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- (73) Patenthaver: **thyssenkrupp Industrial Solutions AG, ThyssenKrupp Allee 1, 45143 Essen, Tyskland
thyssenkrupp AG, ThyssenKrupp Allee 1, 45143 Essen, Tyskland**
- (72) Opfinder: **KACHE, Guido, Mozartstr. 7, 59269 Beckum, Tyskland
WILCZEK, Michael, Hangkamp 4, 48231 Warendorf, Tyskland
ASSMANN, Björn-Olaf, Kletterrosenweg 1, 59063 Hamm, Tyskland**
- (74) Fuldmægtig i Danmark: **RWS Group, Europa House, Chiltern Park, Chiltern Hill, Chalfont St Peter, Bucks SL9 9FG, Storbritannien**
- (54) Benævnelse: **FREMGANGSMÅDE OG ANLÆG TIL FREMSTILLING AF CEMENT**
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Description

The invention relates to a method and to a plant for producing cement.

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In the grinding of cement, the cement starting material, which is composed of cement clinker and further additives, such as silica dust, pozzolan, fly ash, burnt shale, limestone and/or granulated blast furnace slag and/or sulfate carriers, is ground
10 in at least one ball mill and then separated into fine material and coarse material in a classifier, wherein the coarse material is fed back to the ball mill until the desired fineness is achieved.

15 DE 10 2007 046 834 A1 discloses a method for producing high grade Portland cements, in which a two-stage grinding plant is used. The first grinding stage comprises a first mill and a first dynamic classifier, wherein the mill can be formed by a ball, material bed roll mill or vertical roller mill. The output
20 from the first mill is fed to the first dynamic classifier, the coarse grains from which are fed back to the first mill. The fine material output from the first dynamic classifier is fed to a second dynamic classifier or, alternatively, passes directly into a silo, which is likewise connected to the inlet
25 of the second dynamic classifier. A finely divided grinding additive, such as granulated blast furnace slag or coarse granulated blast furnace slag, is furthermore fed from another silo to the inlet of the second dynamic classifier. Moreover, sulfate carriers can be added in addition. The coarse grains
30 from the second dynamic classifier pass into a second mill, which can be formed by a ball mill, a vertical roller mill or a stirred ball mill, for example. The output from the second mill once again passes to the second dynamic classifier, the fine material from which is input into a cement silo via a conveying
35 section.

EP 0 648 539 A2 discloses a recirculating grinding mill having two high pressure roll presses, each of which interacts with a

classifier. Provision is furthermore made to enable a partial amount from a first grinding circuit to be drawn off as a first finished product B, while a second finished product A is produced in a second grinding circuit.

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It is now the underlying object of the invention to specify a method and a plant for producing cements which is distinguished by high production flexibility and additional ways of influencing cement properties.

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According to the invention, this object is achieved by the features of Claims 1 and 8.

In the method according to the invention for producing cements, cement starting material is ground in at least one ball mill and is subsequently separated into fine material and coarse material in a classifier, wherein the coarse material is supplied to the ball mill again. The fine material from the classifier is divided quantitatively into a first partial amount and a second partial amount, wherein the first partial amount forms a first cement, while the second partial amount of the fine material is fed to a dry-operated stirred ball mill for further grinding.

The cement starting material should be interpreted to mean, in particular, cement clinker, although further grinding additives, e.g. granulated blast furnace slag, silica dust, pozzolan, fly ash, burnt shale, limestone, sulfate carriers etc., are also usually provided.

Merely using a ball mill makes it possible to produce a cement that complies with standards, having the required Blaine fineness of 300 to 500 m²/kg, for example. The method according to the invention now offers the additional possibility of quantitatively removing a partial amount of the first cement and feeding it to a dry-operated stirred ball mill for further grinding, wherein the resulting second cement is selectively mixed with the first cement or used as a separate product.

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By virtue of the high number of grinding elements and the high kinetic energy of the grinding elements which is introduced by the stirring mechanism of the stirred ball mill, the stirred ball mill is particularly suitable for grinding particles of the order of 300 to 500 m²/kg. In this case, it is possible to achieve Blaine fineness levels of above 500 m²/kg, in particular in the region of 500 to over 800 m²/kg.

The advantage of the method according to the invention consists especially in the fact that the re-grinding of a quantitative partial stream of the first cement makes it possible to produce a cement which is tailor-made for the customer. Moreover, this re-grinding can be carried out at times in which there is sufficient capacity in the existing energy supply since the stirred ball mill does not act as a fixed component of a two-stage grinding plant.

The method according to the invention differs from the two-stage grinding method according to DE 10 2007 046 834 A1 in that a quantitative partial amount of the first cement continues to be ground in the stirred ball mill in order to produce a second cement, which optionally allows the production of a tailor-made, customer-specific cement through mixing with the first cement or can be used as a separate product. In DE 10 2007 046 834 by contrast, the coarse material from the first grinding stage is supplied to the second mill. As a result, the fineness of the end product can only be modified by adjusting the dynamic classifier. Moreover, continuous use of the second mill is required.

In the method according to the invention, the fineness can be set individually through the mixing ratio of the first and second cement. Another advantage also consists in that the dry-operated stirred ball mill does not have to be operated continuously.

According to another embodiment of the invention, it is envisaged that the second partial amount which is fed to the dry-operated stirred ball mill accounts for 3 to 20% by weight,

preferably 5 to 10% by weight, of the fine material from the classifier. In this case, the dry-operated stirred ball mill can be operated as a simple continuous mill, i.e. without connected classifiers, thereby correspondingly reducing the outlay on apparatus. According to another illustrative embodiment, however, it is also possible to make provision for the dry-operated stirred ball mill to be operated with a dedicated classifier, wherein the grit from this classifier is passed back to the stirred ball mill.

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The cement plant according to the invention essentially comprises at least one ball mill with an inlet for the feeding in of cement starting material and an outlet, a classifier having a classifier inlet, a coarse material outlet and a fine material outlet, wherein the outlet of the ball mill is connected to the classifier inlet, and the coarse material outlet is connected to the inlet of the ball mill. Moreover, at least one first cement silo and a conveying section are provided, which is arranged between the fine material outlet of the classifier and the at least one first cement silo. Finally, a dry-operated stirred ball mill is provided, which is connected to the fine material outlet of the classifier via a material divider or splitter arranged in the conveying section.

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A material divider or splitter should be interpreted to mean a device which splits up a material stream quantitatively. In a classifier, by contrast, the material is separated according to particle size.

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The dry-operated stirred ball mill has an inlet and an outlet, wherein the inlet is connected to the material divider and, according to another embodiment of the invention, is connected to at least one storage tank for further grinding additives. The further grinding additives can be granulated blast furnace slag, silica dust, pozzolan, fly ash, burnt shale, limestone, sulfate carriers or the like. The grinding additive is expediently fed to the stirred ball mill at a Blaine fineness of 200 - 500 m²/kg.

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Further embodiments of the invention are explained in detail with reference to the following description and the drawing.

In the drawing:

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Figure 1 shows a cement plant according to the invention having a dry-operated stirred ball mill, which is operated as a continuous mill,

10 Figure 2 shows a schematic sectional view of a dry-operated stirred ball mill, and

Figure 3 shows a cement plant according to the invention having a dry-operated stirred ball mill, which is operated with a
15 dedicated classifier.

Figure 1 shows a first illustrative embodiment according to the invention of a plant for producing cements, in particular a cement grinding plant having a ball mill 1 and a classifier 2.
20 The ball mill 1 has an inlet 1a for feeding in cement starting material 3 and an outlet 1b. The cement starting material 3 is fed to the inlet 1a of the ball mill 1 via a first conveying section 4.

25 Here, the classifier 2 is designed as a dynamic classifier and provides a classifier inlet 2a, a coarse material outlet 2b and a fine material outlet 2c, wherein the outlet 1b of the ball mill 1 is connected via a conveyor 5, in particular via a bucket conveyor, to the classifier inlet 2a. To convey the material
30 from the outlet 1b of the ball mill 1 to the conveyor 5, a second conveying section 6 is provided here, and a third conveying section 7 is provided for conveyance between the conveyor 5 and the classifier inlet 2a. The coarse material 8 from the classifier 2 is conveyed to the inlet 1a of the ball mill 1 via
35 a suitable connection, e.g. chutes, lines or a fourth conveying section 9. The classifier 2 is operated with classifying air 11, which is fed to the classifier 2 with the aid of a fan 12. The fine material 10 is separated in cyclone separators 2d to 2g

from the classifying air 11, which is then fed back to the classifier 2. Some of the recirculated classifying air 11 is supplemented with fresh air, while some is discharged via a dust filter 13. The fine material 10 separated out in the cyclone separators 2d to 2g of the classifier 2 is conveyed into at least one first cement silo 15 via a fifth conveying section 14. The dust 16 separated out in the dust filter 13 also passes via the fifth conveying section 14 into the first cement silo 15.

The ball mill 1 has a ball charge 1c, 1d suitable for the desired comminution and, as illustrated, can be subdivided into more than one grinding chamber, which each have a different ball charge 1c, 1d. The ball mill can also be designed as an air flow mill, wherein the material discharge is accomplished pneumatically by means of an air flow. In this case, it is conceivable for the discharged material to be input into the dynamic classifier 2 together with the air flow. Here, however, mechanical separation of the ground material 17 from the ball charge 1d takes place in the region of the outlet 1b of the ball mill 1, wherein the ball mill is ventilated and freed from dust by the air flow 18. The air flow 18 is fed to a second dust filter 19, wherein the separated dust is fed to the classifier 2 via the conveyor 5, together with the ground material 17. The separated air flow 18 is released into the atmosphere.

The plant shown in figure 1 furthermore provides a dry-operated stirred ball mill 20 having an inlet 20a and an outlet 20b. Furthermore, a material divider 21 is provided in the conveying section 14, said divider being connected to the inlet 20a of the stirred ball mill 20. The material divider 21 can be controlled in such a way that it divides the fine material 10 fed in via the fifth conveying section 14 into a first partial amount 10a and a second partial amount 10b, wherein the first partial amount 10a is conveyed onward as a first cement 27 in the direction of the first cement silo 15, while the second partial amount 10b passes to the stirred ball mill 20. The second partial amount 10b is preferably 3 to 20% by weight, preferably 5 to 10% by weight, of the fine material 10. It is conceivable here for

further fine grinding additives (200-500 m²/kg according to Blaine) to be supplied to the stirred ball mill 20 by means of at least one storage tank 22.

5 The second partial amount 10b, which has been further comminuted in the stirred ball mill 20 is discharged via the outlet 20b with the aid of conveying air 23 and is separated in a downstream separator 24 from the conveying air 23, which is then fed back to the stirred ball mill 20. The second partial amount 10b
10 further comminuted in the stirred ball mill 20 and separated out in the separator 24 can optionally be conveyed as a second cement 25 into at least one second cement silo 26 or, alternatively, can be mixed with the first cement 27 formed by the first partial amount 10a and can be stored in the at least one first cement
15 silo. The mixing ratio of the first and the second cement 27, 25 is established by means of suitable mixing and metering devices in accordance with the properties desired for the end product.

20 It is, of course, also conceivable for the mixing of the two cements to be accomplished by joint withdrawal from the two silos 15, 26 or by withdrawal from the second cement silo 26 before the first cement 27 enters the first cement silo 15. By means of the ball mill 1, the first cement 27 can be produced
25 with a Blaine fineness of between 300 and 500 m²/kg. In the stirred ball mill 20, it is possible to increase the Blaine fineness of the second cement 25, in particular to 500 to >800 m²/kg. The provision of the second cement silo 26 enables the second cement 25 to be stored too, and therefore the stirred
30 ball mill does not have to run continuously. On the contrary, it is possible to provide the operation of the stirred ball mill 20 when the existing energy supply has sufficient capacity.

Figure 2 shows an enlarged illustration of the stirred ball mill
35 20. In contrast to the ball mill 1, the stirred ball mill 20 has a fixed housing 20c and a stirring mechanism 20e driven by means of a motor 20d in the interior of the housing. Furthermore, the stirred ball mill 20 is operated with grinding elements 20f, in

particular grinding balls. The second partial amount 10b of the fine material 10, which is to be comminuted, is fed in in the region of the inlet 20a via a star feeder 20g. Further grinding up is accomplished essentially through contact with the grinding elements 20f, which are moved and accelerated by the stirring mechanism 20e. A discharge rotor 20h, which divides the additionally ground second partial amount 10b from the grinding elements 20f is provided in the region of the outlet 20b, said discharge rotor 20h corotating with the stirring mechanism 20e. Via a conveying air opening 20i provided in the region of the outlet 20b, the conveying air 23 for discharging the material is fed in, flows through the discharge rotor 20h and carries the ground material out via the outlet 20b. To support the conveying effect, a further conveying air opening 20j can also be provided in the region of the outlet 20b. In the present case, the stirred ball mill 20 is designed as a dry-operated stirred ball mill, thereby making subsequent drying of the ground material unnecessary.

In the illustrative embodiment shown in figure 1, the stirred ball mill 20 is designed as a continuous mill. In the context of the invention, however, it is also possible to envisage the stirred ball mill 20 interacting with a dedicated classifier 28, as illustrated in figure 3. This further (dedicated) classifier 28 has an inlet 28a, which is connected to the outlet 20b of the stirred ball mill 20, a coarse material outlet 28b, which, for recirculation of coarse material, is connected to the inlet 20a of the dry-operated ball mill 20, and a fine material outlet 28c, which, in turn, can be connected in the manner already indicated according to figure 1, either to a second cement silo 26 or for mixing with the first cement 27. With the aid of the further classifier 28, which interacts with the stirred ball mill 20, the fineness of the second cement 25 can be adjusted very precisely to a desired fineness.

Patentkrav

1. Fremgangsmåde til fremstilling af cementer, hvorved cementudgangsmateriale (3) formales i i det mindste en kuglemølle (1) og derefter i en sigte (2) adskilles i finfraktion (10) og grovfraktion (8), hvorved grovfraktionen (8) endnu en gang tilføres til kuglemøllen (1), kendetegnet ved, at finfraktionen (10) mængdemæssigt opdeles i en første og en anden delmængde (10a, 10b), hvorved den første delmængde (10a) danner en første cement (27), mens den anden delmængde (10b) af finfraktionen (10) tilføres til en tørt drevet røreværskuglemølle (20) til videre formaling, og en derved opstående anden cement (25) valgfrit blandes med den første cement (27) eller udnyttes som selvstændigt produkt.
2. Fremgangsmåde ifølge krav 1, kendetegnet ved, at sigten (2) drives sådan, at sigtens (2) finfraktion (10) har en finhed mellem 300 og 500 m²/kg ifølge Blaine.
3. Fremgangsmåde ifølge krav 1, kendetegnet ved, at den anden cement (25) formales til en finhed større end 500 m²/kg ifølge Blaine i den tørt drevne røreværskuglemølle (20).
4. Fremgangsmåde ifølge krav 1, kendetegnet ved, at der som anden delmængde (10b) afgrenes 3 til 20 % af finfraktionen (10).
5. Fremgangsmåde ifølge krav 1, kendetegnet ved, at den tørt drevne røreværskuglemølle (20) drives som kontinuerlig mølle.
6. Fremgangsmåde ifølge krav 1, kendetegnet ved, at den tørt drevne røreværskuglemølle (20) drives med en særskilt sigte (28), og denne sigtes (28) korn ledes tilbage til røreværskuglemøllen (20).
7. Fremgangsmåde ifølge krav 1, kendetegnet ved, at der til den tørt drevne røreværskuglemølle (20) ud over den anden delmængde (10b) af finfraktionen (10) tilføres yderligere formalingsadditiver.

8. Cementformalingsanlæg med

- i det mindste en kuglemølle (1) med et indløb (1a) til tilførsel af cementudgangsmateriale (3) og et udløb (1b),
- 5 - en sigte (2) med et sigteindløb (2a), et grovfraktionsudløb (2b) og et finfraktionsudløb (2c), hvorved kuglemøllens (1) udløb (1b) står i forbindelse med sigteindløbet (2a), og grovfraktionsudløbet (2b) står i forbindelse med kuglemøllens (1) indløb (1a),
- 10 - i det mindste en første cementsilo (15) og
- en transportstrækning (14), der foreligger mellem sigtens (2) finfraktionsudløb (2c) og den i det mindste ene første cementsilo (15),
- kendetegnet ved, at der foreligger en tørt drevet
- 15 røreværskuglemølle (20), som via en i transportstrækningen (14) anbragt materialedeler (21) står i forbindelse med sigtens (2) finfraktionsudløb (2c).

9. Cementanlæg ifølge krav 8, kendetegnet ved, at den tørt drevne røreværskuglemølle (20) har et udløb (20b), der står i forbindelse med transportstrækningen (14) og/eller med i det mindste en anden cementsilo (26).

10. Cementanlæg ifølge krav 8, kendetegnet ved, at den tørt drevne røreværskuglemølle (20) foreligger som kontinuerlig mølle.

11. Cementanlæg ifølge krav 8, kendetegnet ved, at den tørt drevne røreværskuglemølle (20) har et indløb (20a) og et udløb (20b), hvor udløbet (20b) står i forbindelse med en yderligere sigte (28), der har et grovfraktionsudløb (28b) og et finfraktionsudløb (28c), hvor grovfraktionsudløbet (28b) med henblik på recirkulation af grovfraktionen står i forbindelse med den tørt drevne røreværskuglemøllens (20) indløb (20a), og

30 finfraktionsudløbet (28c) står i forbindelse med transportstrækningen (14) og/eller med i det mindste en anden cementsilo (26).

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12. Cementanlæg ifølge krav 8, kendetegnet ved, at den tørt drevne røreværkskuglemølle (20) har et indløb (20a) og et udløb (20b), hvor indløbet (20a) står i forbindelse med materialedeleren (21) og med i det mindste en forrådsbeholder 5 (22) for yderligere formalingsadditiver.

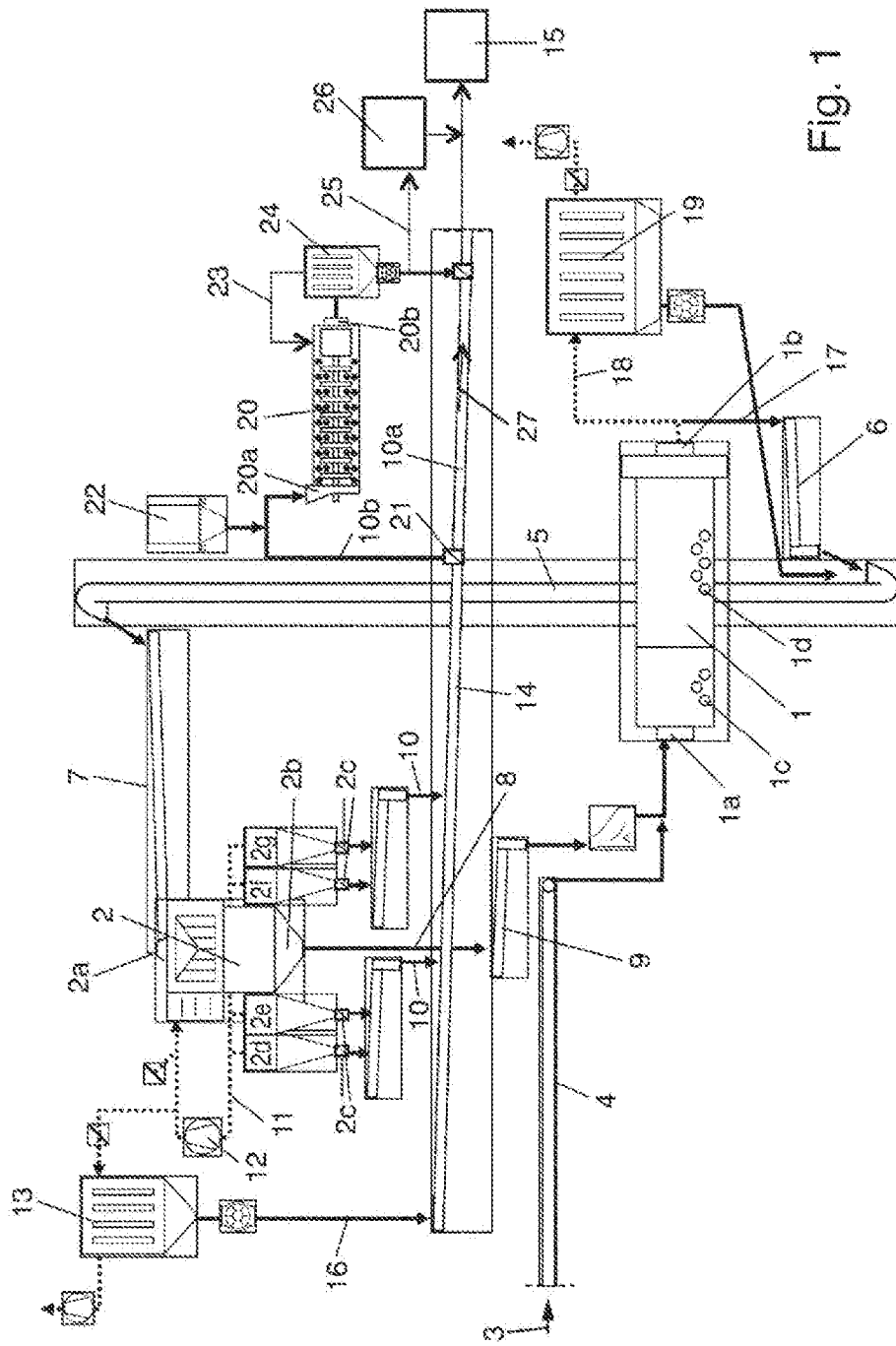


Fig. 1

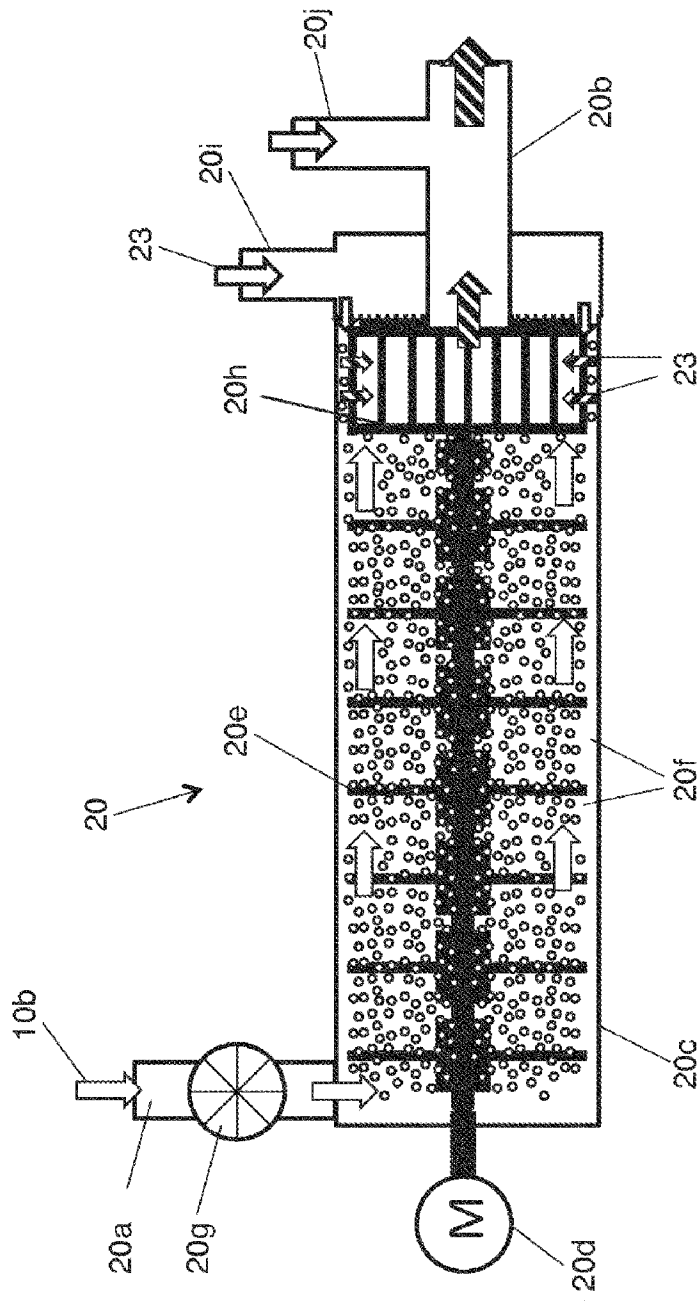


Fig. 2

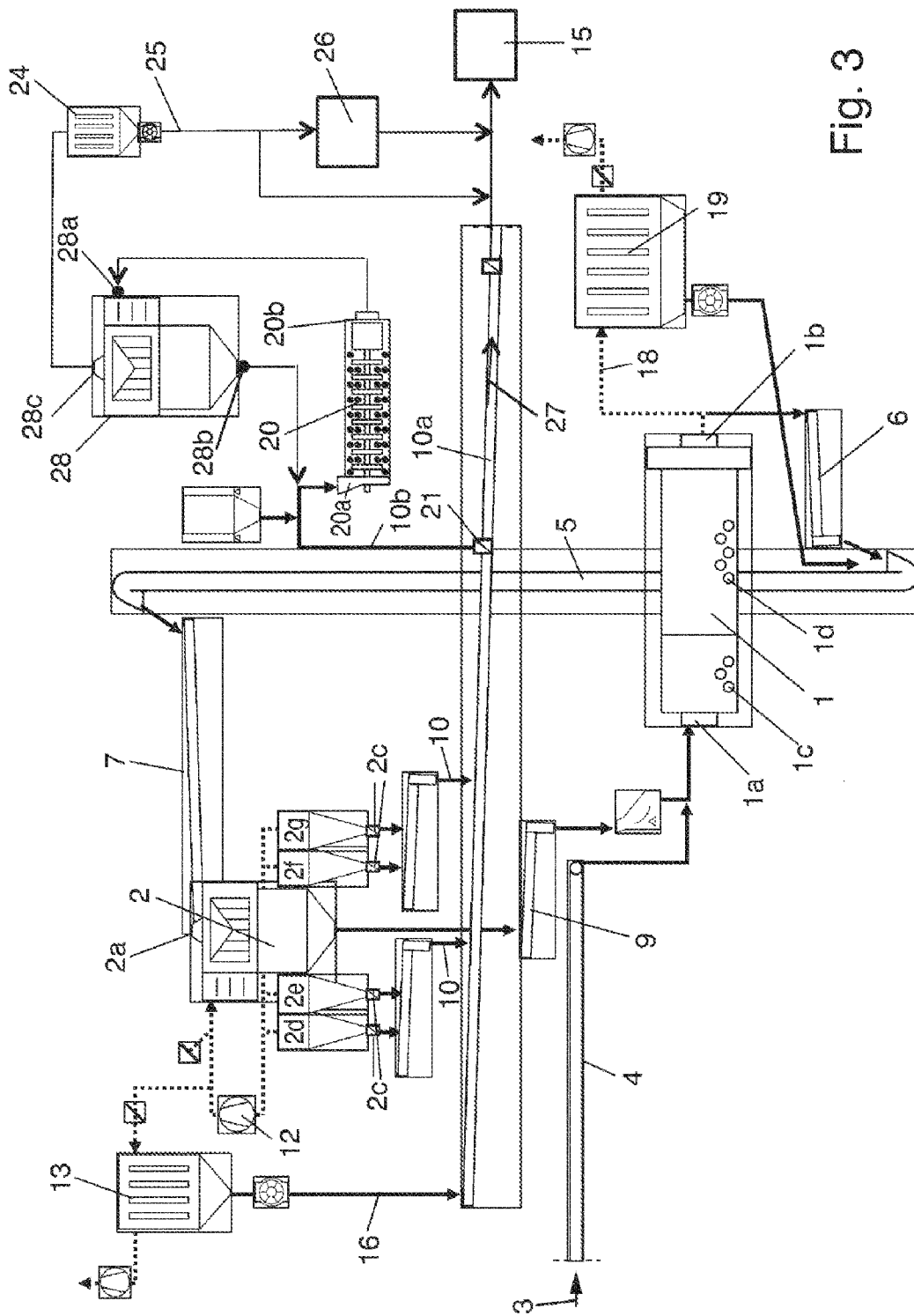


Fig. 3