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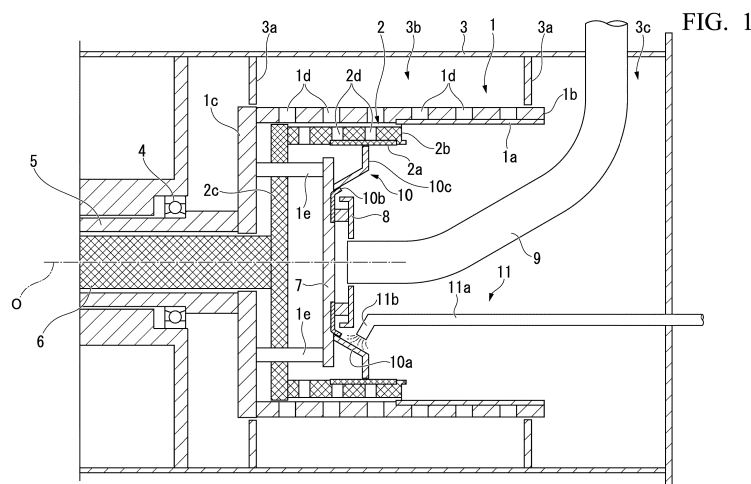
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(54) **PUSH-TYPE CENTRIFUGE AND OPERATION METHOD FOR SAME**

(57) The present invention includes a cylindrical basket (2) which has a cylindrical filtration screen (2a) provided in a body portion thereof and rotates about an axis (O); a processing object supply pipe (9) which is inserted into the basket (2) along the axis (O) and is configured to supply a processing object into the basket (2); a push plate (7) which is housed in the basket (2), is provided to be rotatable integrally with the basket (2) and to be capable of advancing and retreating relative to the basket (2) in a direction of the axis (O), and faces an opening of

the processing object supply pipe (9) with a space therebetween; a pre-thickener (10) which is provided in a side surface of the push plate (7) facing the opening of the processing object supply pipe (9) and has an inclined filtration screen (10a) that goes toward a radially outer circumferential side with respect to the axis (O) as it goes toward the processing object supply pipe (9); and a cleaning liquid supply means (11) which is configured to supply a cleaning liquid toward the inclined filtration screen (10a) of the pre-thickener (10).



Description

[Technical Field]

[0001] The present invention relates to a push-type centrifuge in which a processing object supplied in a basket rotating about an axis is filtered by a filtration screen provided in a body portion of the basket, and a cake filtered from the processing object is discharged from an opening end of the basket by a push plate which is housed in the basket, is rotatable integrally with the basket, and is movable relative to the basket in a direction of the axis, and an operation method for the same.

[0002] Priority is claimed on Japanese Patent Application No. 2018-005649, filed January 17, 2018, the content of which is incorporated herein by reference.

[Background Art]

[0003] As such a push-type centrifuge, for example, a two-stage basket type centrifuge including an outer basket that rotates about an axis; an inner basket that is disposed coaxially in the outer basket to rotate integrally therewith and to advance and retreat with respect to the outer basket in a direction of the axis; a cylindrical filtration screen that is provided in each of the inner and outer baskets; a push plate that is supported by the outer basket and is arranged in the inner basket to face an opening of a supply pipe for the processing object; an annular plate-shaped distributor that is arranged to surround the opening of the supply pipe with a space between the push plate and the distributor; and a pre-thickener that is arranged in a side surface of the push plate facing in an advancing direction of the inner basket with respect to the outer basket to surround an outer circumference of the distributor and has an inclined filtration screen that is inclined toward an outer circumferential side as it goes in advancing direction, is disclosed in Patent Document 1.

[0004] In such a centrifuge, the processing object supplied from the opening of the supply pipe to a portion between the push plate and the distributor moves toward the outer circumferential side on the inclined filtration screen of the pre-thickener by centrifugal force, and a liquid content or particles such as crystals in the processing object having a small particle size are filtered to some extent and are preliminarily concentrated. Then, the processing object is filtered by centrifugal force while being accumulated on an inner circumferential surface of the cylindrical filtration screen of the inner basket to form a cake, is also accumulated in the direction of the axis by the advancing of the inner basket toward the opening end of the outer basket, and then is pushed by the push plate due to the retreating of the inner basket with respect to the outer basket and is discharged to an inner circumferential surface of the outer basket. In addition, the cake of the processing object discharged to the inner circumferential surface of the outer basket in this manner is

further filtered by the cylindrical filtration screen of the outer basket, is pushed by the advancing of the inner basket, and is discharged from the opening end thereof.

[0005] As described above, in the push-type centrifuge including the pre-thickener, since the processing object is preliminarily concentrated by the inclined filtration screen of the pre-thickener, it is possible to improve filtration efficiency in the cylindrical filtration screen of the inner basket or the outer basket. Further, for example, as a case in which crystal particles are separated from a processing object obtained in a crystallization process of ammonium sulfate or the like, even when it is required to selectively separate large crystal particles having a predetermined particle size or larger to obtain a product, the particles having a small particle size can be classified separately from the processing object together with the liquid content by the inclined filtration screen of the pre-thickener as described above, and thus it is not necessary to separately provide a classification device or the like in a subsequent stage of the centrifuge and it is possible to efficiently obtain particles having a large particle size while suppressing equipment costs and running costs.

[Citation List]

[Patent Literature]

[0006] [Patent Document 1]

Japanese Unexamined Patent Application, First Publication No. 2014-091093

[Summary of Invention]

[Technical Problem]

[0007] However, in the push-type centrifuge including such a pre-thickener, the movement of the processing object accumulated on the cylindrical filtration screen of the inner and outer baskets is caused by mechanical advancing and retreating of the inner basket, while the movement of the particles of the filtered processing object in the inclined filtration screen of the pre-thickener depends on only the centrifugal force generated by the rotation of the basket. Therefore, in a case in which a concentration of a solid content of the supplied processing object is high or becomes high, the fluidity of the processing object becomes poor, and thus retention or accumulation of the solid content may occur in the inclined filtration screen, or the inclined filtration screen may be clogged.

[0008] Further, in a case in which a concentration of the solid content of the supplied processing object is high or becomes high as described above, when the fluidity of the processing object becomes poor, the movement of the solid content in the processing object is also likely to be restricted. Due to this, the particles having a small particle size, which should be separated and removed from the processing object together with the liquid con-

tent, are captured by the cake of the solid content on the inclined filtration screen and moved to the inner basket, and thus the required classification performance may not be obtained.

[0009] The present invention has been made under such a background, and an object thereof is to provide a push-type centrifuge and an operation method for the same in which, even in a case in which a concentration of the solid content of the processing object is high or becomes high, the fluidity of the processing object on the inclined filtration screen of the pre-thickener can be secured, retention or accumulation and clogging of the inclined filtration screen can be prevented, the particles having a small particle size can also be efficiently separated and removed together with the liquid content, and the necessary classification performance can be obtained.

[Solution to Problem]

[0010] A push-type centrifuge of the present invention includes a cylindrical basket which has a cylindrical filtration screen provided in a body portion thereof and rotates about an axis; a processing object supply pipe which is inserted into the basket along the axis and is configured to supply a processing object into the basket; a push plate which is housed in the basket, is provided to be rotatable integrally with the basket and to be capable of advancing and retreating relative to the basket in a direction of the axis, and faces an opening of the processing object supply pipe with a space therebetween; a pre-thickener which is provided in a side surface of the push plate facing the opening of the processing object supply pipe and has an inclined filtration screen that goes toward a radially outer circumferential side with respect to the axis as it goes toward the processing object supply pipe; and a cleaning liquid supply means which is configured to supply a cleaning liquid toward the inclined filtration screen of the pre-thickener. Further, in an operation method of the present invention using such a push-type centrifuge, operation method comprising: centrifuging the processing object while supplying the cleaning liquid toward the inclined filtration screen of the pre-thickener by the cleaning liquid supply means.

[0011] In the push-type centrifuge configured in this manner and an operation method for the same, since the cleaning liquid supply means that supplies the cleaning liquid toward the inclined filtration screen of the pre-thickener is provided, even in a case in which a concentration of a solid content of the processing object is high or becomes high, the fluidity of the processing object on the inclined filtration screen can be secured. Therefore, the processing object can be discharged to the cylindrical filtration screen of the basket while being preliminarily concentrated reliably by the centrifugal force generated by the rotation of the basket, and retention or accumulation of the processing object and clogging of the inclined filtration screen can be prevented, so that movement of

the solid content in the processing object can be prevented from being restricted, movement of particles having a small particle size to the liquid content side can be promoted by the cleaning liquid, and particles having a large particle size can be mainly discharged to the basket, and thus it is possible to obtain the necessary classification performance.

[0012] Here, as the cleaning liquid supply means, for example, a cleaning liquid supply means including a cleaning liquid supply pipe that is inserted into the basket, and a spray nozzle that is attached to a tip end of the cleaning liquid supply pipe, the spray nozzle facing the inclined filtration screen can be used. Since the inclined filtration screen of the pre-thickener rotates together with the basket, even if the cleaning liquid supply pipe and the spray nozzle are fixed, the cleaning liquid can be evenly supplied to the processing object on the inclined filtration screen over the entire circumference thereof.

[0013] Further, it is desirable that a mesh opening amount in the inclined filtration screen be larger than a mesh opening amount in the cylindrical filtration screen. Accordingly, it is possible to further promote the discharge of the particles having a small particle size, the liquid content of the processing object, and the cleaning liquid from the inclined filtration screen, and thus to further improve the classification performance.

[Effects of Invention]

[0014] As described above, according to the present invention, even in a case in which a concentration of the solid content of the processing object is high or becomes high, the fluidity of the processing object on the inclined filtration screen can be secured, retention and accumulation of the processing object and clogging of the inclined filtration screen can be prevented, and movement of particles having a small particle size to the liquid content side can be promoted by the cleaning liquid, and thus the necessary classification performance can be obtained.

[Brief Description of Drawings]

[0015] Fig. 1 is a cross-sectional view showing an embodiment of the present invention along an axis of a basket.

[Description of Embodiments]

[0016] Fig. 1 shows an embodiment of a push-type centrifuge of the present invention, and the present invention is applied to a two-stage basket type centrifuge including an outer basket 1 and an inner basket 2 as described in Patent Document 1. That is, the centrifuge according to the present embodiment includes a horizontal outer basket 1 which has a cylindrical outer filtration screen 1a attached to one end side (a right side in Fig. 1) of an inner circumferential surface of a cylindrical body

portion thereof centering on an axis O, and an inner basket 2 which is coaxially housed in the outer basket 1 and also has a cylindrical inner filtration screen 2a attached to one end side of an inner circumferential surface of a cylindrical body portion thereof. The inner basket 2 is a basket of the present invention, and the inner filtration screen 2a is a cylindrical filtration screen of the present invention. As the outer filtration screen 1a or the inner filtration screen 2a, for example, a cylindrical wire screen or a plate screen is used.

[0017] These cylindrical outer basket 1 and inner basket 2 are in a bottomed cylindrical shape in which circular opening ends 1b and 2b are each provided at one end thereof, and the other ends (left ends in Fig. 1) thereof are each attached to disk-shaped holding plates 1c and 2c to be held thereto. A length of the inner basket 2 in a direction of the axis O is shorter than that of the outer basket 1, and the inner basket is housed in the casing 3 together with the outer basket 1 and rotates integrally therewith about the axis O. Note that an outer diameter of the opening end 2b of the inner basket 2 is slightly smaller than an inner circumferential surface of the outer filtration screen 1a of the outer basket 1. Further, a large number of through holes 1d and 2d are each formed in the body portions of the outer basket 1 and the inner basket 2, and gap portions of the outer filtration screen 1a and the inner filtration screen 2a communicate with each of these through holes 1d and 2d.

[0018] A partition wall 3a which extends to an inner circumferential side toward an outer circumferential surface of the outer basket 1 and has an inner diameter slightly larger than an outer diameter of the outer basket 1 is provided at each of positions in the casing 3 corresponding to both ends of the outer basket 1 in the direction of the axis O. In the casing 3, a portion between the partition walls 3a is a discharge chamber 3b for a liquid content separated from a processing object, and the inside of the casing 3 which is located on the one end side further from the partition wall 3a on the one end side is a discharge chamber 3c for a solid content (a cake) obtained by separating the liquid content from the processing object by the outer filtration screen 1a of the outer basket 1.

[0019] The holding plate 1c of the outer basket 1 is attached to one end of a hollow cylindrical main shaft 5 which is rotatably supported by a bearing 4 and is inserted into the casing 3 along an axis O. Accordingly, when a rotational force of a rotation drive means such as a motor (not shown) is transmitted to the main shaft, the main shaft 5 rotates and thus the outer basket 1 rotates at a high speed about the axis O. Further, a push shaft 6 is inserted inside the main shaft 5 to be rotatable integrally with the main shaft 5 and to be capable of advancing and retreating in the direction of the axis O with a constant stroke by an advancing and retreating drive means such as a hydraulic cylinder or an electric cylinder (not shown). Therefore, one end of the push shaft 6 penetrates the holding plate 1c of the outer basket 1 and is attached to

the holding plate 2c of the inner basket 2, so that the inner basket 2 is also rotatable integrally with the outer basket 1 and is also capable of advancing and retreating in the direction of the axis O at the other end side within the outer basket 1.

[0020] Further, a plurality of support shafts 1e are attached to the holding plate 1c of the outer basket 1 to be circumferentially spaced at positions apart from the axis O toward an outer circumferential side and to extend in parallel to the axis O toward the one end side. These support shafts 1e penetrate the holding plate 2c and project into the inner basket 2, and a disk-shaped push plate 7 is attached to one end of each of these support shafts 1e. Therefore, the push plate 7 is rotatable integrally with the outer basket 1 and the inner basket 2 about the axis O coaxially therewith, and is capable of advancing and retreating with respect to the inner basket 2 in the direction of the axis O with a constant stroke.

[0021] Further, on the one end side of the push plate 7, an annular disk-shaped distribution plate (distributor) 8 having a smaller radius than the push plate 7 and having an opening at a center is supported integrally with the push plate 7 with a space therebetween. Furthermore, a processing object supply pipe 9 is inserted into the casing 3 to be attached thereto, the processing object supply pipe 9 is inserted into the opening of the distribution plate 8 through the inside of the opening ends 1b and 2b of the outer basket 1 and the inner basket 2, and a supply port of the processing object supply pipe is open between the push plate 7 and the distribution plate 8. Therefore, the push plate 7 faces an opening of the processing object supply pipe 9 with a space therebetween.

[0022] Further, a pre-thickener 10 is provided in a side surface of the push plate 7 facing the opening of the processing object supply pipe 9 and on an outer circumferential side from the opening of the processing object supply pipe 9 in a radial direction with respect to the axis O to surround the opening of the processing object supply pipe 9. The pre-thickener 10 has a frusto-conical inclined filtration screen 10a made of a wire screen or the like which goes to a radially outer circumferential side with respect to the axis O as it goes from the side surface of the push plate 7 toward the processing object supply pipe 9. In the present embodiment, a mesh opening amount of the inclined filtration screen 10a, that is, a size of the gap portion of the inclined filtration screen 10a, is larger than a mesh opening amount of the inner filtration screen 2a which is the cylindrical filtration screen of the present invention.

[0023] Furthermore, an inner circumferential portion of the inclined filtration screen 10a is covered with the cover 10b at a portion on the other end side in the direction of the axis O in a range up to at least an end edge of the distribution plate 8 on the other side toward the one end side. Accordingly, a portion on the other end side further from the end edge of the distribution plate 8 on the other end side is not exposed on an inner circumference of the pre-thickener 10. Further, an annular disk-shaped scrap-

er 10c in which an outer circumferential edge has an outer diameter slightly smaller than an inner diameter of the inner filtration screen 2a is attached to an outer circumferential portion of the pre-thickener 10.

[0024] The push-type centrifuge configured in this manner further includes a cleaning liquid supply means 11 that supplies a cleaning liquid toward the inclined filtration screen 10a of the pre-thickener 10. In the present embodiment, the cleaning liquid supply means 11 includes a cleaning liquid supply pipe 11a that is inserted into the inner basket 2 from one end side of the inner basket 2, and a spray nozzle 11b that is attached to a tip end of the cleaning liquid supply pipe 11a facing the inclined filtration screen 10a.

[0025] More specifically, the cleaning liquid supply pipe 11a is inserted into the inner basket 2 below the processing object supply pipe 9 in parallel with the axis O. Further, the spray nozzle 11b is bent obliquely downward with respect to the cleaning liquid supply pipe 11a to go downward as it goes toward the other end side at the tip end in the inner basket 2 which is the other end portion of the cleaning liquid supply pipe 11a, and is capable of ejecting the supplied cleaning liquid in a conical radial shape centering on a center line perpendicular to the inclined filtration screen 10a as shown in Fig. 1 in a cross section along the axis O.

[0026] In the push-type centrifuge configured in this manner, the processing object (slurry), in which the solid and liquid contents are mixed, supplied from the processing object supply pipe 9, comes into contact with the push plate 7 that rotates at a high speed together with the outer basket 1 and the inner basket 2. In the present embodiment, the processing object is distributed to the outer circumferential side from a portion between the push plate 7 and the distribution plate 8 by a centrifugal force and adheres to an inner circumferential surface of the inner filtration screen 2a of the inner basket 2. Therefore, when the inner basket 2 advances from a state in which the inner basket 2 retreats with respect to the push plate 7 while the processing object is supplied in this manner, the processing object is filtered by the centrifugal force while being continuously accumulated on the inner circumferential surface of the inner filtration screen 2a of the advancing inner basket 2 in the direction of the axis O, and thus a cake of the processing object is formed.

[0027] Next, when the inner basket 2 advancing in this manner reaches a stroke end of the advancing and is changed to retreat, the cake of the processing object accumulated on the inner circumferential surface of the inner filtration screen 2a is sequentially pushed to the one end side of the inner basket 2 by the scraper 10c of the pre-thickener 10 attached to the push plate 7 that advances relative to the retreating inner basket 2, and the cake accumulated on this one end side is first discharged from the opening end 2b to an inner circumferential surface of the outer filtration screen 1a of the outer basket 1 and is further filtered by the centrifugal force while being continuously accumulated thereon in the direction of the

axis O as well.

[0028] That is, in the present embodiment, the push plate 7 pushes the processing object to the outer basket 1 via the pre-thickener 10.

[0029] Then, the cake accumulated on the inner circumferential surface of the outer filtration screen 1a and filtered in this manner is sequentially pushed to the one end side by the opening end 2b of the inner basket 2 due to the next advancing of the inner basket 2 which has reached a stroke end of the retreating, and the cake accumulated on the one end side is first discharged from the opening end 1b of the outer basket 1 to the discharge chamber 3c for the cake of the casing 3. Further, the liquid content separated from the processing object by the outer filtration screen 1a and the inner filtration screen 2a is discharged to the discharge chamber 3b for the liquid content of the casing 3 through the through holes 1d and 2d formed in the body portions of the outer basket 1 and the inner basket 2.

[0030] Here, in the push-type centrifuge of the above-described configuration including the pre-thickener 10, before the processing object which is supplied from the processing object supply pipe 9 and is distributed on the outer circumferential side by the centrifugal force adheres to the inner circumferential surface of the inner filtration screen 2a, the processing object first adheres to the inclined filtration screen 10a of the pre-thickener 10, and the inclined filtration screen 10a removes the liquid content and particles of the solid content having a small particle size to some extent to preliminarily concentrate the processing object. The processing object adhered to the inclined filtration screen 10a in this manner is pushed toward the outer circumferential side by the centrifugal force, and is accumulated on the inner circumferential surface of the inner filtration screen 2a as described above.

[0031] The push-type centrifuge of the above-described configuration includes the cleaning liquid supply means 11 that supplies the cleaning liquid toward the inclined filtration screen 10a of the pre-thickener 10. In an embodiment of an operation method of the present invention, the cleaning liquid is supplied to the processing object that is preliminarily concentrated while being pushed to the outer circumferential side by the centrifugal force on the inclined filtration screen 10a. Therefore, even in a case in which a concentration of the solid content of the processing object is high or becomes high, the fluidity of the processing object on the inclined filtration screen 10a can be secured due to the cleaning liquid supplied by the cleaning liquid supply means 11.

[0032] Therefore, even in a case in which a concentration of the solid content of the processing object is high or becomes high, the processing object accumulated on the inclined filtration screen 10a can be reliably discharged to the inner filtration screen 2a of the inner basket 2 while being preliminarily concentrated by the centrifugal force generated by the rotation of the inner basket 2, and retention or accumulation of the processing object

and clogging of the inclined filtration screen 10a can be prevented. Further, by securing the fluidity of the processing object in this manner, it is also possible to prevent movement of the solid content in the processing object from being restricted, so that it is possible to prevent particles having a small particle size from being captured by the solid content and to promote movement of the particles having a small particle size to the liquid content side by the cleaning liquid, and it is also possible to mainly discharge particles having a large particle size to the basket and to secure the classification performance necessary for obtaining many particles with such a large particle size.

[0033] Further, in the present embodiment, as this cleaning liquid supply means 11, a cleaning liquid supply means including the cleaning liquid supply pipe 11a that is inserted into the inner basket 2, and the spray nozzle 11b that is attached to the tip end of the cleaning liquid supply pipe 11a facing the inclined filtration screen 10a is used. Here, since the inclined filtration screen 10a of the pre-thickener 10 rotates together with the inner basket 2 and the push plate 7, even if the cleaning liquid supply pipe 11a and the spray nozzle 11b of the cleaning liquid supply means 11 are fixed, the cleaning liquid can be evenly supplied to the processing object on the inclined filtration screen 10a over the entire circumference thereof.

[0034] Further, in the present embodiment, the mesh opening amount of the inclined filtration screen 10a is larger than the mesh opening amount of the inner filtration screen 2a which is the cylindrical filtration screen of the inner basket 2. That is, for example, in a case in which both the inclined filtration screen 10a and the inner filtration screen 2a are wire screens, a space between the adjacent wires of the inclined filtration screen 10a is larger than a space between the adjacent wires of the inner filtration screen 2a. Therefore, it is possible to further promote the discharge of the particles having a small particle size, the liquid content of the processing object, and the cleaning liquid from the inclined filtration screen 10a, and it is possible to further improve the classification performance by the inclined filtration screen 10a.

[0035] Note that the cleaning liquid supplied by the cleaning liquid supply means 11 may be water depending on the processing object, and the cleaning liquid and the liquid content in the processing object separated from the processing object by the inclined filtration screen 10a, and the liquid filtered from the particles having a small particle size which are also separated from the processing object may be circulated to be supplied. Further, in the present embodiment, the case in which the present invention is applied to the two-stage basket type centrifuge including the outer basket 1 and the inner basket 2 has been described. However, the present invention can be applied to a one-stage basket type centrifuge of only the inner basket 2 or a centrifuge of three or more stages.

[0036] Further, in addition to the cleaning liquid supply means 11 that supplies the cleaning liquid toward the

inclined filtration screen 10a of the pre-thickener 10, a cleaning liquid supply means that supplies a cleaning liquid toward the inner filtration screen 2a or the outer filtration screen 1a may be provided.

[Industrial Applicability]

[0037] According to the present invention, it is possible to secure the fluidity of the processing object on the inclined filtration screen of the pre-thickener.

[Reference Signs List]

[0038]

1	Outer basket
1a	Outer filtration screen
1b	Opening end of outer basket 1
2	Inner basket (basket)
2a	Inner filtration screen (cylindrical filtration screen)
2b	Opening end of inner basket 2
3	Casing
5	Main shaft
6	Push shaft
7	Push plate
8	Distribution plate
9	Processing object supply pipe
10	Pre-thickener
10a	Inclined filtration screen
11	Cleaning liquid supply means
11a	Cleaning liquid supply pipe
11b	Spray nozzle
O	Axis of inner basket 2 (basket)

Claims

1. A push-type centrifuge comprising:

a cylindrical basket which has a cylindrical filtration screen provided in a body portion thereof and rotates about an axis;
 a processing object supply pipe which is inserted into the basket along the axis and is configured to supply a processing object into the basket;
 a push plate which is housed in the basket, is provided to be rotatable integrally with the basket and to be capable of advancing and retreating relative to the basket in a direction of the axis, and faces an opening of the processing object supply pipe with a space therebetween;
 a pre-thickener which is provided in a side surface of the push plate facing the opening of the processing object supply pipe and has an inclined filtration screen that goes toward a radially outer circumferential side with respect to the axis as it goes toward the processing object supply pipe; and

a cleaning liquid supply means which is configured to supply a cleaning liquid toward the inclined filtration screen of the pre-thickener.

2. The push-type centrifuge according to claim 1, wherein the cleaning liquid supply means includes a cleaning liquid supply pipe that is inserted into the basket, and a spray nozzle that is attached to a tip end of the cleaning liquid supply pipe, the spray nozzle facing the inclined filtration screen.

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3. The push-type centrifuge according to claim 1, wherein a mesh opening amount in the inclined filtration screen is larger than a mesh opening amount in the cylindrical filtration screen.

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4. The push-type centrifuge according to claim 2, wherein a mesh opening amount in the inclined filtration screen is larger than a mesh opening amount in the cylindrical filtration screen.

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5. An operation method for a push-type centrifuge using the push-type centrifuge according to claim 1, the operation method comprising: centrifuging the processing object while supplying the cleaning liquid toward the inclined filtration screen of the pre-thickener by the cleaning liquid supply means.

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6. An operation method for a push-type centrifuge using the push-type centrifuge according to claim 2, the operation method comprising: centrifuging the processing object while supplying the cleaning liquid toward the inclined filtration screen of the pre-thickener by the cleaning liquid supply means.

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7. An operation method for a push-type centrifuge using the push-type centrifuge according to claim 3, the operation method comprising: centrifuging the processing object while supplying the cleaning liquid toward the inclined filtration screen of the pre-thickener by the cleaning liquid supply means.

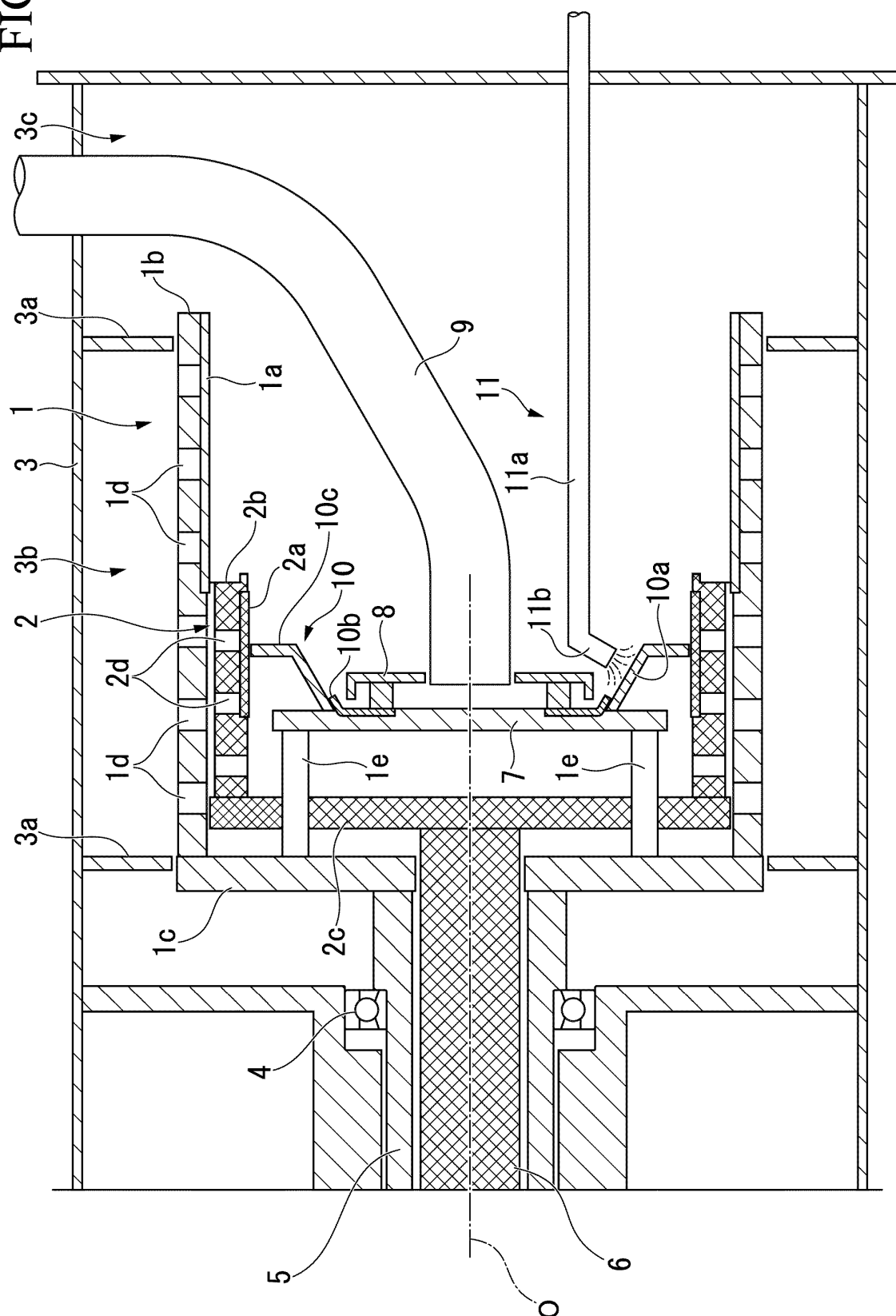
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8. An operation method for a push-type centrifuge using the push-type centrifuge according to claim 4, the operation method comprising: centrifuging the processing object while supplying the cleaning liquid toward the inclined filtration screen of the pre-thickener by the cleaning liquid supply means.

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FIG. 1



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/035039

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. B04B3/02 (2006.01) i, B04B15/12 (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. B04B3/02, B04B15/12, B01D33/06, C02F11/12, F26B

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 1971-2018

Registered utility model specifications of Japan 1996-2018

Published registered utility model applications of Japan 1994-2018

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	JP 2004-351411 A (FERRUM AG) 16 December 2004, claims, paragraphs [0004]-[0005], [0043]-[0052], fig. 1-2 & US 2004/0206689 A1, claims, paragraphs [0004]-[0005], [0058]-[0066], fig. 1-2 & EP 1468742 A1	1-4
Y	DE 102011055513 A1 (ANDRITZ KMPT GMBH) 23 May 2013, paragraphs [0051]-[0054], fig. 1-5 & CH 705773 A2	1-4



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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search
19 October 2018 (19.10.2018)Date of mailing of the international search report
30 October 2018 (30.10.2018)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/035039

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CH 312160 A (ESCHER WYSS AG) 31 December 1955, page 3, right column, line 92 to page 4, left column, line 18, fig. 1 (Family: none)	1-4
Y	WO 2007/119374 A1 (TSUKISHIMA KIKAI CO., LTD.) 25 October 2007, paragraphs [0017]-[0024], fig. 1 & CN 101421046 A & KR 10-2008-0113282 A & TW 200800401 A	1-4
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