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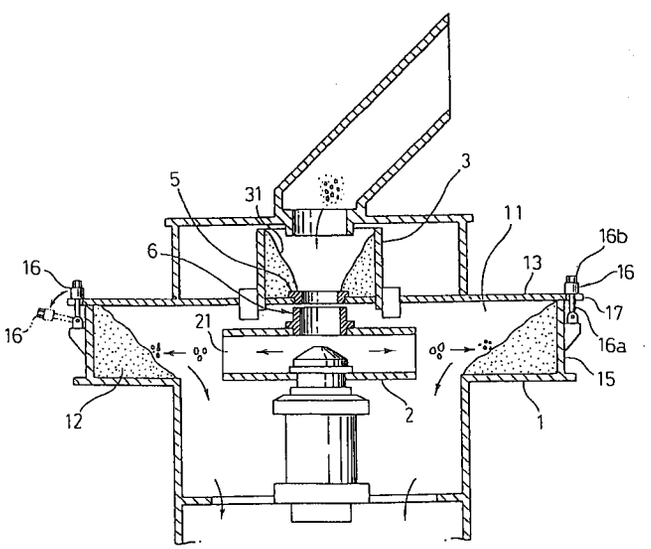
(54) CENTRIFUGAL CRUSHING MACHINE AND REINFORCING MATERIAL FOR A SUPPLY PORT OF RAW MATERIAL TO BE CRUSHED

(57) A centrifugal crushing machine and a reinforcing material for a supply port of raw material to be crushed characterized in that supply ports (14, 23) are provided at central portions, respectively, inside a chute (3) for raw material to be crushed provided on the top plate (13) of a crushing chamber (11) and of an upper disc plate (22) of a rotor (2), and that an upper reinforcing member (5) and a lower reinforcing member (6 or 7) are separately mounted on, respectively, peripheral portions of the supply ports (14, 23).

Fig. 1



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Description

Background of the Invention

Field of the Invention

The invention relates to a centrifugal crusher comprising a crushing chamber formed inside a crusher housing, an impact material set around the periphery of the crushing chamber, a rotor positioned in the center of the crushing chamber that rotates in a horizontal plane and expels raw material from its peripheral ports to the impact material, a supply path through which raw material is fed into the rotor, and a reinforcing material for the supply port thereof.

Prior Art

Fig. 4 illustrates a conventional centrifugal crusher used for crushing mineral ores and similar materials. Briefly, the crushing chamber 11 is formed by the interior of a housing 1, which is a shell of the crusher. A high-speed rotor 2, rotating in a horizontal plane, is positioned in the center of the crushing chamber. Ores or other material to be crushed (hereinafter referred to as raw material) is fed into the rotor 2, wherein the centrifugal force generated by the whirling of the rotor discharges the material radially from the expulsion ports 21 at the peripheral face of the rotor. The expelled material impacts on and is crushed by a dead bed 12, formed by crushed pieces of the material which has piled in a ring inside the crushing chamber 11, or a steel anvil or other means not shown in the drawing.

Fig. 5 illustrates the configuration of a feed channel through which the raw material is fed into the rotor 2 of a centrifugal crusher of the type described above. A box-shaped or other type of chute 3, provided for receiving the raw material, is erected on the top of and in the center of a roof 13 of the crushing chamber. A supply port 14 is opened through the roof 13 in the center of the chute 3, and another supply port 23 is opened through a circular plate 22 at the upper part of the rotor, and a supply pipe 4 passes through both ports.

The upper end of the supply pipe 4 is sealed to the upper face of the roof 13 by a flange 41, and the bottom end of the supply pipe is inserted into the supply port 23. Raw material being fed from the top of the chute 3 forms a dead bed around the periphery of the chute 3, and also passes through the supply pipe 4 into the rotor 2.

However, since the supply pipe 4 is attached to the roof 13, a gap must be left between the bottom of the supply pipe 4 and the supply port 23 of the rotor 2. Hence, the inner diameter of the supply pipe 4, specifically the diameter of the feed channel of the material, is restricted. This means that the feed channel cannot be expanded in order to increase the feed volume as a means of increasing the crushing efficiency of the crusher.

Moreover, with the gap between the supply port 23 and the supply pipe 4, raw material fed into the rotor will bounce back and strike the rim of the supply port 23. This will eventually erode the rim of the supply port and shorten the life time of the rotor 2, making such a crusher uneconomical.

In order to resolve these problems, the invention provides a centrifugal crusher and a reinforcing material for the rim of the supply port thereof, in which the diameter of the feed channel can be expanded in order to increase the feed volume, thereby improving the crushing efficiency. Further, the design prevents wear-and-tear of the rim of the supply port of the rotor caused by the repellent action of the material, thereby extending the life time of the rotor.

Disclosure of the Invention

The invention is based on the concept that the conventional supply pipe is separated into an upper and a lower component, wherein a lower reinforcing material is fitted directly onto the rim of the rotor supply port. This eliminates the need to leave a gap between the rotor supply port and the supply pipe as in a conventional crusher. Hence, the diameter of the feed channel for the raw material can be widened by an amount which is equivalent to this gap, thereby increasing the feed volume and improving the crushing efficiency.

Further, since there is no gap between the rotor supply port and the supply tube, raw material which is bouncing back does not impel against the rim of the rotor supply port. This prevents wear-and-tear of the rim of the supply port, thus extending the life time of the rotor and making the crusher more economical.

Furthermore, the lower reinforcing material is tube-shaped, and its upper end is in close proximity to the upper reinforcing material, in which case the gap between the upper and lower components is small enough to prevent powdered and tiny pieces of raw material to be blown out from the rotor and to be dispersed outside through the gap. This reduces malfunctions in the crusher caused by crushed debris plugging the area between the roof and the upper face of the rotor.

Moreover, the inner face of the upper reinforcing material is sloping to gradually widen from the bottom to the top, which directs raw material to fall along the outside edges most distant from the center of the rotor. This effectively pares and prevents a bulge from being formed in the dead bed, and enables a constant volume of raw material to be fed to the rotor.

Furthermore, the inner face of the lower reinforcing material is sloping to gradually widen from the top to the bottom, which directs the raw material, as it bounces and scatters, to fall down the outside edges most distant from the center of the rotor. This again pares and prevents a bulge from being formed in the dead bed, and enables a constant volume of the raw material to be fed

to the rotor. Since the raw material fans out as it is fed to the rotor, the feed volume is increased.

In addition, the reinforcing material is divided into a separate upper and lower component, wherein the upper component is ring-shaped and of short length. This facilitates the removal of the crusher head in order to inspect the crushing chamber, since the crusher head need only be raised very slightly and slide sideways.

Brief Explanation of the Drawings

Fig. 1 is an explanatory diagram of the overall configuration of the invention according to the embodiment of Example 1.

Fig. 2 is an explanatory diagram of the essential components of the invention according to the embodiment of Example 1.

Fig. 3 is an explanatory diagram of the overall configuration of the invention according to the embodiment of Example 2.

Fig. 4 is an explanatory diagram of the overall configuration of a conventional centrifugal crusher.

Fig. 5 is an explanatory diagram of the feed channel of a conventional centrifugal crusher.

Detailled Description of the Preferred Embodiments

Examples of the present invention are explained below with reference to the attached figures of the drawings.

Example 1

As shown in Fig. 2, a supply port 14 and a supply port 23 are opened through a roof 13 of a crushing chamber into a chute 3, and through the center of a round plate 22 at the upper part of a rotor, respectively. The supply ports 14 and 23 are positioned such that their central axes coincide. Also, the diameters of the supply ports 14 and 23 are bored to be only marginally larger than the external diameter of an inlay collar component of reinforcing materials, to be described later, and are configured in such a manner that the inlay collar can fit inside the rim. The dimensions of the diameters of the supply ports 14 and 23 are preset so as to obtain the required feed channel diameter for a given thickness of the inlay collar.

A ring-shaped upper reinforcing material 5 and a tube-shaped lower reinforcing material 6 are fitted into the rims of the supply port 14 and the supply port 23, respectively. The reinforcing materials 5 and 6 can be made of a special high-chromium steel or other abrasion-resistant material.

The upper reinforcing material 5 is configured by an inlay collar 51 and a flange 52, wherein the external diameter of the inlay collar 51 is only minimally smaller than the diameter of the supply port 14 such that it can be fitted into the port. The flange 52, molded to be larger than the diameter of the supply port 14, is sealed to the roof 13, and configured in such a maner that the upper reinforcing material 5 can be anchored. The anchoring of the upper reinforcing material 5 and the lower reinforcing material 6, to be described later, can be achieved by tightening with bolts or by other methods which will enable the reinforcing materials to be removed and replaced when eroded.

The lower reinforcing material 6 is configured by an inlay collar 61, a flange 62 and a neck 63, wherein the inlay collar 61 and the flange 62 are configured in the same manner as the upper reinforcing material 5. The neck 63 is of a height such that its upper end is in close proximity to the upper reinforcing material 5.

The inner spaces of the reinforcing materials 5 and 6 form feed channels 53a and 64, respectively, for the raw material. Since a gap need not be left between the reinforcing material and the rim of the supply port 23, the diameter of the feed channel 64 can be larger than the feed tube used conventionally, thereby increasing the feed volume of the raw material.

However, the diameter of the feed channel 53a is molded to be slightly smaller than the diameter of the feed channel 64. Otherwise, if the diameters of the two feed channels 53a and 64 are the same, small pieces of raw material would become caught in the gap between the bottom face of the upper reinforcing material 5 and the upper face of the lower reinforcing material 6.

As shown in Fig. 1 of the drawings, the head of the crusher above the roof 13 of the crushing chamber is configured so as to be separable from the main body thereof. For example, in one possible structure, the roof 13 is configured to be a separate unit detachable from side walls 15 of the crushing chamber 11, wherein the roof 13 and the side walls 15 are joined by an anchoring device 16. Various anchoring devices can be used; for example, one end of a pin 16a is supported axially by the side wall 15, and a fastening jig 16b is affixed to the other end thereof. The pin 16a is inserted into a notch 17 bored into the edge of the roof 13, wherein the upper face of the roof 13 is affixed by tightening the fastening jig 16b.

The elements as described above comprise the unique features of the centrifugal crusher according to this invention, and the rest of the structure is the same as in a conventional crusher.

In order to operate the crusher, a rotor 2 is rotated, and raw material is fed into the chute 3. The raw material so introduced first piles up around the periphery of the chute 3 forming a dead bed 31. Subsequently, the raw material passes through the upper reinforcing material 5 and the lower reinforcing material 6, is fed into the rotor 2, then expelled towards the dead bed around the periphery of the rotor 2 where it is crushed.

The crusher head can be removed to inspect the crushing chamber. For this purpose, the anchoring device 16 is loosened and the pin 16a is dropped to disconnect the roof 13 from the side walls 15. Next, the

crusher head is raised slightly and slid sideways away from the crushing chamber.

Example 2

In Example 1, the inner face of the upper reinforcing material 5 is upright and of constant diameter, but as shown in Fig. 3 according to Example 2, an inner face 54 of the upper reinforcing material 5 is sloping to gradually widen from the bottom to the top to form the feed channel.

Also, whereas in Example 1 the lower reinforcing material is tube-shaped, a ring-shaped lower reinforcing material 7, as shown in Fig. 3, can also be used. The reinforcing material 7 is configured by an inlay collar 71 and a flange 72. The external diameter of the inlay collar 71 is made to be minimally smaller than that of the supply port 23, and the flange 72 is molded to be mountable onto and of a diameter larger than the supply port 23, and is sealed to the upper circular plate 22 of the rotor 2.

The inner face of the lower reinforcing material 7 is sloping to gradually widen from the top to the bottom, and the inner space formed therein becomes a feed channel 74 for the raw material. Since there is no need to leave a gap between the reinforcing material and the rim of the supply port 23, the diameter of the feed channel 74 can be larger than the feed tube used conventionally, thereby increasing the feed volume of the raw material.

In the same manner as in Example 1, the diameter of the feed channel of the upper reinforcing material 5 is molded to be slightly smaller than the diameter of the feed channel 74 of the lower reinforcing material 7. Otherwise, if the diameters of the two feed channels are the same, raw material passing through the upper reinforcing material 5 would strike against the inner edge of the flange 72 of the lower reinforcing material 7 and would be cast outside.

As shown in Fig. 3, pieces of raw material being fed into the rotor form a dead bed 8 with an edge parallel to the partition of the rotor 2. If the humidity is high, the dead bed 8 will become sticky, in which case a bulge 81 could be formed at the center of the rotor 2, thereby reducing the feed volume of the raw material, or plugging the rotor 2. However, since the inner surface 54 of the upper reinforcing material 5 gradually widens from the bottom to the top, the raw material flows along the dead bed 31 and the inner surface 54, then falls along the outer edges most distant from the center of the rotor 2.

Moreover, since an inner face 73 of the lower reinforcing material 7 is sloping to gradually widen from top to bottom, the raw material, while bumping and dispersing, is fed to the outer sides most distant from the center of the rotor 2. This will constantly pare and therefore prevent the formation of the bulge 81 in the dead bed 8 formed by the raw material.

Also, since the raw material spreads out as it is being fed, the feed volume is effectively increased.

However, if the inner face of the upper reinforcing material 5 is upright, then the dead bed 31 will be formed up to the corner "a" in the drawing, in which case the raw material will fall towards the center of the rotor 2. Also, if the inner face of the lower reinforcing material 7 is upright, then although the raw material will be bumping together, it will not fan out, and will again be fed towards the center of the rotor 2. Hence, in both cases the formation of a bulge 81 in the dead bed 8 cannot be prevented. Moreover, the narrow feed channel will reduce the feed volume of the raw material.

Example 3

In this Example 3, the inner face of the upper reinforcing material 5 having a configuration as in Example 1 can slope to gradually widen from the bottom to the top as in Example 2. Also, the inner face of the tube-shaped lower reinforcing material 6 of Example 1 can slope to gradually widen from the top to the bottom as in Example 2.

Example 4

The inner diameters of the upper reinforcing material 5 and the lower reinforcing material 7 having the configuration of Example 2 can, instead of being widened as in Example 2, be of constant diameter from top to bottom.

Industrial Field of Application

As described above, the invention relates to a centrifugal crusher and a reinforcing material for the raw material supply port thereof which crusher can be used for the crushing of mineral ores and similar raw material.

Claims

1. A centrifugal crusher, comprising

a crushing chamber formed inside a crusher housing,
an impact material formed around the periphery of the crushing chamber,
a rotor positioned in the center of the crushing chamber, which rotates in the horizontal plane and discharges raw material from its peripheral ports towards the impact material, and
a feed channel to supply raw material into the rotor, wherein a supply port is opened in the center of a roof of the crushing chamber and a ring-shaped upper reinforcing material is fitted onto the rim of the supply port,
and wherein another supply port is bored in the center of an upper circular plate of the rotor and a tube-shaped lower reinforcing material is fitted onto the rim of the supply port such that its

upper end is in close proximity to the upper reinforcing material.

2. A centrifugal crusher, comprising

a crushing chamber formed inside a crusher housing,
an impact material formed around the periphery of the crushing chamber,
a rotor positioned in the center of the crushing chamber, which rotates in a horizontal plane and discharges raw material from its peripheral ports towards an impact material, and
a feed channel to supply raw material into the rotor,
wherein a supply port is opened in the center of a roof of the crushing chamber and a ring-shaped upper reinforcing material is fitted onto the rim of the supply port, and wherein another supply port is bored in the center of an upper circular plate of the rotor and a ring-shaped lower reinforcing material is fitted onto the rim of the supply port.

3. The crusher according to claim 1 or 2, in which the inner face of the upper reinforcing material slopes to gradually widen from the bottom to the top.

4. The crusher according to any of claims 1 to 3, in which the inner face of the lower reinforcing material slopes to gradually widen from the top to the bottom.

5. The crusher according to any of claims 1 to 4, in which the inner diameter of the lower end of the upper reinforcing material is smaller than the inner diameter of the lower reinforcing material.

6. The crusher according to any of claims 1 to 5, in which the upper reinforcing material is mounted in the supply port of the roof so as to be detachable.

7. The crusher according to any of claims 1 to 6, in which the lower reinforcing material is mounted in the supply port of the upper circular plate of the rotor so as to be detachable.

8. The crusher according to any of claims 1 to 7, in which a flange is molded around the outer perimeter of the upper reinforcing material, and the flange is sealed to the upper surface of the roof.

9. The crusher according to any of claims 1 to 8, in which a flange is molded around the outer perimeter of the lower reinforcing material, and the flange is sealed to the upper surface of the upper circular plate of the rotor.

10. The crusher according to any of claims 1 to 9, in which the upper reinforcing material is made from a special high-chromium steel.

11. The crusher according to any of claims 1 to 10, in which the lower reinforcing material is made from a special high-chromium steel.

12. The crusher according to any of claims 1 to 11, in which the crusher head above the roof is structured so as to be separable from the main body of the crusher.

13. A reinforcing material for a raw material supply port bored in the center of an upper circular plate of a rotor of a centrifugal crusher, wherein the reinforcing material is tube-shaped and can fit into the rim of the supply port.

14. A reinforcing material for a raw material supply port bored in the center of an upper circular plate of a rotor of a centrifugal crusher, wherein the reinforcing material is ring-shaped and can fit into the rim of the supply port.

15. The reinforcing material for a raw material supply port of a centrifugal crusher according to claim 13 or 14, in which the inner face slopes to gradually widen from the top to the bottom.

16. A reinforcing material for a raw material supply port bored in the center of a roof of a crushing chamber of a centrifugal crusher, wherein the reinforcing material is ring-shaped and can fit into the rim of the supply port.

17. The reinforcing material for a raw material supply port of a centrifugal crusher according to claim 16, in which the inner face of the reinforcing material slopes gradually to widen from the bottom to the top.

Amended claims under Art. 19.1 PCT

1. A centrifugal crusher, comprising
a crushing chamber formed inside a crusher housing, an impact material formed around the periphery of the crushing chamber,
a rotor positioned in the center of the crushing chamber, which rotates in a horizontal plane and discharges raw material from its peripheral ports towards the impact material, and
a feed channel to supply raw material into the rotor,
wherein a supply port is opened in the center of a roof of the crushing chamber and a ring-shaped upper reinforcing material is fitted onto a rim of the supply port,
and wherein another supply port is bored in the

center of the upper circular plate of the rotor and a tube-shaped lower reinforcing material is fitted onto the rim of the supply port such that its upper end is in close proximity to the upper reinforcing material.

2. The crusher according to claim 1,
in which the crusher head above the roof is structured so as to be separable from the main body of the crusher.

3. A centrifugal crusher, comprising
a crushing chamber formed inside a crusher housing,
an impact material formed around the periphery of the crushing chamber,
a rotor positioned in the center of the crushing chamber that rotates in a horizontal plane and discharges raw material from its peripheral ports towards the impact material, and
a feed channel to supply raw material into the rotor,
wherein a supply port is opened in the center of a roof of the crushing chamber and a ring-shaped upper reinforcing material is fitted onto a rim of the supply port,
wherein another supply port is bored in the center of an upper circular plate of the rotor and a ring-shaped lower reinforcing material is fitted onto the rim of the supply port,
and wherein the crusher head above the roof is structured so as to be separable from the main body of the crusher.

4. The crusher according to any of claims 1 to 3,
in which the inner face of the upper reinforcing material slopes to gradually widen from the bottom to the top.

5. The crusher according to any of claims 1 to 4,
in which the inner face of the lower reinforcing material slopes to gradually widen from the top to the bottom.

6. The crusher according to any of claims 1 to 5,
in which the inner diameter of the lower end of the upper reinforcing material is smaller than the inner diameter of the lower reinforcing material.

7. The crusher according to any of claims 1 to 6,
in which the upper reinforcing material is mounted in the supply port of the roof so as to be detachable.

8. The crusher according to any of claims 1 to 7,
in which the lower reinforcing material is mounted in the supply port of the upper circular plate of the rotor so as to be detachable.

9. The crusher according to any of claims 1 to 8,
in which a flange is molded around the outer perimeter of the upper reinforcing material, and the flange is sealed to the upper surface of the roof.

10. The crusher according to any of claims 1 to 9,
in which a flange is molded around the outer perimeter of the lower reinforcing material, and the flange is sealed to the upper surface of the upper circular plate of the rotor.

11. The crusher according to any of claims 1 to 10,
in which the upper reinforcing material is made from a special high-chromium steel.

12. The crusher according to any of claims 1 to 11,
in which the lower reinforcing material is made from a special high-chromium steel.

13. A reinforcing material for a raw material supply port bored in the center of an upper circular plate of a rotor of a centrifugal crusher,
wherein the reinforcing material is tube-shaped and can fit into a rim of the supply port.

14. The reinforcing material for a raw material supply port of a centrifugal crusher according to claim 13,
in which the inner face slopes to gradually widen from the top to the bottom.

15. A reinforcing material for a raw material supply port bored in the center of an upper circular plate of a rotor of a centrifugal crusher,
wherein the reinforcing material is ring-shaped and mountable into the rim of the supply port, wherein its inner face is sloping to gradually widen from the bottom to the top.

16. A reinforcing material for a raw material supply port bored in the center of a roof of a crushing chamber of a centrifugal crusher,
wherein the reinforcing material is ring-shaped and mountable into the rim of the supply port, wherein its inner face is sloping to gradually widen from the bottom to the top.

Fig. 1

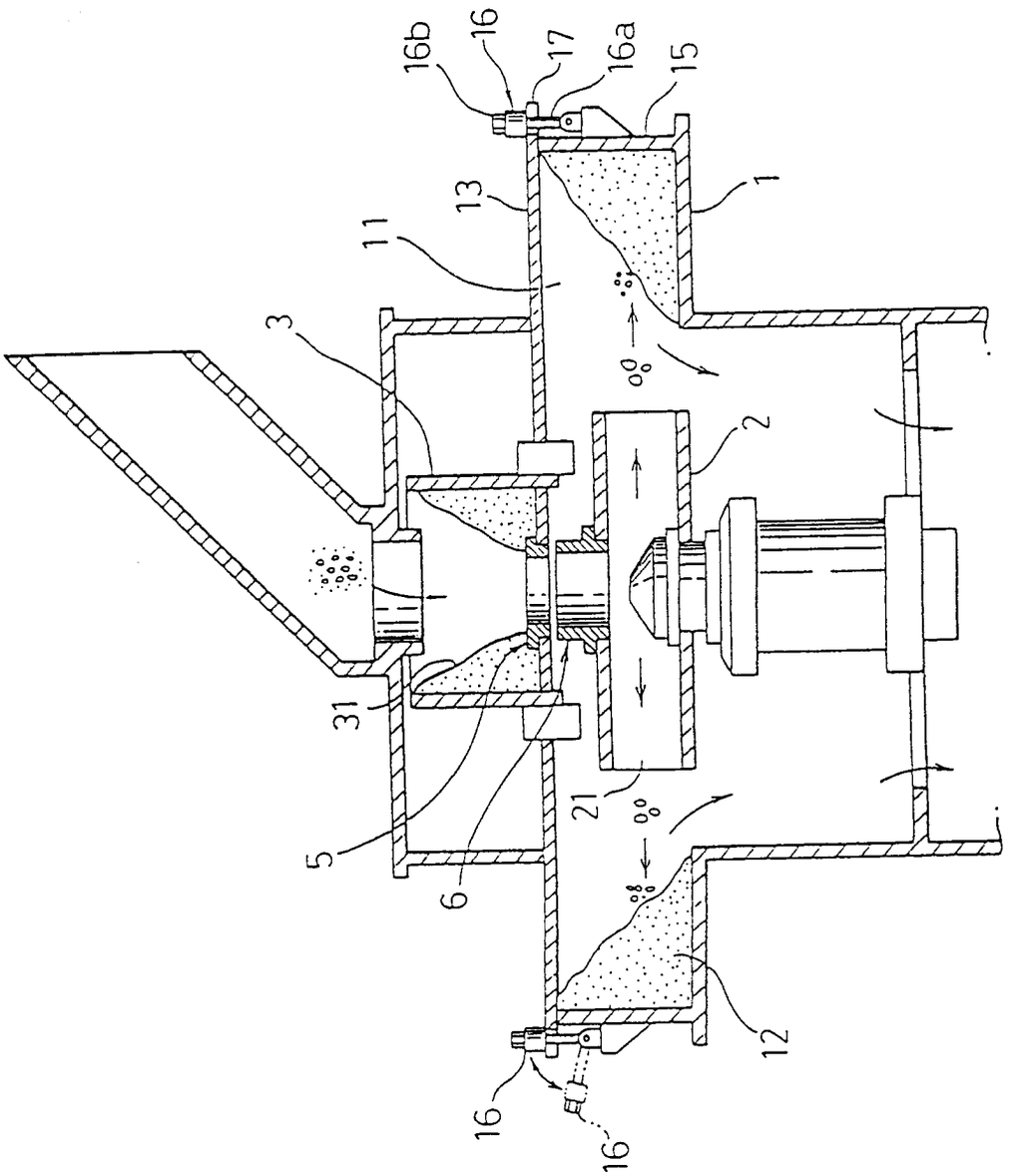


Fig. 2

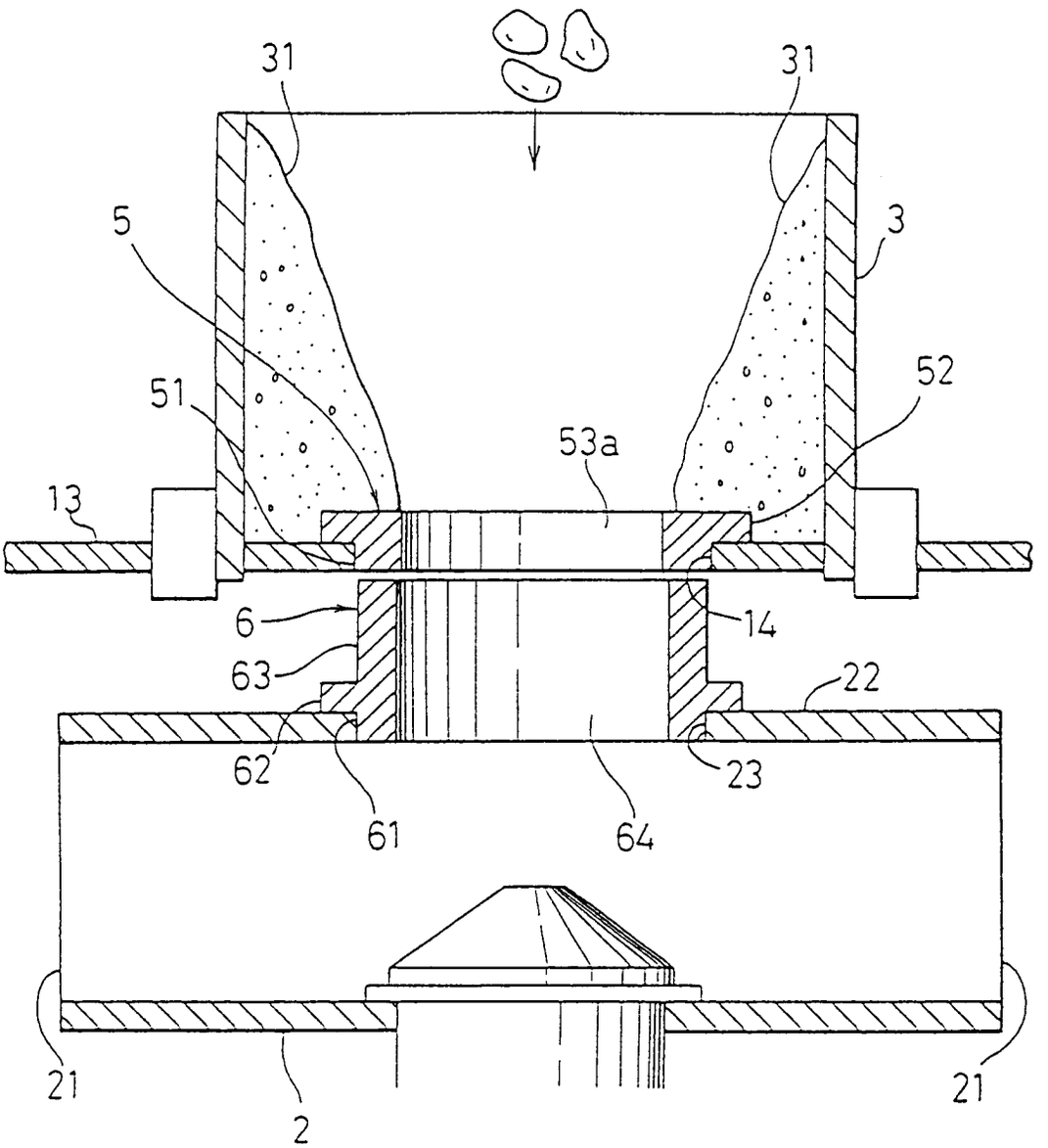


Fig. 3

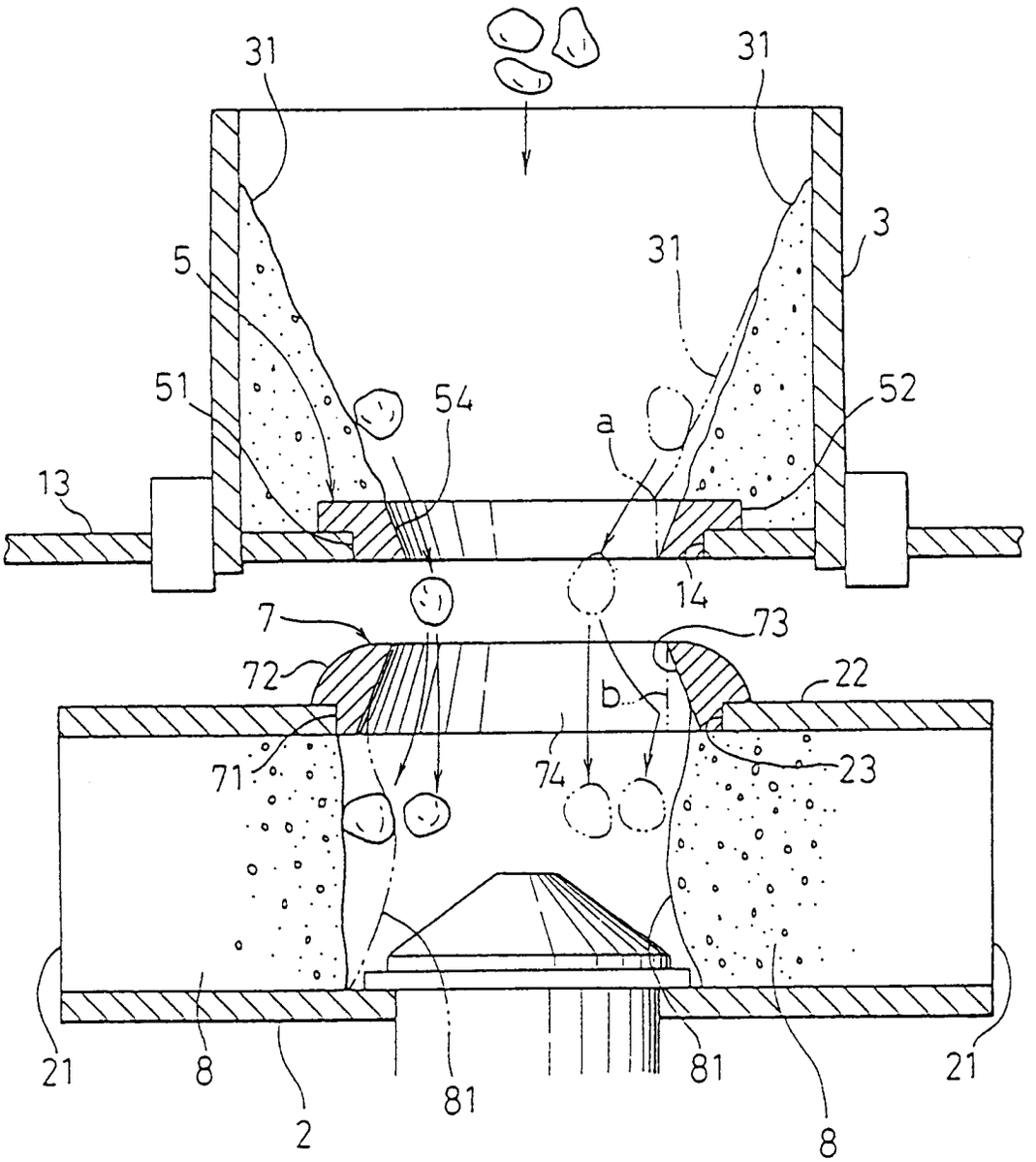


Fig. 4

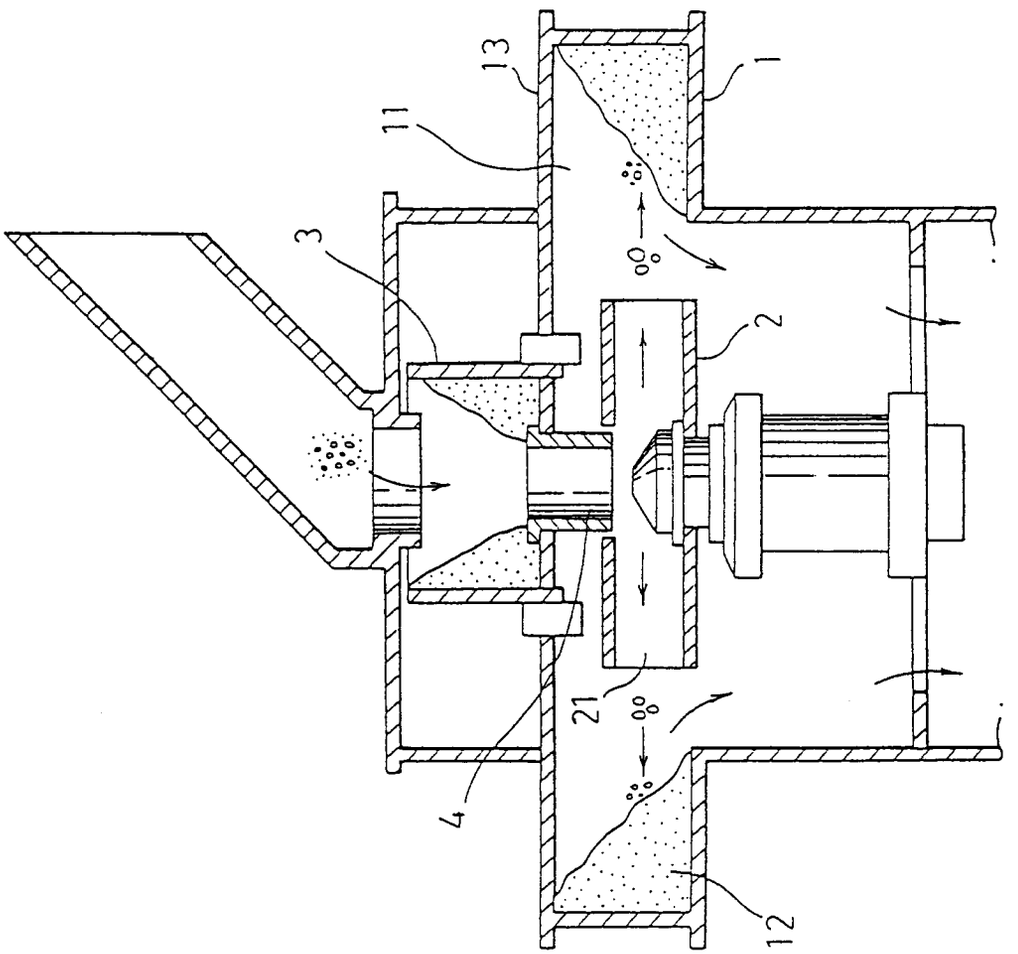
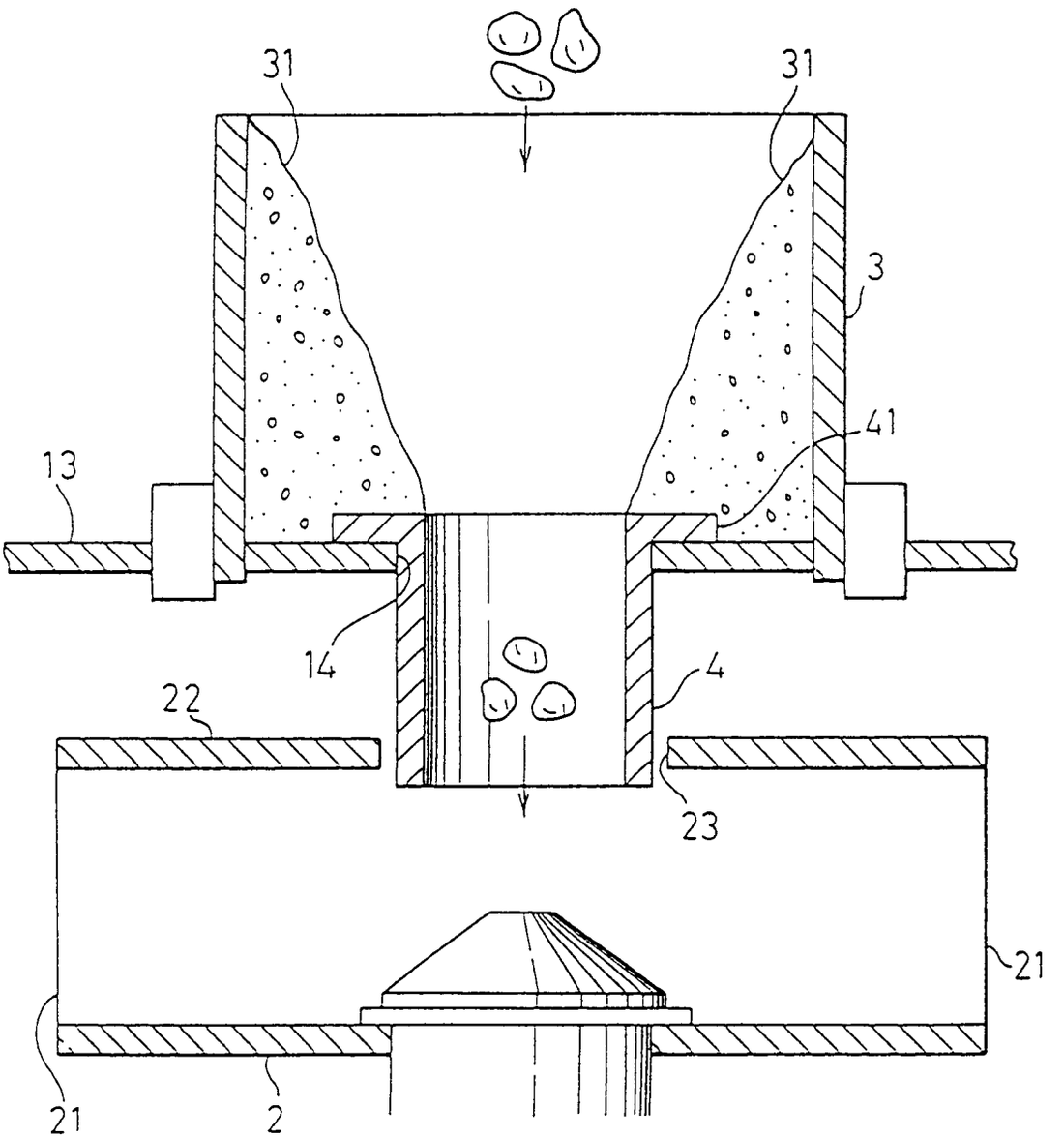


Fig. 5



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP94/02013

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl^{6} B02C13/14,13/286

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^{6} B02C13/00-31

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

Jitsuyo Shinan Koho 1926 - 1995
Kokai Jitsuyo Shinan Koho 1971 - 1995

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.
X	JP, U, 3000057 (Kotobuki Giken Kogyo K. K.), July 26, 1994 (26. 07. 94), Abstract, claim, Figs. 1 to 3 (Family: none)	1-17
X Y	JP, U, 5-85445 (Kotobuki Giken Kogyo K. K.), November 19, 1993 (19. 11. 93), Abstract, claim, Figs. 1 to 3 (Family: none)	1-9, 12-17 10-11
Y	JP, U, 62-132741 (Kobe Steel, Ltd.), August 21, 1987 (21. 08. 87), Claim (Family: none)	10,11

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

* Special categories of cited documents:
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Date of the actual completion of the international search	Date of mailing of the international search report
February 22, 1995 (22. 02. 95)	March 14, 1995 (14. 03. 95)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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