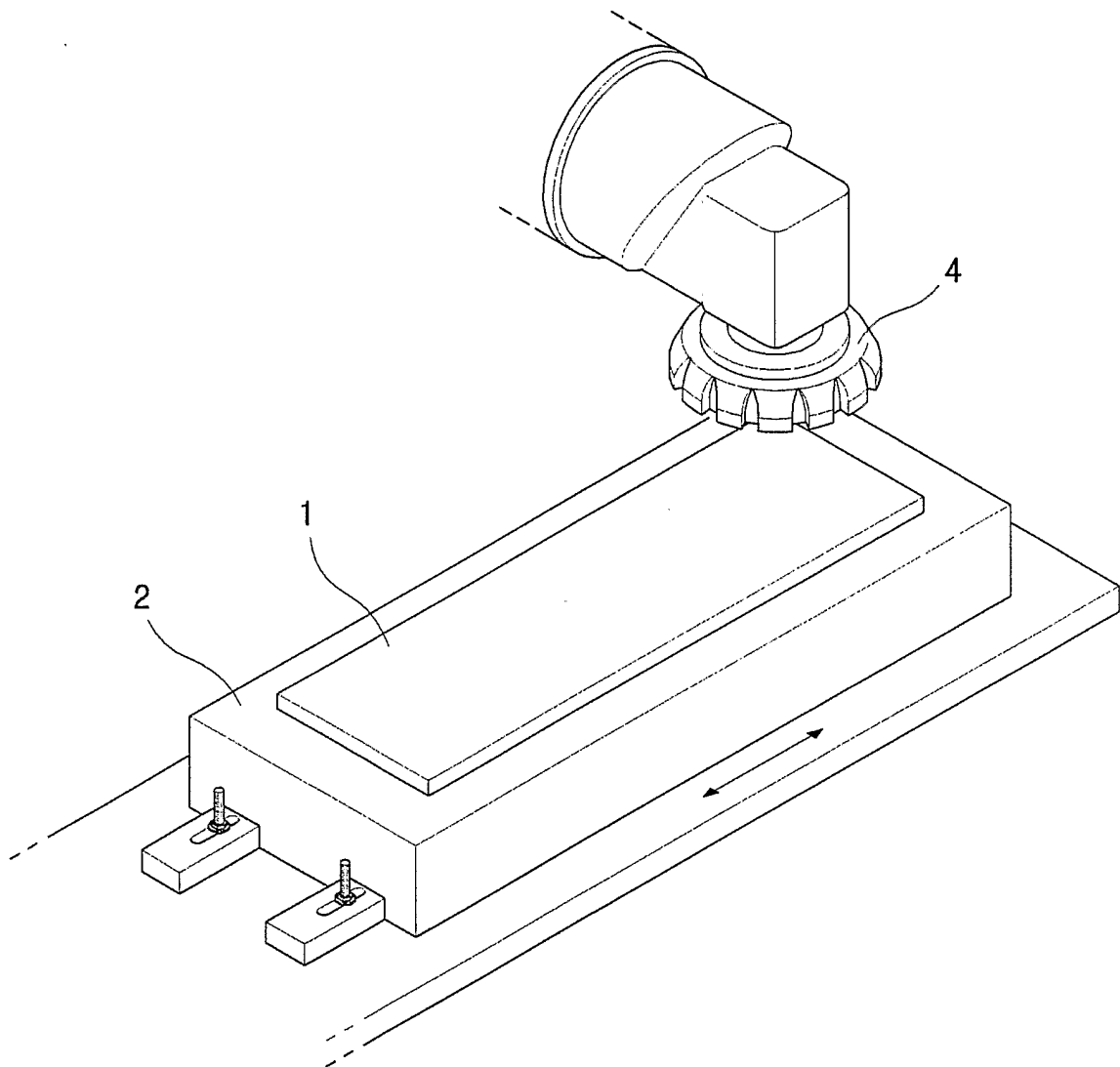
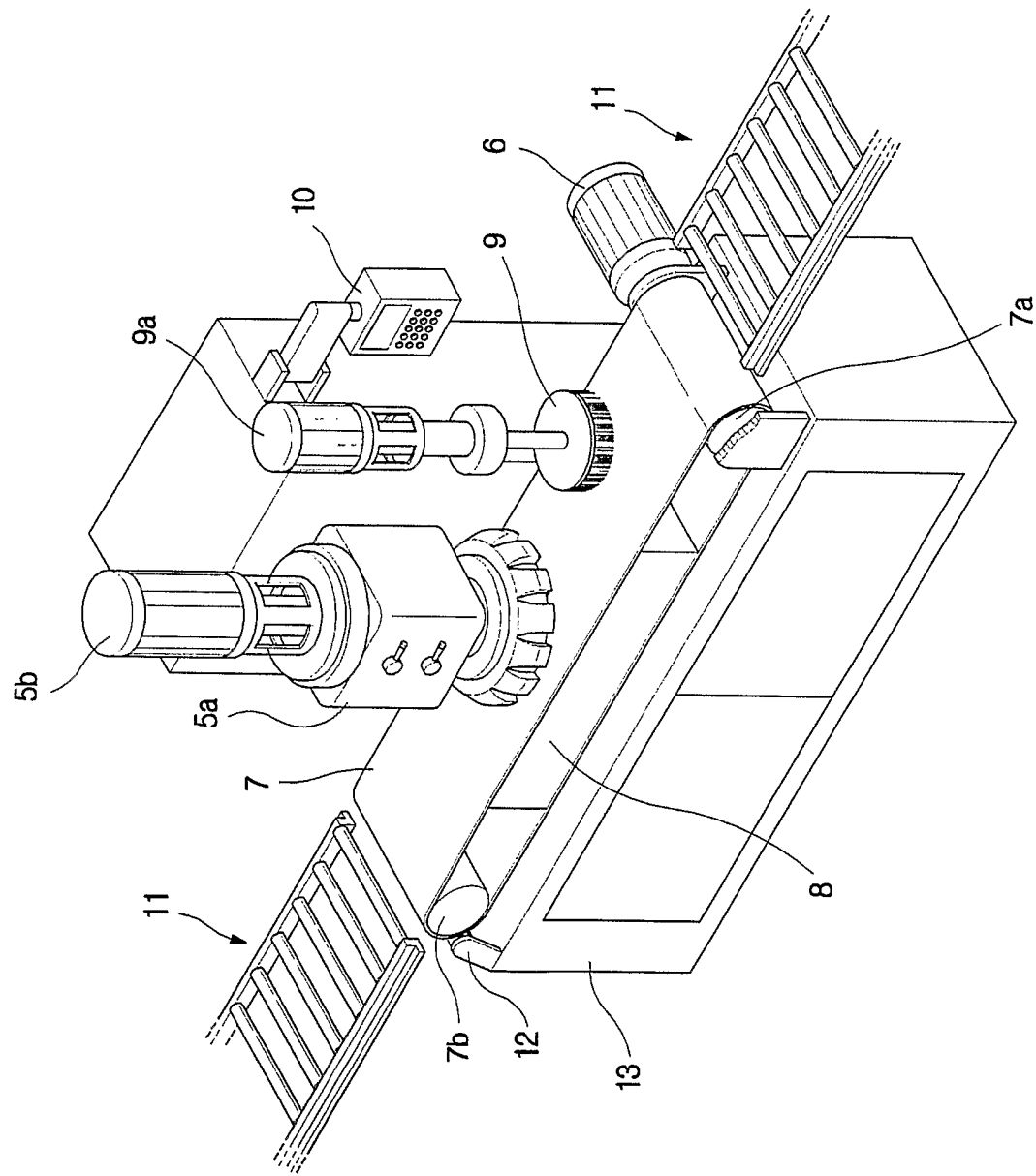
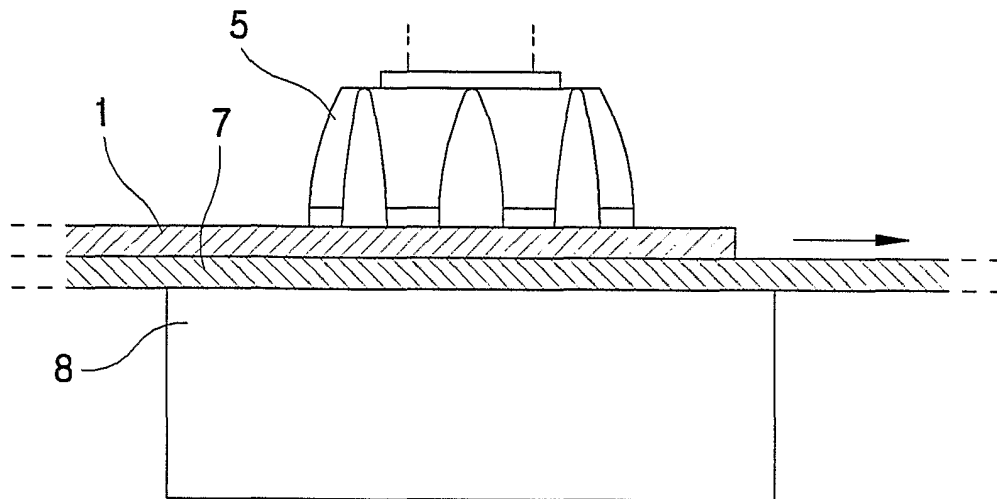


FIG. 3



4/4

FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR03/01450

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 B23C 1/08, B23C 3/13

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7 B23C 1/08, B23C 3/13

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Patents and applications for inventions since 1975

Korean Utility models and applications for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 3954044(The Ingersoll Machine Company), 4 May 1976 see figure 1 and claims	1 - 6
Y	JP, A, 07-124815(KAWASAKI STEEL CORP), 16 May 1995 see figure 1 and claim 1	1 - 6
Y	JP, A, 03-245911(KAWASAKI STEEL CORP), 1 Nov 1991 see figures and claims	1 - 6
Y	JP, A, 10-94880(MITSUBISHI ELECTRIC CORP), 14 Apr 1998 see figure 4 and claim 1	1 - 6

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

17 OCTOBER 2003 (17.10.2003)

Date of mailing of the international search report

18 OCTOBER 2003 (18.10.2003)

Name and mailing address of the ISA/KR



Korean Intellectual Property Office
920 Dunsan-dong, Seo-gu, Daejeon 302-701,
Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

KWON, In Sup

Telephone No. 82-42-481-5421

