



(12) **EUROPEAN PATENT APPLICATION**  
published in accordance with Art. 153(4) EPC

(43) Date of publication:  
**21.03.2012 Bulletin 2012/12**

(51) Int Cl.:  
**B22C 5/04 (2006.01) B22C 5/16 (2006.01)**  
**B22C 5/18 (2006.01)**

(21) Application number: **10774802.2**

(86) International application number:  
**PCT/JP2010/056668**

(22) Date of filing: **14.04.2010**

(87) International publication number:  
**WO 2010/131544 (18.11.2010 Gazette 2010/46)**

(84) Designated Contracting States:  
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR**

- **SUZUKI, Yoshinobu**  
Toyokawa-shi  
Aichi 442-0061 (JP)
- **ONO, Yasushi**  
Toyokawa-shi  
Aichi 442-0061 (JP)
- **ISHIGURO, Kenji**  
Toyokawa-shi  
Aichi 442-0061 (JP)

(30) Priority: **15.05.2009 JP 2009118258**

(71) Applicant: **Sintokogio, Ltd.**  
**Nagoya-shi, Aichi 450-0002 (JP)**

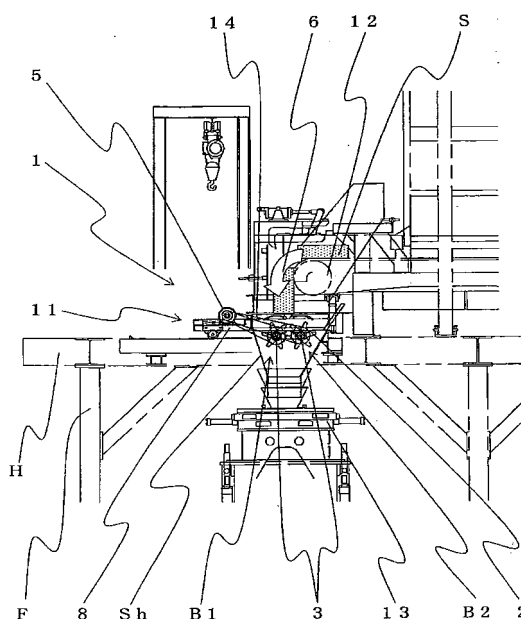
(74) Representative: **Thum, Bernhard**  
**Wuesthoff & Wuesthoff**  
**Patent- und Rechtsanwälte**  
**Schweigerstrasse 2**  
**81541 München (DE)**

(72) Inventors:  
• **CHIKYU, Keiji**  
Toyokawa-shi  
Aichi 442-0061 (JP)

(54) **LUMP CRUSHING DEVICE AND CONDITIONED SAND SUPPLYING SYSTEM**

(57) The object of the invention is to provide a machine for disintegrating balls in molding sand that is not high, to avoid a high space being required for installing it. The machine maintains the performance of an aeration-type molding machine. The object is also to provide a system for supplying molding sand that saves the space for installing it and facilitates the maintenance of it. The machine for disintegrating balls in molding sand comprises a first bar for disintegrating the balls that is supported at both ends. The bar has a plurality of blades that radiate from a rotating shaft. The machine also comprises a second bar for disintegrating the balls that is supported on the common plane horizontal with, parallel to, and at a certain distance from, the first bar. The second bar rotates in a reverse direction from that of the first bar. When molding sand is loaded from above to a space between the first and second bar the balls are disintegrated while the molding sand is downwardly combed. The system for supplying molding sand is **characterized in that** the bars are supported by the frame of the carriage and in that the motors for rotating the bars are mounted on the carriage.

Fig. 1



## Description

### Technical Field

**[0001]** The present invention relates to a machine for disintegrating balls in molding sand. Specifically, it relates to a machine in a foundry for transporting, by a transporting device such as a conveyer belt, molding sand that has been prepared by a sand muller or a sand mixer, and for disintegrating balls in the molding sand when loading the sand into an inlet that is disposed on a green-sand molding machine. It also relates to a system for supplying molding sand by using that machine.

### Background Art

**[0002]** Conventionally, molding sand that has been prepared from green sand and that is to be used for molding is subject to pressure when mulling it. Thus sand particles adhere to each other to form balls. The balls are mixed in the molding sand. A machine for disintegrating these balls in mulled sand to make the sand better for molding has been known (for example, see Japanese Patent Laid-open Publication No. H09-052142).

### Disclosure of Invention

**[0003]** The machine disclosed in that publication comprises many inner pins and many outer pins. They all stand vertically. The inner and outer pins are concentrically disposed. The inner pins are rotated to disintegrate the balls in the green sand between them and the outer pins, which are fixed. This machine is useful for preparing molding sand.

However, this machine is high. Thus a high space is required to install it. To install the machine, the conveyer belt that has been installed over the green-sand molding machine must be raised by about 1 meter. For this reason, renovating the building may be needed. Thus in some cases installing the machine is abandoned. If no renovation of the building is needed, the available space becomes narrower, to thereby make it difficult to maintain the machine.

If a molding machine utilizes air, such as an aeration-type molding machine, molding sand is uniformly filled in a mold cavity, especially in a small space such as a pocket, by means of airflow. To improve or maintain such a performance, it is preferable to supply molding sand that does not include balls. Thus the need for a machine for disintegrating balls in molding sand has increased.

**[0004]** In view of the aforementioned circumstances, the object of the present invention is to supply a machine for disintegrating balls in molding sand that is not high and does not require a high space for installing it. This machine is utilized to maintain the performance of a molding machine that utilizes air, such as an aeration-type molding machine. Another object of the present invention is to provide a system for supplying molding sand that

does not reach high level, that enables space to be saved, and that facilitates maintenance of the machine.

**[0005]** The machine for disintegrating balls in molding sand of the present invention comprises a first bar for disintegrating balls in molding sand that is supported at both ends and has a plurality of blades that are arranged to radiate from the rotating shaft of the bar. It also comprises a second bar for disintegrating balls in molding sand that is supported on a common plane horizontal with, parallel to, and at a certain distance from, the first bar. The second bar rotates in a reverse direction from the direction of the first bar. When molding sand is fed from the upper position to a space between the first and second disintegrating bars, balls are disintegrated while the molding sand is downwardly combed.

**[0006]** The system for supplying molding sand of the present invention utilizes the machine that is described above. It is **characterized in that** the disintegrating bars are supported on a frame of a carriage. And an electric motor for rotating the disintegrating bars is mounted on the carriage.

**[0007]** By the present invention, the machine for disintegrating balls in molding sand is not high, and so does not require a great height for installing it. Thus the cost for the facilities can be saved. The present invention has an advantage such that the performance of an aeration-type molding machine can be maintained. Further, the present invention has advantages such that a space for a system for supplying molding sand can be saved and maintenance can be facilitated.

**[0008]** The basic Japanese patent application, No. 2009-118258, filed May 15, 2009, is hereby incorporated by reference in the present application in its entirety.

The present invention will become more fully understood from the detailed description given below. However, the detailed description and the specific embodiment are illustrations of desired embodiments of the present invention, and are described only for an explanation. Various possible changes and modifications will be apparent to those of ordinary skill in the art on the basis of the detailed description.

The applicant has no intention to dedicate to the public any disclosed embodiment. Among the disclosed changes and modifications, those which may not literally fall within the scope of the present claims constitute, therefore, a part of the present invention in the sense of the doctrine of equivalents.

The use of the articles "a," "an," and "the" and similar referents in the specification and claims are to be construed to cover both the singular and the plural, unless otherwise indicated herein or clearly contradicted by the context. The use of any and all examples, or exemplary language (e.g., "such as") provided herein, is intended merely to better illuminate the invention, and so does not limit the scope of the invention, unless otherwise claimed.

### Brief Description of Drawings

#### [0009]

Fig. 1 is the partial cross-sectional front view of the machine for disintegrating balls in molding sand of the present invention that illustrates the arrangement of the machine.

Fig. 2 is the partial cross-sectional side view of the machine for disintegrating balls in molding sand of the present invention that illustrates the arrangement of the machine.

Fig. 3 is the front view of the machine for disintegrating balls in molding sand of the present invention that illustrates the status under maintenance.

Fig. 4 is the plan view of the machine for disintegrating balls in molding sand of the present invention.

Fig. 5 is the front view of the main part of the machine for disintegrating balls in molding sand of the present invention.

Fig. 6 is the cross-sectional view taken in the direction of arrows A and A in Fig. 5.

Fig. 7(a) is the cross-sectional view taken in the direction of arrows B and B in Fig. 5, and (b) is the left side view of (a).

Fig. 8 is the cross-sectional view taken in the direction of arrows C and C in Fig. 5.

### Best Mode for Carrying Out the Invention

[0010] Below the machine for disintegrating balls in molding sand as an embodiment of the present invention is described with reference to the drawings. Figs. 1 and 2 are schematic diagrams for showing the arrangement of the machine for disintegrating balls in molding sand of the present invention. They illustrate the status under normal operation. Fig. 3 illustrates a status under maintenance. Fig. 4 is a schematic plan view of the main body of the machine. In Fig. 1 a column F and a beam H are shown.

[0011] As shown in Figs. 1 to 4, the machine 1 for disintegrating balls in molding sand comprises a first bar B1 for disintegrating balls in molding sand and a second bar B2 for disintegrating balls in molding sand. The second bar B2 is supported on the common plane horizontal with the first bar B1. They are parallel to each other and placed a certain distance apart. The second bar B2 has a rotating shaft 3-2 that rotates in a reverse direction from that of the first bar B1.

[0012] Both ends of both bars B1, B2 are supported by, for example, a frame 8 of a carriage. Both bars B1,

B2 have a plurality of blades 2-1, 2-2 (collectively called "2") that are disposed at uniform intervals in the circumferential and axial directions on respective rotating shafts 3-1, 3-2 (collectively called "3"). The blades 2-1, 2-2 are not necessarily disposed at uniform intervals in the circumferential and axial directions on the rotating shafts 3-1, 3-2. They may be disposed at arbitrary intervals. A chute Sh has an upper opening below one end of a conveyor belt for transporting molding sand. The upper end has a frame structure that is connected to the frame 8 of the carriage. The chute Sh is shaped to narrow downwardly. The bottom of it is connectable to a tank for sand that is an upper part of a molding machine. That is, the chute Sh appears to be composed of a rectangle, a trapezoid, and a rectangle (see Fig. 8). The chute may have any shape, unless molding sand spills outside it.

[0013] The blades 2 can be formed by a clipped plate, a round bar, or a stud bolt. They radiate from the rotating shaft 3.

[0014] As shown in Fig. 4, the machine 1 for disintegrating balls in molding sand is configured so that the blades 2-2 of the second bar B2 go downwardly through the gaps 4 between the blades 2-1, 2-1 of the first bar B1 to disintegrate the balls by downwardly combing the molding sand.

In this embodiment, the gap between the blades is 13 mm in the longitudinal direction of the bars B1, B2. The minimum distance between the shaft 3 and the blades 2 is 73 mm. By adjusting the lengths of the blades 2 of the shafts 3 or the distance between the shafts 3, balls that have a diameter of 6 mm or over are disintegrated. The blades 2 are fixed one after another by changing the angle by 120 degrees.

[0015] By constructing the machine as discussed above, the balls are efficiently disintegrated by combing, shearing, or cutting.

[0016] As shown in Fig. 5, the first bar B1 and the second bar B2 are provided with respective motors 5 to rotate the shafts 3-1 and 3-2, respectively. The shafts 3 and the motors 5 are linked by V-belts 14, 14.

[0017] The two motors 5, 5 are used so as to independently rotate the two shafts.

[0018] Further, to rotate the first bar B1 and the second bar B2 at the same speed or different speeds, dedicated inverters (not shown) are provided.

[0019] The rotating speed of the first bar B1 and the second bar B2 can be adjusted so that their rim speeds are equal to, or faster than, the speed of free fall of the molding sand S.

[0020] By adjusting the rim speeds of the first bar B1 and the second bar B2, it is found that the balls are efficiently disintegrated and crumbled.

[0021] In Figs. 1 and 2, the direction in which the molding sand S goes is shown by the arrow 6. The shape of the carriage 11 is defined by the frame 8. The carriage 11 is equipped with four rollers that are disposed on the frame 8. The rollers are configured to move on the rails that are installed on a part of the beam in the building.

However, any construction that enables the machine 1 to move can be used. Rails are not necessarily needed. Any structure that can substitute for them can be used. The rollers are equipped with stoppers to be fixed during a time other than maintenance.

**[0022]** Fig. 2 illustrates the side cross-sectional view of the arrangement of the machine 1 for disintegrating balls in molding sand of the present invention. With reference to Figs. 4, 6, and 7, a means 7 is provided for detecting slippage of the shafts 3 of the first bar B1 and the second bar B2. The means 7 for detecting the slippage detects the slippage by counting an object 10 that is attached to the shaft 3 by means of a proximity switch 9. If the count by the proximity switch 9 significantly decreases, then the slippage has occurred. The object 10 is formed as an L-shaped plate. However, any structure can be used for it if the proximity switch 9, which is disposed on the frame 8 of the carriage, counts how many times the object 10 comes close. If the number of rotations of the shafts 3 can be counted, any structure can be used.

**[0023]** If abrasion-resistant material is welded to, or ceramics are sprayed on, the blades 2 of the first bar B1 and the second bar B2, the lives of the bars for disintegrating the balls can be extended.

**[0024]** During the normal operation, as shown in Fig. 1, the machine 1 for disintegrating balls in molding sand is located just below a machine 12 for loading molding sand. At maintenance, as shown in Fig. 3, the machine 1 is moved with the carriage 11 to the left side on the drawing. It is moved away from the machine 12 for loading molding sand.

The upper part of the molding machine 13 has an elevating function. This function is achieved because the machine for loading molding sand of the molding machine 13 is telescopically supported by a cylinder (not shown). This cylinder enables that function to be carried out. During maintenance the molding machine 13 is downwardly separated from the machine 1 for disintegrating balls in molding sand.

The machine 1 for disintegrating balls in molding sand is constructed as discussed above.

**[0025]** Below the operation of the machine of the present invention is described. In Fig. 1 the machine 1 for disintegrating balls in molding sand is activated. Then molding sand S is loaded from above to the space between the first bar B1 and the second bar B2 by the machine 12 for loading molding sand. The molding sand S is downwardly combed so as to disintegrate the balls in it. That is, the first bar B1 rotates clockwise and the second bar B2 rotates counterclockwise.

**[0026]** The effects of the machine for disintegrating balls were examined. Before using the machine 1 for disintegrating balls in the molding sand of the present invention, the average rate of the content of the balls was 6.78% on the machine 12 for loading molding sand. After using it, that rate was 3.18% on the molding machine 13, which is disposed at the downstream side of the machine

1 for disintegrating balls in molding sand. Thus the rate decreased by 3.60%. In this examination, a "ball" means a lump of sand that has a diameter of 6 mm or over. In this examination the "balls" are measured as follows.

5 That is, sand that is taken at the point where it is measured is sieved ten times through a screen with a mesh size of 6 mm. Then the weight of sand on the screen is measured. The rate of the weight of sand on the screen to that of the sand that is taken is calculated as the rate of content of the balls. As a result, the performance of an aeration-type molding machine can be maintained. Homogeneous molds can be manufactured.

**[0027]** The slippage is examined as follows. If an excessive amount of molding sand is loaded into the machine 1 for disintegrating balls in molding sand, or if too many balls are included, the capacity of the machine 1 may be exceeded.

**[0028]** The proximities of the object 10 that is attached to the shaft 3 is counted by the proximity switch 9. If the significant decrease of the count by the proximity switch 9 is detected, the occurrence of the slippage is detected. If so, a display showing an abnormal operation is shown or loading the molding sand is stopped.

**[0029]** Now an operation for maintenance is described. As shown in Figs. 1 to 4, the machine 1 for disintegrating balls in molding sand comprises the first bar B1 for disintegrating the balls, which bar is supported at both ends. The first bar B1 has a plurality of blades 2 that are arranged to radiate from the rotating shaft 3. The machine 1 also comprises the second bar B2 for disintegrating the balls, which bar is supported on the common plane horizontal with, parallel to, and at a certain distance from, the first bar B1. The second bar B2 rotates in a reverse direction from the direction of the first bar B1. The system for supplying molding sand utilizes the machine 1 for disintegrating balls in molding sand. The bars B1, B2 for disintegrating the balls in molding sand are supported by the frame 8 of the carriage. An electric motor for rotating the bars B1, B2 is mounted on the carriage 11. The normal operation is carried out in this status. The bars B1, B2 may be supported by the frame 8 directly or via the other member or members. Here, the phrase "the bars B1, B2 are supported by the frame 8" means any structure that includes a structure where they are supported by the chute Sh.

**[0030]** With reference to Fig. 3 the procedure for maintenance is now described. As shown in Fig. 3, the machine 1 for disintegrating balls in molding sand that has been located just below the machine 12 for loading sand is moved with the carriage 11 to the left side in the drawing. Thus the machine 1 is moved away from the machine 12. By doing so, replacing the bars B1, B2 for disintegrating the balls in molding sand is facilitated. If required, a mobile crane K is used to decrease the amount of hard work (work where strong muscles, such as arm or thigh muscles, are used, and so much energy is consumed). Since the machine 1 for disintegrating balls in molding sand that was just below the machine 12 for loading mold-

ing sand during normal operation is moved away from the machine 12, maintaining the system for supplying molding sand of the present invention is easy to do. Preferably the machine is brought to the side opposite the machine 12. However, it may be brought in any direction.

**[0031]** If the molding machine 13 has an elevating function, the maintenance becomes easier, since the carriage 11 moves without interfering with the chute Sh, which is disposed under the machine 1 for disintegrating balls in molding sand.

**[0032]** If the sand muller has mulling wheels, large balls are often generated. In this case, the system of the present invention significantly makes the performance of molding better. If the sand muller has an agitator, the system has advantages to remove small balls and the balls that are generated during the transportation of molding sand.

As discussed above, the machine 1 for disintegrating balls in molding sand of the present invention has an advantage in having the facilities and the space for installing the machine to be not high, to thus save costs. It also has an advantage to maintain the performance of an aeration-type molding machine.

Further, the system for supplying molding sand of the present invention has advantages such that the space for it can be saved and the maintenance can be facilitated.

**[0033]** The scope of the present invention must not be construed to be limited to a specific desired embodiment. The present invention can be utilized for many applications, which one having ordinary skill in the art would know, such as crumbling sand that has been solidified by heat effects after casting, within the scope of the claims. The present invention is not limited to a machine or system for molding sand.

## Claims

1. A machine for disintegrating balls in molding sand comprising:

a first bar for disintegrating the balls that is supported at both ends,  
 a second bar for disintegrating the balls that is supported on a common plane horizontal with, parallel to, and at a certain distance from, the first bar, the second bar rotating in a reverse direction from the direction of the first bar;  
 both the first bar and the second bar have a plurality of blades that are arranged to radiate from a rotating shaft;  
 wherein when molding sand is loaded from above to a space between the first bar and the second bar the balls are disintegrated while the molding sand is downwardly combed.

2. The machine for disintegrating balls in molding sand

of claim 1, wherein the blades of the second bar enter gaps between the blades of the first bar to thereby disintegrate the balls by downwardly combing the molding sand.

3. The machine for disintegrating balls in molding sand of claim 1 or 2, wherein the first bar and the second bar have respective motors for independently rotating the bars.

4. The machine for disintegrating balls in molding sand of claim 3, wherein to adjust rotating speed of the first bar and the second bar at different speeds inverters are provided for the respective bars.

5. The machine for disintegrating balls in molding sand of claim 4, wherein the rotating speeds of the first bar and the second bar are adjusted so that the rim speeds are the same as, or faster than, the speed of free fall of the molding sand.

6. The machine for disintegrating balls in molding sand of claim 1, 2, 4, or 5, further comprising:

a means for detecting slippage of the rotating shaft of the first bar or the second bar.

7. The machine for disintegrating balls in molding sand of claim 1, 2, 4, or 5, further comprising:

wherein abrasion-resistant material is welded to, or ceramics are sprayed on, the blades of the first bar and the second bar.

8. A system for supplying molding sand that uses the machine for disintegrating balls in molding sand of claim 1 or 2, wherein the bars for disintegrating the balls in molding sand are supported by the frame of a carriage and motors for rotating the bars are mounted on the carriage.

9. The system for supplying molding sand of claim 8, wherein the molding machine has an elevating function.

10. The system for supplying molding sand of claim 9, wherein a sand muller has mulling wheels.

11. The system for supplying molding sand of claim 9, wherein a sand muller has an agitator.

Fig. 1

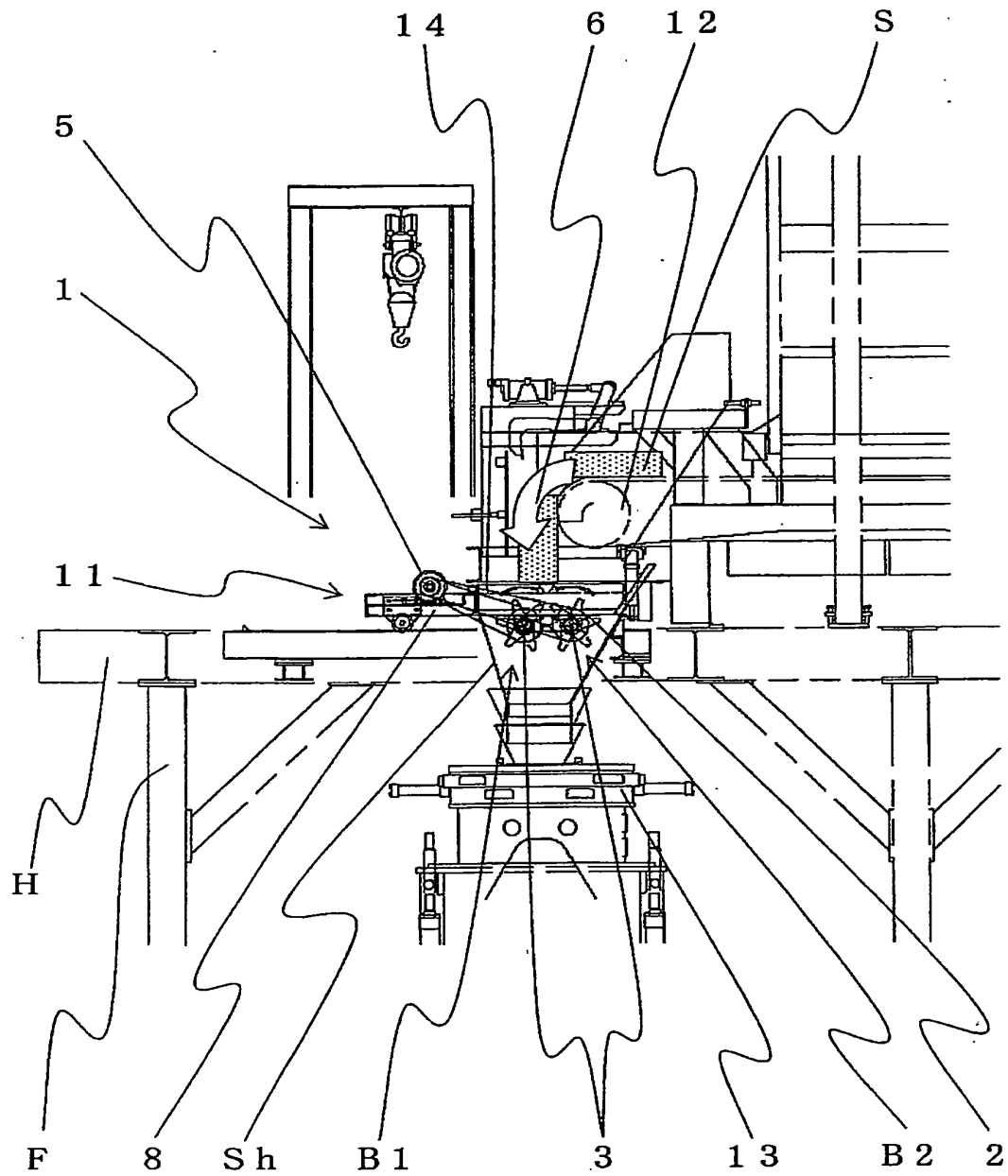


Fig. 2

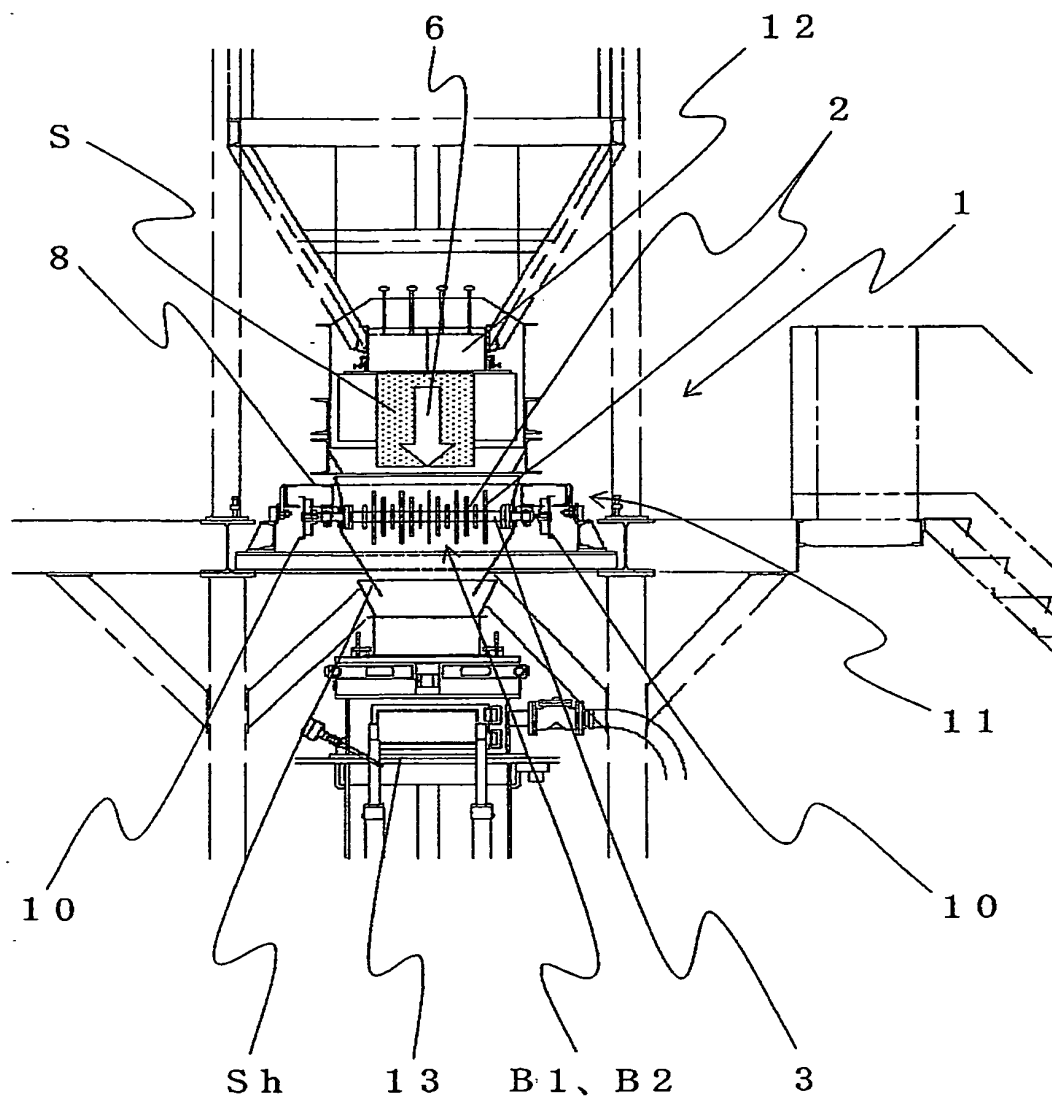


Fig. 3

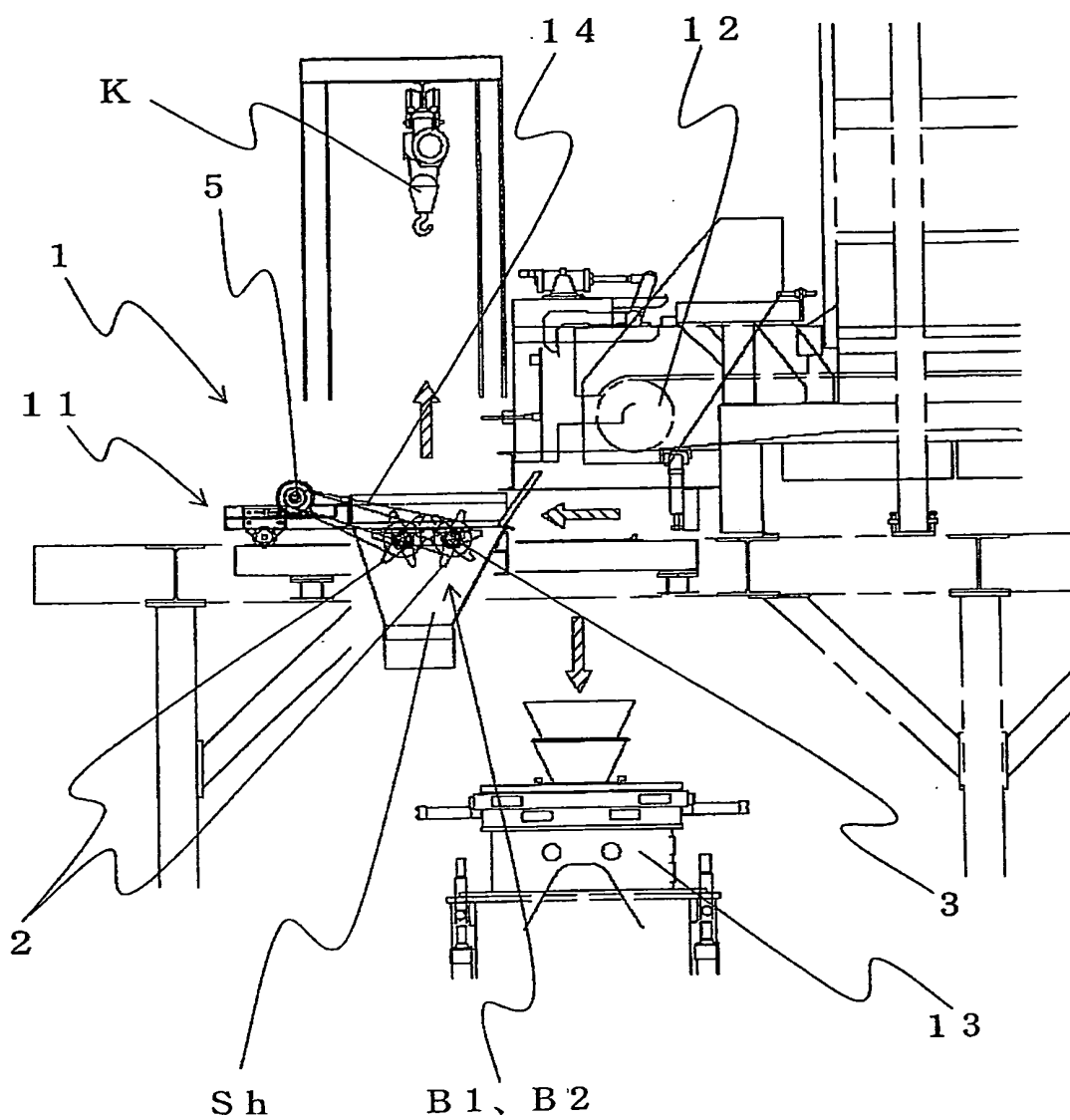




Fig. 4

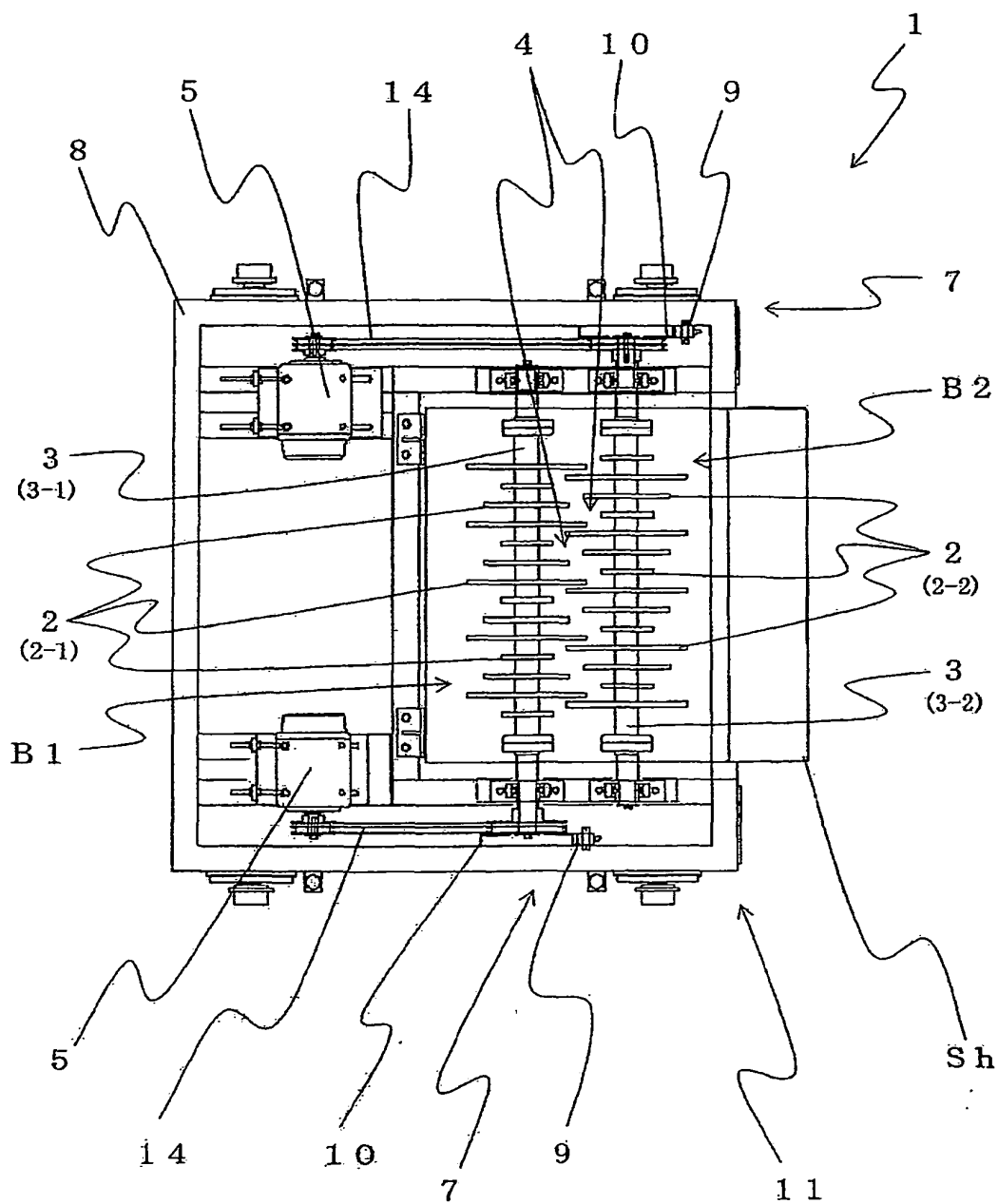


Fig. 5

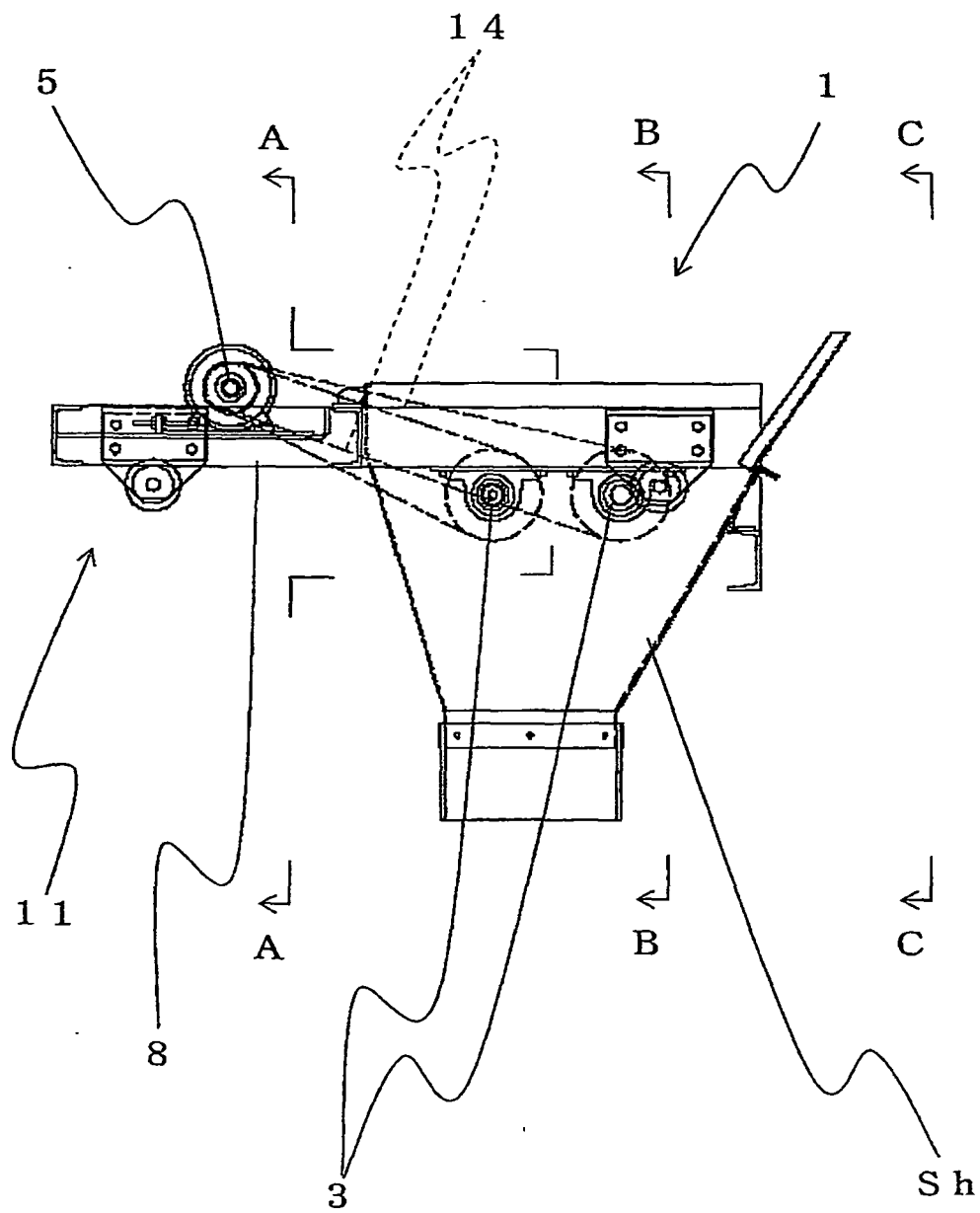


Fig. 6

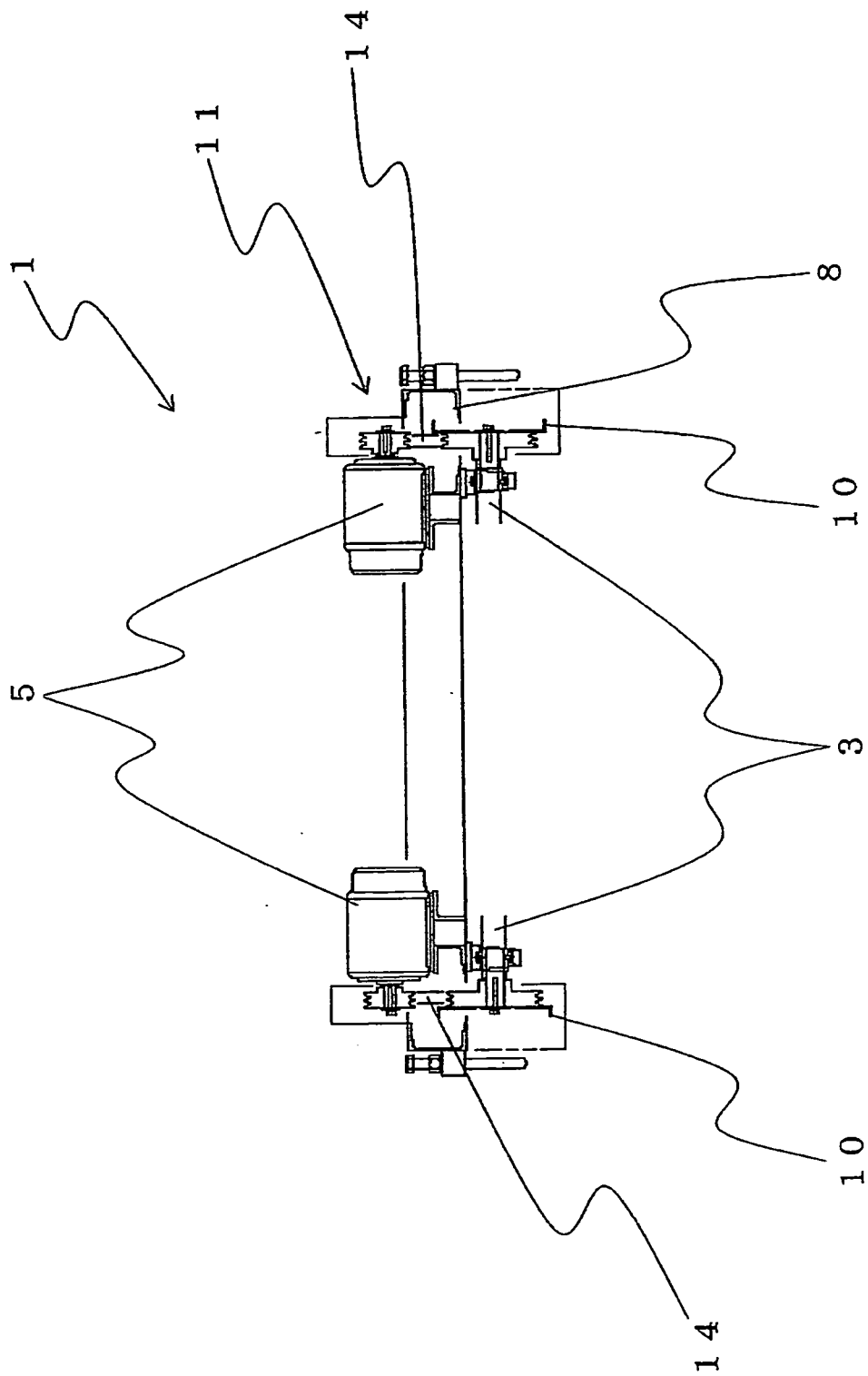


Fig. 7

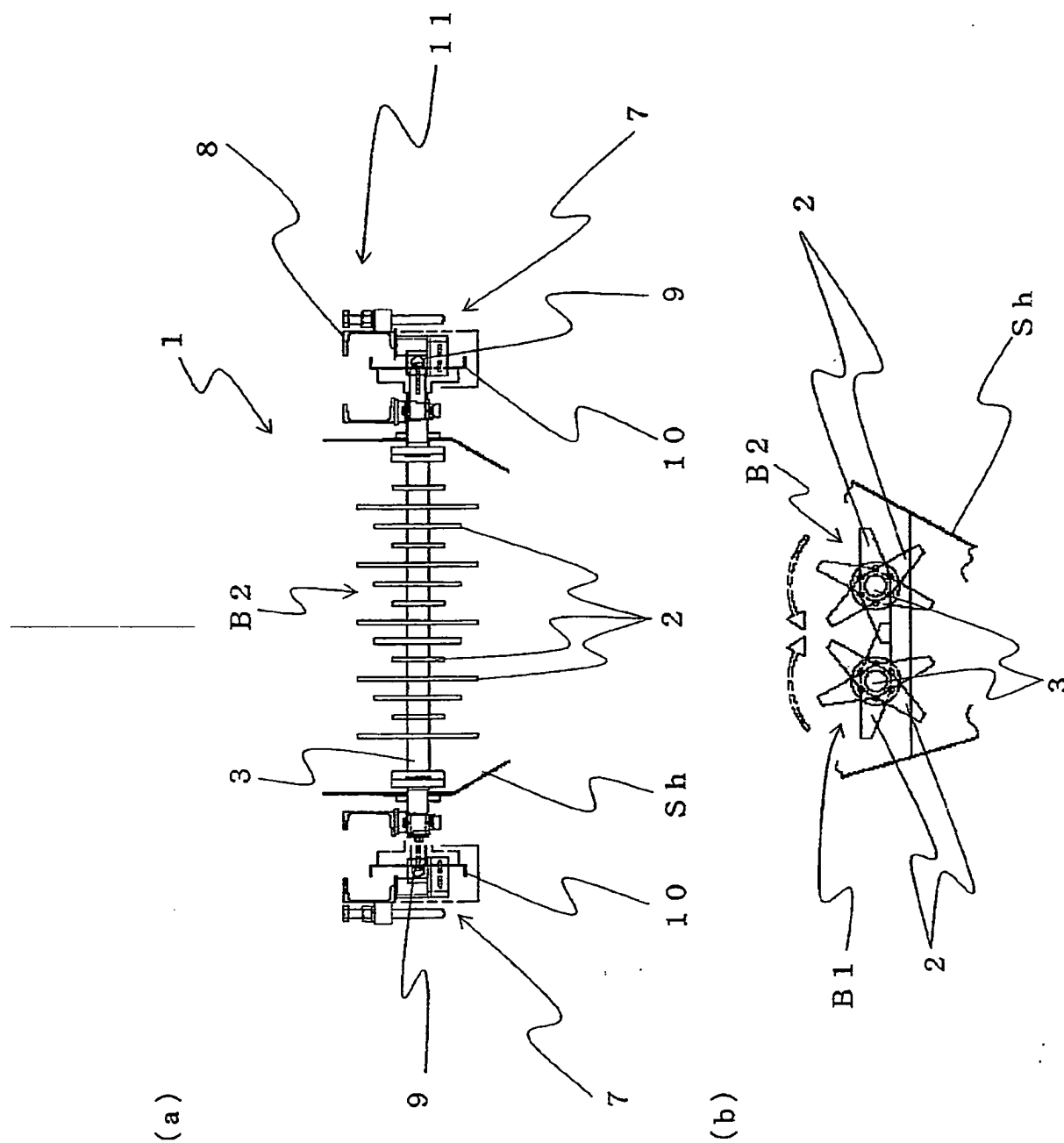
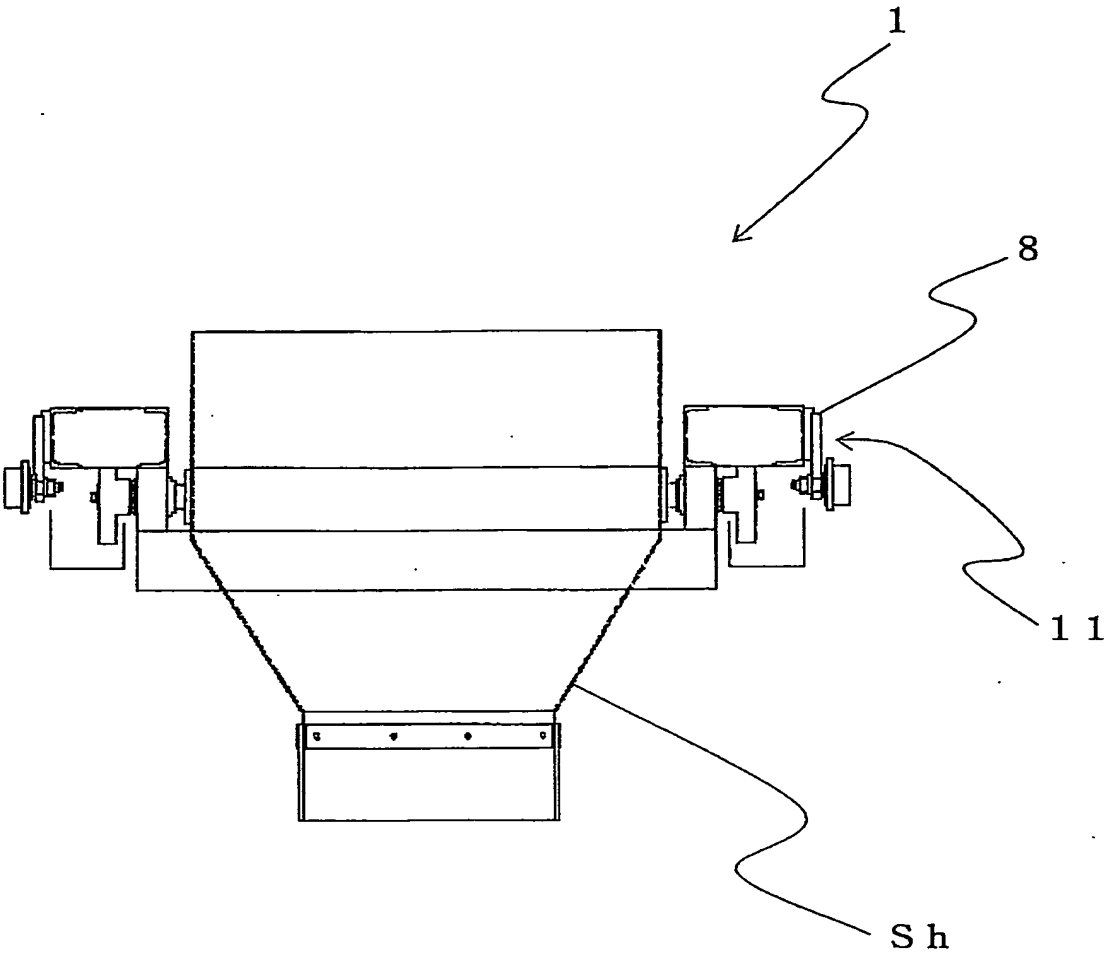


Fig. 8



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/056668

## A. CLASSIFICATION OF SUBJECT MATTER

B22C5/04(2006.01) i, B22C5/16(2006.01) i, B22C5/18(2006.01) i

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)

B22C5/04, B22C5/16, B22C5/18

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

|                           |           |                            |           |
|---------------------------|-----------|----------------------------|-----------|
| Jitsuyo Shinan Koho       | 1922-1996 | Jitsuyo Shinan Toroku Koho | 1996-2010 |
| Kokai Jitsuyo Shinan Koho | 1971-2010 | Toroku Jitsuyo Shinan Koho | 1994-2010 |

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         | Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 37080/1991 (Laid-open No. 125045/1992) (Sinto Kogyo Ltd.), 13 November 1992 (13.11.1992), claims; paragraph [0012]; fig. 2 (Family: none)        | 1-11                  |
| Y         | Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 184817/1983 (Laid-open No. 94344/1985) (Hino Motors, Ltd.), 27 June 1985 (27.06.1985), page 6, line 18 to page 7, line 15; fig. 3 (Family: none) | 1-11                  |



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 another 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

"&amp;" document member of the same patent family

Date of the actual completion of the international search  
10 June, 2010 (10.06.10)Date of mailing of the international search report  
22 June, 2010 (22.06.10)Name and mailing address of the ISA/  
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/056668

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                                    | Relevant to claim No. |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Y<br>A    | Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 25934/1973 (Laid-open No. 127417/1974) (Tochiku Kogyo Kabushiki Kaisha), 31 October 1974 (31.10.1974), page 4, line 10 to page 5, line 13 (Family: none) | 3-7<br>1, 2, 8-11     |
| Y<br>A    | JP 9-13177 A (Tokuden Co., Ltd., Asahi Glass Co., Ltd.), 14 January 1997 (14.01.1997), paragraph [0052] (Family: none)                                                                                                                                                | 7<br>1-6, 8-11        |
| A         | JP 50-28168 Y2 (Shimomura Denyusha, Ltd.), 20 August 1975 (20.08.1975), page 1, right column, lines 4 to 12; fig. 1 (Family: none)                                                                                                                                    | 1-11                  |
| A         | Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 117040/1986 (Laid-open No. 25148/1988) (Fukuji OTO), 19 February 1988 (19.02.1988), fig. 4, 5 (Family: none)                                             | 1-11                  |

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

**REFERENCES CITED IN THE DESCRIPTION**

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

**Patent documents cited in the description**

- JP H09052142 B [0002]
- JP 2009118258 A [0008]