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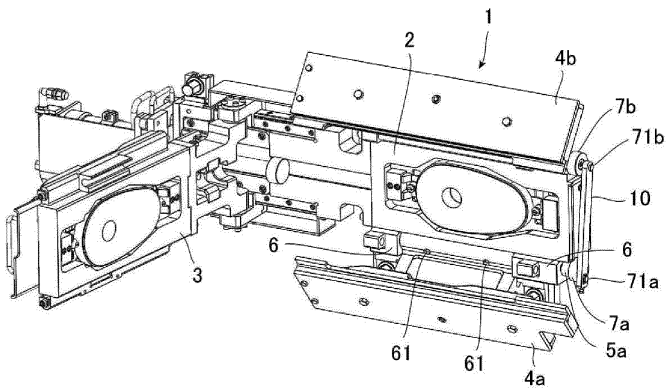
(54) SLIDING NOZZLE DEVICE

(57) It is intended to provide a sliding nozzle apparatus which comprises a pair of sliding metal frame retaining sections provided on respective sides of opposed long edges of a fixed metal frame in an openable and closable manner, wherein the sliding nozzle apparatus is capable of allowing the sliding metal frame retaining sections to be simultaneously opened and closed by a simple manipulation. The sliding nozzle apparatus further comprises: a pair of shafts 5a, 5b each integrated with a respective one of the sliding metal frame retaining sections 4a, 4b and each rotatably supported on a corresponding one of the sides of the opposed long edges of the fixed metal frame 2; a first link member 7a and a second link member 7b provided, respectively, at one ends of the shafts of the sliding metal frame retaining sections; and link means 10 coupling the first and second link members together, such that, when one of the sliding metal frame retaining sections is manually opened or closed, the shaft of the other sliding metal frame retaining section is reversely rotated to cause the other sliding metal frame retaining section to be simultaneously opened or closed.

[Fig 1]



EP 3 763 461 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a sliding nozzle apparatus used for controlling the flow rate of molten metal, and more particularly to a sliding nozzle apparatus comprising a pair of sliding metal frame retaining sections provided on respective sides of opposed long edges of a fixed metal frame in an openable and closable manner.

BACKGROUND ART

[0002] A sliding nozzle apparatus is attached to, e.g., a molten steel outlet of a ladle, wherein it is configured such that, in a state in which two, upper and lower, refractory plates each having a respective one of two nozzle hole portions are superimposed on each other, with a surface pressure being loaded therebetween, the lower plate is linearly slid with respect to the upper plate to change the degree of opening between the nozzle hole portions, thereby controlling the flow rate of molten steel (molten metal).

[0003] Generally, this type of sliding nozzle apparatus comprises: a fixed metal frame which holds an upper plate; a sliding metal frame which holds a lower plate and is configured to be linearly slid so as to slidingly move the lower plate with respect to the upper plate; a sliding metal frame retaining section which slidably retains the sliding metal frame; an elastic body which loads a surface pressure between the upper and lower plates; and a driving apparatus configured to drive the sliding metal frame.

[0004] Although the sliding metal plate retaining section is generally formed of a single body, there is another type formed of two divided bodies for the purpose of downsizing. For example, in the following Patent Document 1, a pair of opening and closing metal frames (sliding metal frame retaining sections) 40 are provided symmetrically with respect to a sliding-directional axis of a sliding metal frame 30, and attached to a fixed metal frame 20, individually, as shown in FIGS. 8 and 9. Each of the sliding metal frame retaining sections 40 comprises a portal arm 41, a spring box 42, a surface pressure guide 48, and a slide member 46. More specifically, a base end of the portal arm 41 is swingably attached to a pin 22 provided in the fixed metal frame 20, and the spring box 42 is disposed between two arms 41a of the portal arm 41, and integrally provided with the surface pressure guide 48.

[0005] This sliding nozzle apparatus requires the work of opening each of the pair of sliding metal frame retaining sections outwardly, and then closing it, during plate replacement.

[0006] However, in a case where, during the plate replacement, the sliding nozzle apparatus is placed in a horizontal posture in a manner allowing the pair of sliding metal plate retaining sections to be arranged one-above-the-other, and then each of the sliding metal plate retaining sections is opened, an upper one of the sliding metal plate retaining sections needs to be opened against its own weight (gravitational force). This places a burden on a worker. Further, even if the upper sliding metal plate retaining section is successfully opened, it is likely to be swung to its original closed position by the own weight. Further, a lower one of the sliding metal plate retaining sections is likely to be automatically swung and opened by its own weight. This is undesirable for safety reasons. Moreover, the work of closing the lower sliding metal plate retaining section needs to be carried out against the own weight. This places a burden on a worker. This work also involves a problem that the lower sliding metal plate retaining section is likely to be returned to its open position by the own weight. In order to avoid such swinging movements of the sliding metal plate retaining sections due to their own weights, each of the sliding metal plate retaining sections has to be fixed by using a hook or the like, leading to a problem of an increase in time and effort for the plate replacement work.

CITATION LIST

[Parent Document]

[0007] Patent Document 1: JP 2014-208380A

SUMMARY OF INVENTION

[Technical Problem]

[0008] The problem to be solved by the present invention is to provide a sliding nozzle apparatus comprising a pair of sliding metal frame retaining sections provided on respective sides of opposed long edges of a fixed metal frame in an openable and closable manner, wherein the sliding nozzle apparatus is capable of allowing the sliding metal frame retaining sections to be simultaneously opened and closed by a simple manipulation.

[Solution to Technical Problem]

[0009] The present invention provides a sliding nozzle apparatus having features described in the following sections (1) to (8).

(1) A sliding nozzle apparatus comprising a pair of sliding metal frame retaining sections provided on respective sides of opposed long edges of a fixed metal frame in an openable and closable manner, wherein the sliding nozzle apparatus further comprises: a pair of shafts each integrated with a corresponding one of the sliding metal frame retaining sections and each rotatably supported on a respective one of the sides of the opposed long edges of the fixed metal frame; a first link member and a second link member provided, respectively, at one ends of the shafts of the sliding metal frame retaining sec-

tions; and link means coupling the first and second link members together, such that, when one of the sliding metal frame retaining sections is manually opened or closed, the shaft of the other sliding metal frame retaining section is reversely rotated to cause the other sliding metal frame retaining section to be simultaneously opened or closed.

(2) The sliding nozzle apparatus as described in the section (1), wherein each of the first and second link members has a coupling portion at a position eccentric with respect to a central axis of the shaft thereof, wherein the link means comprises a link bar whose opposite ends are pivotally coupled, respectively, to the coupling portions of the first and second link members, such that the link bar intersects with a line connecting the central axes of the shafts.

(3) The sliding nozzle apparatus as described in the section (2), wherein, in a state in which the sliding metal frame retaining sections are fully closed, the first link member and the second link member are, in vertical cross-section, at point-symmetric positions with respect to a center defined by a midpoint of the line connecting the central axes of the shafts, and wherein the link bar is formed as a single piece to directly couple the coupling portions together.

(4) The sliding nozzle apparatus as described in the section (2), wherein the link bar is composed of a first link bar and a second link bar whose one ends are coupled, respectively, to the first link member and the second link member, and wherein the link means further comprises a first gear and a second gear provided on the fixed metal frame and meshed with each other, wherein the other ends of the first and second link bars are pivotally attached, respectively, to the first and second gears in an eccentric manner.

(5) The sliding nozzle apparatus as described in any one of the sections (2) to (4), which is configured such that a coupling position between the first or second link member and the link bar is adjustable.

(6) The sliding nozzle apparatus as described in any one of the sections (2) to (4), which is configured such that a length of the link means to couple the first and second link members together is adjustable.

(7) The sliding nozzle apparatus as described in any one of the sections (1) to (6), which is used under a condition that, during plate replacement, the sliding metal frame retaining sections are arranged one-above-the other.

(8) The sliding nozzle apparatus as described in the section (7), wherein the sliding metal frame retaining sections have different weights.

[Effect of Invention]

[0010] In the present invention, when manually opening/closing the pair of sliding metal frame retaining sections, only one of the sliding metal frame retaining sections can be opened/closed to cause the other sliding metal frame retaining section to be opened/closed interlockingly, so that it is possible to simultaneously open/close the pair of sliding metal frame retaining sections by a simple manipulation. This makes it possible to simplify the work of opening and closing the pair of sliding metal frame retaining sections to improve work efficiency.

[0011] Further, even when the sliding nozzle apparatus is used under the condition that, during plate replacement, the pair of sliding metal frame retaining sections are arranged one-above-the other, the work of opening and closing the upper and lower sliding metal frame retaining sections can be carried out in a labor-saving manner. Further, the upper and lower sliding metal frame retaining sections are interlockingly opened and closed in any state, so that it is possible to simplify the work to improve work efficiency.

BRIEF DESCRIPTION OF DRAWINGS

[0012]

FIG. 1 is a perspective view of a sliding nozzle apparatus according a first embodiment of the present invention (in a state in which a pair of sliding metal frame retaining sections are opened).

FIG. 2 is an exploded perspective view showing portal arms and shafts of the sliding metal frame retaining sections in the sliding nozzle apparatus according the first embodiment.

FIG. 3 is a side view of the sliding nozzle apparatus according the first embodiment (in a state in which the pair of sliding metal frame retaining sections are closed).

FIG. 4 is a side view of the sliding nozzle apparatus according the first embodiment (in the state in which the pair of sliding metal frame retaining sections are opened).

FIG. 5 is an enlarged diagram of a first link member in the sliding nozzle apparatus according the first embodiment.

FIG. 6 is a side view of a sliding nozzle apparatus according a second embodiment of the present invention.

FIG. 7 is a perspective view of a sliding nozzle apparatus according a third embodiment of the present invention.

FIG. 8 is a sectional view of a sliding nozzle apparatus disclosed in the Patent Document 1 (which corresponds to FIG. 2 in the Patent Document 1).

FIG. 9 is a perspective view of the sliding nozzle apparatus disclosed in the Patent Document 1 (which corresponds to FIG. 1 in the Patent Document 1).

DESCRIPTION OF EMBODIMENTS

[0013] With reference to the drawings, the present in-

vention will now be described based on some preferred embodiments thereof.

< FIRST EMBODIMENT >

[0014] The first embodiment is one example where the present invention is applied to the sliding nozzle apparatus disclosed in the Parent Document 1 (as shown in FIGS. 8 and 9 of this application) as a basic conventional structure. In the conventional structure, each of a pair of sliding metal frame retaining sections has been pivotally supported by a pin 22. In this embodiment, as shown in FIGS. 1 to 3, instead of the pin, a shaft 5a is integrated with a lower sliding metal frame retaining section 4a, and is rotatably supported by two shaft supporting portions 6 of a fixed metal frame 2. Specifically, this shaft 5a is integrated with a portal arm 41a of the lower sliding metal frame retaining section 4a by two screws 61. Further, a first link member 7a is provided at one end of the shaft 5a.

[0015] Similarly, a shaft 5b is integrated with an upper sliding metal frame retaining section 4b, and a second link member 7b is provided at one end of the shaft 5b.

[0016] Specifically, each of the first link member 7a and the second link member 7a is formed in a disc shape, and attached to a corresponding one of the one ends to the shafts 5a, 5b. Further, each of a pair of pins 71a, 71b is provided on a respective one of the first and second link members 7a, 7b to protrude outwardly, at a position eccentric with respect to a central axis of the corresponding shaft, to serve as a coupling portion. A single-piece link bar 10 serving as link means is provided such that opposite ends thereof are pivotally attached, respectively, to the pins 71a, 71b. In this state, the link bar 10 intersects with a straight line connecting the central axes of the shafts 5a, 5b, wherein a distance between the center of the shaft 5a and the pin 71a is equal to a distance between the center of the shaft 5b and the pin 71b.

[0017] As shown in FIG. 3, in a state in which the pair of sliding metal frame retaining sections 4a, 4b are fully closed, the pin 71a of the first link member 7a is located at the 9 o'clock position, and the pin 71b of the second link member 7b is located at the 3 o'clock position. These lower and upper link members (the pins 71a, 71b) are, in vertical cross-section, at point-symmetric positions with respect to the midpoint of the straight line connecting the central axes of the shafts 5a, 5b.

[0018] FIG. 5 is an explanatory diagram of a mechanism for adjusting a coupling position between the coupling portion (pin 71a) of the first link member 7a and the link bar 10. The link bar 10 is formed with an elongate hole 10a, and a screw 10b is screwed from a distal edge face of the link bar 10 into the link bar 10 such that a distal end 10b-1 of the screw 10b protrudes inside the elongate hole 10a. The distal end 10b-1 of the screw 10b is formed in an angular C shape to fittingly receive the pin 71a in the angular C-shaped groove. That is, the coupling position between the pin 72a and the link bar 10 can be changed by moving the screw 10b forwardly and backwardly, so that it is possible to adjust a coupling length between the first link member 7a (pin 71a) and the second link member 7b (pin 71b).

[0019] Next, a mechanism for n opening and closing the sliding metal frame retaining sections 4a, 4b in this embodiment will be described. In FIG. 3, when the upper sliding metal frame retaining section 4b is opened, the second link member 7b provided on the shaft 5b is rotated in the arrowed direction (clockwise direction), and, accordingly, the first link member 7a is rotated in the opposite arrowed direction (counterclockwise direction). Thus, the lower sliding metal frame retaining section 4a can be simultaneously opened in an interlocking manner (as shown in the state in FIG. 4).

[0020] On the other hand, in the work of closing the sliding metal frame retaining sections 4a, 4b, when the upper sliding metal frame retaining section 4b is closed, the first link member 7a is rotated in a direction opposite to that of the second link member 7b. Thus, the lower sliding metal frame retaining section 4a can be simultaneously closed in an interlocking manner. After closing the pair of sliding metal frame retaining sections 4a, 4b, a stopper pin is inserted into a through-hole extending from the sliding metal frame retaining sections 4a, 4b to the fixed metal frame, to confirm that the sliding metal frame retaining sections 4a, 4b are completely closed.

[0021] In the first embodiment, each of the shafts 5a, 5b of the sliding metal frame retaining sections 4a, 4b is rotatably supported with respect to the fixed metal frame 2, so that the one ends of the shafts 5a, 5b can be coupled by a link mechanism (link means) such that the shafts 5a, 5b are rotated, respectively, in opposite directions. Therefore, in the first embodiment, the link mechanism can be provided on only one side of opposed short edges of the fixed metal frame 2. The sliding nozzle apparatus is equipped with a mechanism for opening and closing a sliding metal frame 3 for the purpose of plate replacement work, and a mechanism for driving the sliding metal frame 3 by a driving device. In the first embodiment, the link mechanism can be provided on only one side of the opposed short edges of the fixed metal frame 2, so that it is free from exerting an influence on movements of these mechanisms.

[0022] In the first embodiment, the link bar 10 couples the coupling portion 71a of the first link member 7a and the coupling portion 71b of the second link member 7b together, such that the link bar 10 intersects with the straight line connecting the central axes of the shafts 5a, 5b, whereby the first and second link members have a relationship in which they are rotated, respectively, in opposite directions. This makes it possible to narrow the range of movement of the link mechanism. In the first embodiment, the disc-shaped link members 7a, 7b are provided, respectively, on the one ends of the shafts 5a, 5b. Alternatively, each of the link members may be formed in any other suitable shape other than a disc shape, such as a rod or bar shape, or a plate shape.

[0023] In the first embodiment, when the sliding metal

frame retaining sections 4a, 4b are fully closed, the first link member 7a and the second link member 7b are, in vertical cross-section, at point-symmetric positions with respect to a center defined by the midpoint of the straight line connecting the central axes of the shafts 71a, 71b. Thus, even when the pins 71a, 71b are coupled together by the single-piece link bar 10, the first link member 7a and the second link member 7b can be approximately synchronously rotated, respectively, in opposite directions. This makes it possible to structurally simplify the link mechanism, thereby providing excellent maintainability, and allowing the sliding nozzle apparatus to be downsized. Further, the coupling length between the first link member 7a and the second link member 7b can be finely adjusted by using the screw 10b associated with the elongate hole 10a of the link bar 10, so that it is possible to completely close the pair of sliding metal frame retaining sections 4a, 4b without any deviation in synchronization.

[0024] In the first embodiment, the lower sliding metal frame retaining section 4a and the upper sliding metal frame retaining section 4b have approximately the same weight, and are eccentrically fixed, respectively, to the shafts 5a, 5b. Thus, during the opening work, the lower sliding metal frame retaining section 4a is swung downwardly by the action of its own weight (gravitational force), so that the work of opening the upper sliding metal frame retaining section 4b requires almost no manipulation force.

[0025] On the other hand, when closing the sliding metal frame retaining sections 4a, 4b, the upper sliding metal frame retaining section 4b is swung in a closing direction (downwardly) by the action of its own weight (gravitational force), so that this closing work also requires almost no manipulation force.

[0026] Therefore, in the case where the sliding metal frame retaining sections 4a, 4b have the same weight, the sliding metal frame retaining sections 4a, 4b are stopped at an arbitrary position without a natural swinging movement. On the other hand, when there is a need to open or close the sliding metal frame retaining sections 4a, 4b by means of one of their own weights, the weight of one of the sliding metal frame retaining sections may be set to be greater than that the other sliding metal frame retaining section. In this case, due to an imbalance of weight, the sliding metal frame retaining sections can be naturally swung.

[0027] Although the first embodiment has been described based on a horizontal installation-type sliding nozzle apparatus in which, during plate replacement, a pair of sliding metal frame retaining sections 4a, 4b are arranged one-above-the-other, the present invention may be applied to a vertical installation-type sliding nozzle apparatus in which, during plate replacement, a pair of sliding metal frame retaining sections 4a, 4b are arranged right and left.

< SECOND EMBODIMENT >

[0028] The second embodiment is one example where a link bar comprising a third link member is used as the link means.

[0029] In the second embodiment, for example, in a situation where the link bar 10 in the first embodiment cannot be attached due to the presence of a protruding object on a lateral face of the fixed metal frame 2, the third link member is used to avoid the protruding object.

[0030] Specifically, as shown in FIG. 6, an intermediate rotary member 11 serving as the third link member is rotatably provided on a central region of a lateral face of the fixed metal frame 2 on the side of one of the opposed short edges thereof, and respective one ends of a first link bar 11a and a second link bar 11b are pivotally coupled to the intermediate rotary member 11, independently. The other end of the first link bar 11a is pivotally coupled to a first link member 7a, and the other end of the second link bar 11b is pivotally coupled to a second link member 7b. Here, the first link bar 11a has a turnbuckle 11c in the middle thereof. The turnbuckle 11c can be used to adjust the length of the first link bar 11a and thus the length of link means coupling the first link member 7a (pin 71a) and the second link member 7b (pin 71b).

[0031] FIG. 6 shows a state in which a pair of sliding metal frame retaining sections 4a, 4b are fully opened. When closing the sliding metal frame retaining sections 4a, 4b from the fully opened state, the first link member 7a and the intermediate rotary member 11 are rotated in a counterclockwise direction. On the other hand, the second link member 7b is rotated in a clockwise direction. Thus, when the sliding metal frame retaining section 4a is closed, the sliding metal frame retaining section 4b can be closed interlockingly and simultaneously. Similarly, when opening the sliding metal frame retaining sections 4a, 4b, the first link member 7a and the second link member 7b are rotated, respectively, in opposite directions, so that it is possible to simultaneously open the sliding metal frame retaining sections 4a, 4b in an interlocking manner.

< THIRD EMBODIMENT >

[0032] Referring to FIG. 7, as with the first embodiment, a disc-shaped first link member 7a and a disc-shaped second link member 7b are attached, respectively, to a pair of shafts 5a, 5b, and each of a pair of pins 71a, 71b is provided on a respective one of the first and second link members 7a, 7b to protrude outwardly, at a position eccentric with respect to a central axis of the corresponding shaft, to serve as a coupling portion. Then, one ends of a first link bar 13a and a second link bar 13b are pivotally attached, respectively, to the pin 71a and the pin 71b.

[0033] Further, a first gear 12a and a second gear 12b are rotatably supported on a lateral face of the fixed metal frame on the side of one of the opposed short edges

thereof, such that they are meshed with each other. The first and second gears 12a, 12b are provided, respectively, with pins 121a, 121b at eccentric positions. The other ends of the first and second link bars 13a, 13b are pivotally coupled, respectively, to the pins 121a, 121b.

[0034] As above, the first gear 12a and the second gear 12b are meshed with each other, and thereby the pair of shafts 5a, 5b are rotated, respectively, in opposite directions, so that it becomes possible to simultaneously open and close a pair of sliding metal frame retaining sections 4a, 4b in an interlocking manner.

LIST OF REFERENCE SIGNS

[0035]

1:	sliding nozzle apparatus
2:	fixed metal frame
3:	sliding metal frame
4a, 4b:	sliding metal frame retaining section
41a, 41b:	portal arm
5a, 5b:	shaft
6:	shaft retaining portion
61:	screw
7a:	first link member
71a:	pin
7b:	second link member
71b:	pin
10:	link bar
10a:	elongate hole
10b:	screw
10b-1:	distal end of screw
11:	intermediate rotary member
11a:	first link bar
11b:	second link bar
11c:	turnbuckle
12a:	first gear
121a:	pin
12b:	second gear
121b:	pin
13a:	first link bar
13b:	second link bar

Claims

1. A sliding nozzle apparatus comprising a pair of sliding metal frame retaining sections provided on respective sides of opposed long edges of a fixed metal frame in an openable and closable manner, wherein the sliding nozzle apparatus further comprises:

   a pair of shafts each integrated with a respective one of the sliding metal frame retaining sections and each rotatably supported on a corresponding one of the sides of the opposed long edges of the fixed metal frame;
   a first link member and a second link member provided, respectively, at one ends of the shafts of the sliding metal frame retaining sections; and
   link means coupling the first and second link members together, such that, when one of the sliding metal frame retaining sections is manually opened or closed, the shaft of the other sliding metal frame retaining section is reversely rotated to cause the other sliding metal frame retaining section to be simultaneously opened or closed.

2. The sliding nozzle apparatus as claimed in claim 1, wherein each of the first and second link members has a coupling portion at a position eccentric with respect to a central axis of the shaft thereof, wherein the link means comprises a link bar whose opposite ends are pivotally coupled, respectively, to the coupling portions of the first and second link members, such that the link bar intersects with a line connecting the central axes of the shafts.

3. The sliding nozzle apparatus as claimed in claim 2, wherein, in a state in which the sliding metal frame retaining sections are fully closed, the first link member and the second link member are, in vertical cross-section, at point-symmetric positions with respect to a center defined by a midpoint of the line connecting the central axes of the shafts, and wherein the link bar is formed as a single piece to directly couple the coupling portions together.

4. The sliding nozzle apparatus as claimed in claim 2, wherein the link bar is composed of a first link bar and a second link bar whose one ends are coupled, respectively, to the first link member and the second link member, and wherein the link means further comprises a first gear and a second gear provided on the fixed metal frame and meshed with each other, wherein the other ends of the first and second link bars are pivotally attached, respectively, to the first and second gears in an eccentric manner.

5. The sliding nozzle apparatus as claimed in any one of claims 2 to 4, which is configured such that a coupling position between the first or second link member and the link bar is adjustable.

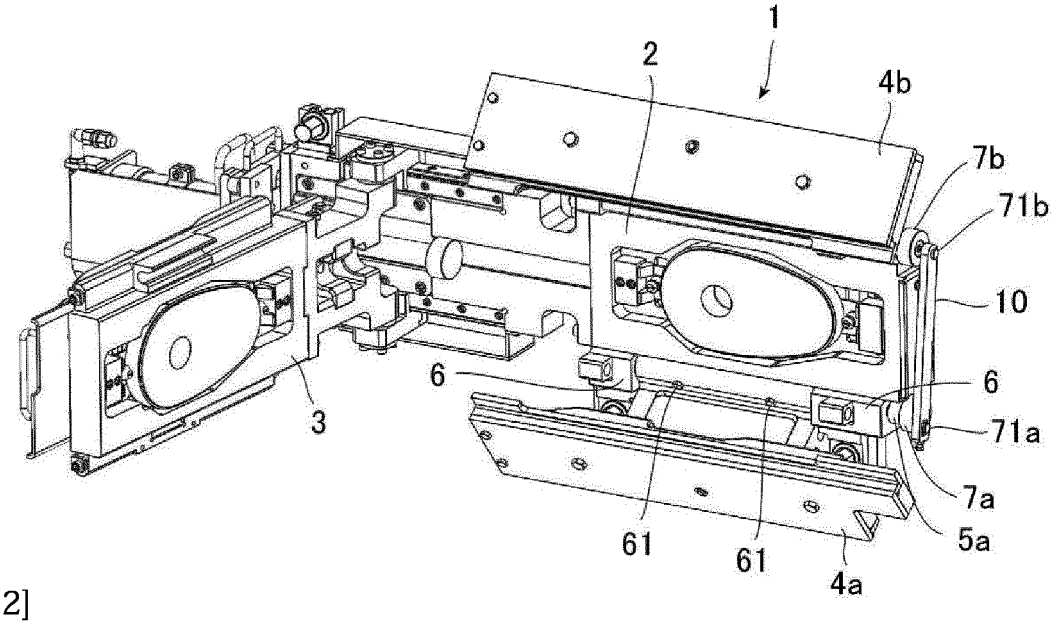
6. The sliding nozzle apparatus as claimed in any one of claims 2 to 4, which is configured such that a length of the link means to couple the first and second link members together is adjustable.

7. The sliding nozzle apparatus as claimed in any one of claims 1 to 6, which is used under a condition that, during plate replacement, the sliding metal frame retaining sections are arranged one-above-the other.

8. The sliding nozzle apparatus as claimed in claim 7,

wherein the sliding metal frame retaining sections have different weights.

[Fig 1]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6
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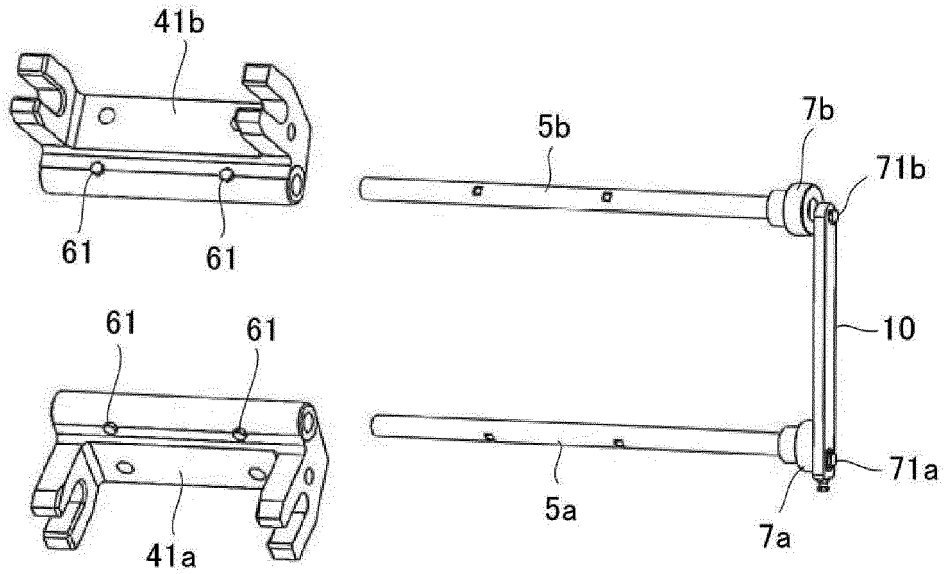
5a
4a
61
61
3

[Fig 2]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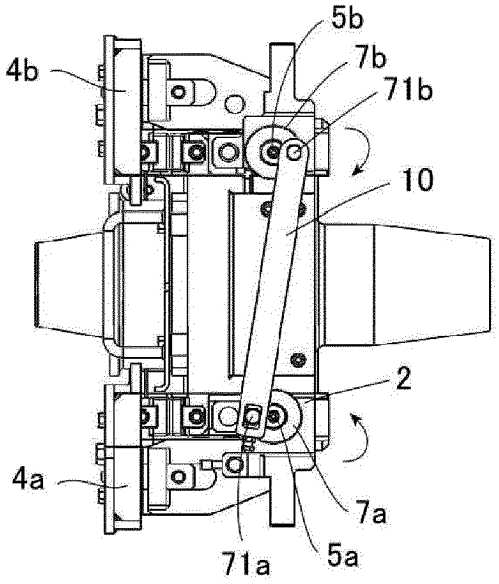
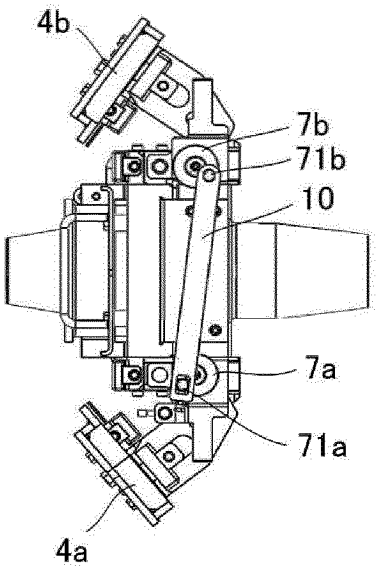
61
41a

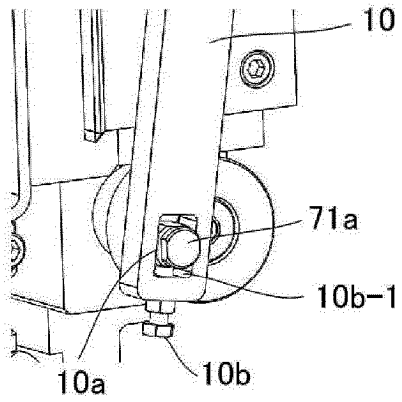
[Fig 3]



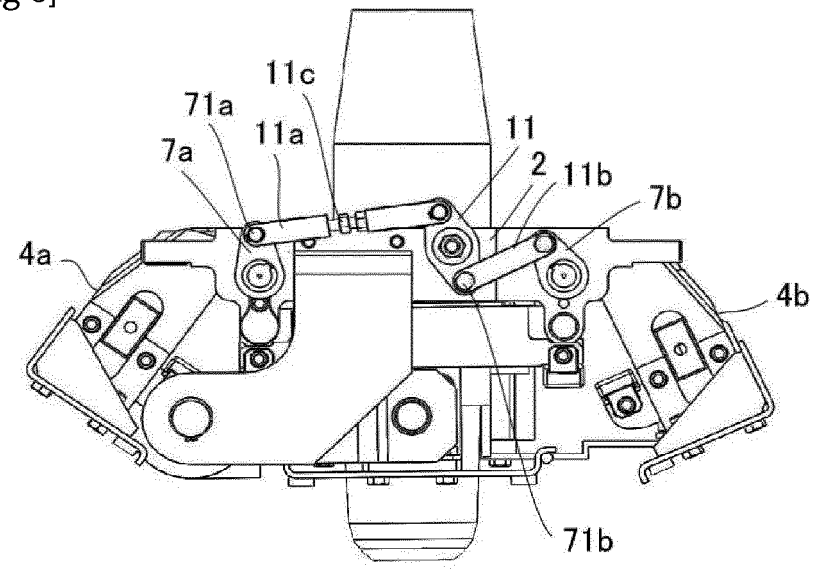
[Fig 4]



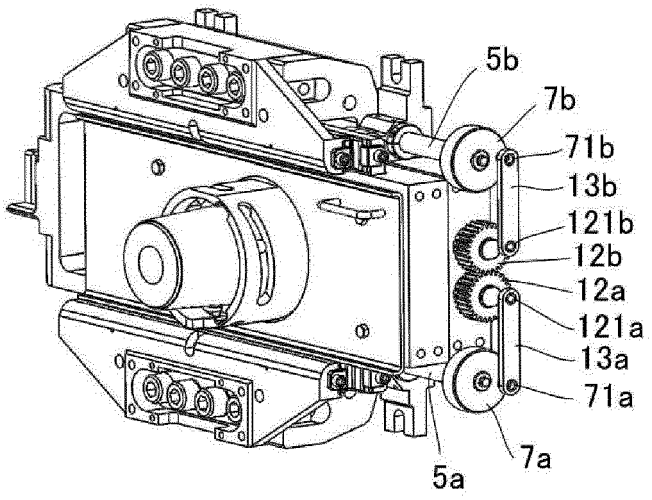
[Fig 5]



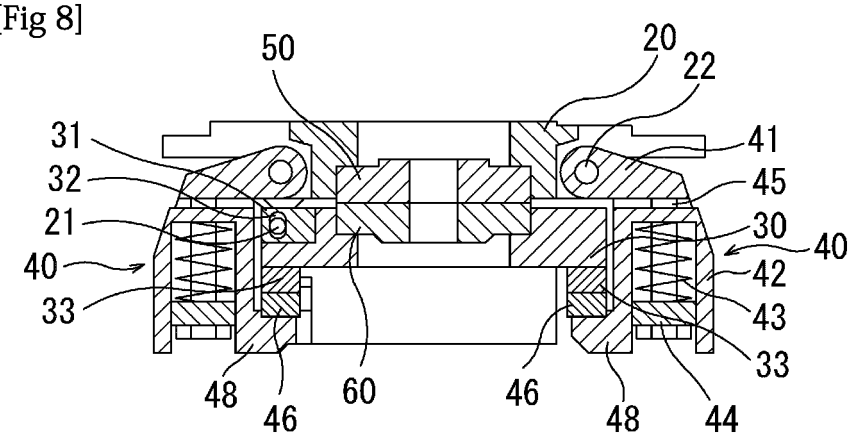
[Fig 6]



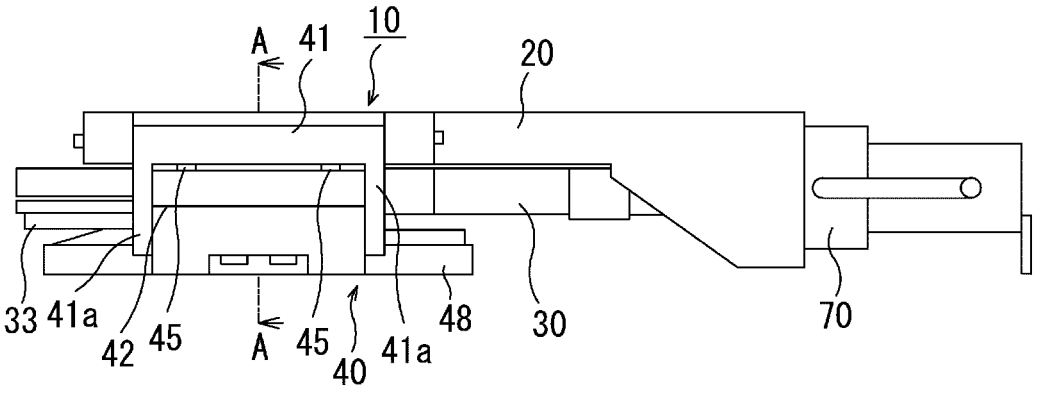
[Fig 7]



[Fig 8]



[Fig 9]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/005133

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. B22D41/34(2006.01)i, B22D11/10(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)
Int. Cl. B22D41/34, B22D11/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2019
Registered utility model specifications of Japan 1996-2019
Published registered utility model applications of Japan 1994-2019

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 A	JP 2014-208380 A (KROSAKI HARIMA CORP.) 06 November 2014, claim 1, paragraphs [0001], [0002], [0018]-[0021], [0025], [0035]-[0038], fig. 1-5 & US 2016/0045956 A1, claim 1, paragraphs [0001], [0002], [0033]-[0035], [0041], [0051]-[0054], fig. 1-5 & EP 2979777 A1 & CN 105102155 A	1-3, 5-7 4, 8
Y A	JP 2014-029105 A (MIYAI KK) 13 February 2014, paragraphs [0001]-[0003], [0010], [0011], [0015], [0018], [0020]-[0029], fig. 1-4 (Family: none)	1-3, 5-7 4, 8
Y A	JP 45-001789 B1 (TERAOKA SEIKOSHO CO., LTD.) 21 January 1970, column 2, line 30 to column 3, line 2, fig. 2 (Family: none)	1-3, 5-7 4, 8

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
15.03.2019	02.04.2019
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/005133

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 11-036270 A (KYOWA SEISAKUSHO KK) 09 February 1999, claim 1, paragraphs [0009]-[0016], fig. 5, 7, 8 (Family: none)	1-3, 5-7 4, 8
A	JP 5-85177 A (KITAMURA SEISAKUSHO KK) 06 April 1993, entire text (Family: none)	1-8

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2014208380 A **[0007]**