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Description

The invention relates to an installation and a method for producing a binder, in particular cement.

In cement installations, use is normally made of cooling devices for cooling the fired cement clinker exiting the furnace. For this purpose, use is made for example of grate coolers. Such a grate cooler has been disclosed in DE 100 18 142 B4. EP 0 678 487 A2 discloses an installation for producing white cement having a grate cooler. Also, from US 3 365 521 A, a grate cooler of an installation for producing alkali-free cements is known. During the operation of grate coolers, red, still incandescent spots or stripes can in many cases be observed on the surface of the material to be cooled, the cause thereof being insufficient cooling of these regions of the layer of the material to be cooled.

If the material fired in the furnace arranged upstream is cast onto the cooler, then the relative coarse and the relatively fine parts, coarse material and fine material, fall onto the cooler surface together. The fine material, in comparison with the coarse material, cools more quickly and requires a shorter residence time in the clinker cooler. Upward floating and/or at least partial fluidization of the fine material leads to the fine material having a significantly longer residence time in the cooler than would be necessary for cooling the fine material. Also, there is a great temperature difference between the fine material and the coarse material, with the coarse material having a significantly higher temperature than the fine material, which leads to inefficient and non-uniform cooling of the entire material. In particular, the cooling of the coarse parts to the core is very energy-intensive and inefficient.

Taking this as a departure point, it is an object of the present invention to provide an installation and a method for producing a binder, in particular cement, with efficient cooling.

Said object is achieved according to the invention by an installation having the features of the independent apparatus Claim 1, and by a method having the features of the independent Claim 14. Advantageous refinements will emerge from the dependent claims.

According to a first aspect, an installation for producing a binder, in particular cement, comprises a furnace for thermally treating a material and a cooling device for cooling the material, which cooling device is arranged downstream of the furnace in the flow direction of the material. The cooling device has a classifying device for classifying the material into at least two grain sizes, coarse material and fine material, wherein a coarse-material cooler for cooling the coarse material and a fine-material cooler for cooling the fine material are arranged downstream of the classifying device.

The furnace is for example a rotary furnace in which the material is fired to form cement clinker and heated to a temperature of approximately 1450°C. In particular a preheater is arranged upstream of the furnace, wherein the material is heated in the preheater by the furnace exhaust gas in a counterflow configuration. The preheater has a plurality of cyclone stages and for example a calciner region in which the material is deacidified in the presence of a supply of heat.

The classifying device is for example a gas stream screen, wherein the material is exposed to a gas stream such that the in particular dispersible fine material is separated from the in particular non-dispersible coarse material. For example, the classifying device comprises a vertical pipeline in which the material is exposed to a gas stream in a counterflow configuration such that the pipeline is exited by the heavier coarse material counter to the gas stream and by the fine material with the gas stream. The classifying device may also comprise a dynamic or a static screen, in which the material is classified into at least two grain sizes. The classifying device separates the material with a cut-off point of approximately 0.1 mm to 5 mm, preferably 0.5 mm to 1 mm, such that the coarse material has a grain size which is greater than 5 mm, preferably greater than 0.5 to 1 mm, in particular greater than 0.1 mm. The fine material has a grain size which is less than 5 mm, preferably less than 0.5 to 1 mm, in particular less than 0.1 mm.

In particular, the fine-material cooler, arranged downstream of the classifying device, and the coarse-material cooler are arranged parallel to one another, with the result that the cooling of the fine material and the cooling of the coarse material are realized separately from one another. The fine-material cooler and the coarse-material cooler are two separate cooling units, wherein the fine material and the coarse material can be cooled at different temperatures using different cooling methods.

Such a separate cooling of the fine material and of the coarse material offers the advantage that more efficient cooling of the coarse material and of the fine material is realized. The coarse material, without the fine material deposited between the coarse-grain material, has a higher porosity, so that, with an air stream flowing through the coarse material, more efficient cooling of the coarse material takes place. At the same time, the coarse material without the fine material presents a lower resistance for the air stream, which results in a smaller pressure loss and a lower consumption of electrical energy. The separate cooling of the fine material and the coarse material moreover has the advantage of a much shorter residence time of the fine material in the gas stream compared with the cooling of the coarse material.

According to a first embodiment, the cooling device has a cooler for cooling material, which cooler is arranged upstream of the classifying device. The entire material, both coarse material and fine material, are cooled in the cooler. For example, the cooler is a grate cooler, in particular a push-grate cooler, wherein the material is flowed through by a cooling-air stream while resting on a grate. Cooling of the material upstream of the classifying device has the advantage that the fine-material cooler and the coarse-material cooler for the subsequent cooling of the material may have smaller dimensions.

According to a further embodiment, the fine-material cooler comprises a fluidized-bed cooler and/or a cyclone cooler. For example, the bulk material is cooled in a fluidized-bed cooler having at least one stage in that it is flowed against by a fluidization gas and brought to a state which is beyond the fluidization point and short of pneumatic transport. The speed required for this purpose is dependent on the particle size distribution, form of material, material density or bed porosity and further properties of the material.

A fluidized-bed cooler preferably comprises a housing, a base which is able to be flowed through and which is flowed through by a gaseous fluidization and cooling medium, means for supplying and discharging a bulk material, and means for supplying and discharging one or more gas streams. The means for supplying and discharging solid and gas streams have, according to the integration into the installation, closure, control and regulating elements. It is expediently possible for indirect heat exchangers flowed through by a cooling medium to be integrated or arranged downstream in the fluidized-bed cooler. The cooling medium may be part of a device for heat recovery. Preliminary dedusting of the fluidization gas may be expedient in part, cyclones being integrated in or arranged downstream of the fluidized-bed stage for this purpose. Depending on further process-technology boundary conditions, for the purpose of dust separation, one or more so-called swirl pipes, whose purpose is to improve the separation of dust from the gas phase, may likewise be integrated in the fluidized-bed cooler.

If the dust has relatively high temperatures, cooling by way of a multi-stage fluidized-bed cooler of cascade form is in particular expedient since, similar to the cooling of a fine-grain material in an entrained flow, such as for example in a cyclone cooler, a very good exchange of heat is realized. The fine-material cooler may have single- or multi-stage cooling in a fluidized state or in an entrained flow, wherein a gaseous cooling medium is conducted in a cross-counterflow configuration in one or more stages.

A cyclone cooler comprises at least one cyclone, into which the fine material entrained in the gas stream is guided. The fine material is separated from the gas stream in the cyclone cooler, wherein use is made of one or more cyclones, which are arranged one behind the other. In particular, the gas stream of the classifying device is supplied to the fine-material cooler, wherein said gas stream, after exiting the fine-material cooler, is preferably supplied back to the classifying device.

According to a further embodiment, the coarse-material cooler comprises a fixed-bed cooler, which is able to be operated in particular with a cross- or counterflow configuration. A fixed-bed cooler which is operated in particular with a crossflow configuration is in particular a grate cooler, in particular a push-grate cooler, wherein the material is flowed through by a cooling-air stream while resting on a grate.

According to a further embodiment, the classifying device has at least one gas inlet for the admission of a gas stream into the classifying device. The gas inlet is arranged such that the gas stream flows through the material. Preferably, the gas stream flows transverse or counter to the flow direction of the material. In particular, the gas stream is formed such that the fine material, by contrast to the coarse material, is moved by the gas stream, this resulting in a separation of the fine material from the coarse material.

According to a further embodiment, the classifying device has at least one gas vent for removing the fine material in the gas stream from the classifying device. The fine material entrained by the gas stream is removed from the classifying device by the gas vent. This makes it possible for the fine material to be treated further separately from the coarse material. In particular, the gas vent has a fan for extracting the fine material. After the gas vent, the fine material is preferably separated from the gas stream and the gas stream is supplied in particular back to the gas inlet.

The classifying device has, between the gas inlet and the gas vent, guide elements for guiding the material and/or the gas stream. The guide elements are for example plates which are arranged at an angle to the flow direction of the gas stream with the fine material. For example, the guide elements are of prismatic form and have a substantially triangular cross section. The cooling device preferably has a comminuting device, in particular a breaker, which is arranged upstream of the classifying device, wherein the arrangement of the guide elements, in particular after the comminuting device, is such that the material exiting the breaker strikes the guide elements.

The guide elements are optionally arranged such that the speed of the gas stream is increased downstream of the guide elements in the gas stream direction. In particular, the speed is increased such that separation of the fine material from the coarse material is realized in the classifying device between the gas inlet and the gas vent. This makes it possible firstly for the volume flow to be reduced and secondly for the flow to be oriented relatively accurately by means of the guide elements such that said flow is oriented counter or transverse to the flow direction of the material.

According to a further embodiment, the classifying device has, between the gas inlet and the gas vent, means through which gaseous media is able to flow, in particular hole sheets, such as perforated plates or plates provided with gaps, and which, relative to the flow direction of the gas, have an angle of inclination. The means have in particular an angle of inclination to the horizontal, which is greater than the angle of repose of the material, that is to say greater than 33-35° in the case of cement clinker. In particular, provision is made of a plurality of means, each of which preferably extends between two adjacent guide elements.

The means, in particular hole plates, such as perforated plates, are preferably arranged after a comminuting device such that the material comminuted by the comminuting device falls onto the means able to be flowed through. In particular, these are arranged such that at least the coarse material cannot fall through the means. The material is deflected by the means at an angle to the horizontal such that the material is guided through a gap formed between the means and a guide element adjacent thereto. When sliding over the means, the material is flowed against by the gas stream, whereby a separation of the fine material from the coarse material is realized. Advantageously, the means, together with the guide elements, bring about deagglomeration of the material in the classifying device, whereby the classification is additionally simplified. Furthermore, the gas flow is accelerated locally by way of the means and the gaps formed between the means and the guide elements, with the result that the classification is able to be carried out with relatively low energy expenditure.

According to a further embodiment, the comminuting device arranged upstream of the classifying device, in particular the breaker, is arranged between the gas inlet and the gas vent. The separation of the fine material from the coarse material is therefore realized already in the breaker and provides a particularly space-saving compact solution.

According to a further embodiment, the installation has a comminuting device for comminuting the coarse material, which comminuting device is arranged downstream of the classifying device. The comminuting device comprises in particular a breaker or a grinding device and a screening device arranged downstream of the grinding device or integrated therein. The grinding device is preferably connected to the coarse-material cooler such that material is guided into the grinding device from the coarse-material cooler, and wherein the screening device is connected to the fine-material cooler such that material is guided into the screening device from the fine-material cooler.

The invention furthermore comprises a method for producing a binder, in particular cement, comprising at least the steps of: thermally treating material in a furnace, and cooling the material in a cooling device, wherein the cooling device comprises a classifying device, and the material in the classifying device is classified into at least two grain sizes, coarse material and fine material. Following the classification, the coarse material is cooled in a coarse-material cooler and the fine material is cooled in a fine-material cooler. The advantages described and explanations given with regard to the installation also apply, in a corresponding manner in terms of method, to the method for producing a binder.

The classification is realized in particular by way of a gas stream, such that the fine material is separated from the coarse material. The speed of the gas stream is preferably increased by means of guide elements. Prior to the classification, the material is at least partially comminuted in a comminuting device, such as for example a breaker. Following the coarse-material cooling, the coarse material is comminuted in a comminuting device, in particular a grinding device or a breaker, and/or, following the fine-material cooling, the fine material is supplied to a screening device arranged downstream of the comminuting device, wherein the comminuted coarse material and/or the fine material are/is separated into finished material and material which is coarse and the material which is coarse is comminuted together with the coarse material in the grinding device.

Preferred exemplary embodiments of the invention

The invention is discussed in more detail below on the basis of several exemplary embodiments with reference to the appended figures.

Figure 1	shows a schematic flow diagram of a method for producing cement according to an exemplary embodiment.
Figures 2 to 5	show schematic illustrations of a classifying device according to different exemplary embodiments.

Figure 1 shows a flow diagram of a method for producing cement. Firstly, the raw material 10 is comminuted in a comminuting device 12, for example a mill such as a roller mill, a vertical roller mill or a ball mill. Then the material is subjected to thermal treatment 14. The thermal treatment comprises heating the material in a preheater 16 and in a furnace 18 arranged downstream of the preheater, wherein the material is heated in the preheater by the furnace exhaust gas in a counterflow configuration. The preheater has a plurality of cyclone stages (not illustrated in Figure 1) and for example a calciner region in which the material is deacidified in the presence of a supply of heat. In the furnace 18, the material is further thermally treated at maximum temperatures between 1000°C and 1450°C, with the result that hydraulically active mineral phases are formed, and subsequently cooled in a cooling device 20.

The cooling device 20 comprises, in the flow direction of the material, a cooler 22, a breaker 24, a classifying device 26, and also a coarse-material cooler 28 and a fine-material cooler 30 arranged parallel thereto. After the furnace 18, the material, in particular the cement clinker, is conveyed into the cooler 22. The cooler 22 is for example a push-grate cooler, a drum cooler, a shaft cooler or a fluidized-bed cooler.

After the cooler 22, the material is broken in the breaker 24. The breaker is for example a roller breaker, hammer breaker or a ball breaker, wherein, after the comminution, the material has a maximum grain size of approximately 50 mm. The material comminuted in the breaker 24 is subsequently supplied to a classifying device 26, in which the material is classified into two grain sizes, fine material and coarse material. The cut-off point of the classifying device occurs in particular at 0.1 mm to 5 mm, preferably 0.5 mm to 1 mm, such that the coarse material has a grain size which is greater than 5 mm, preferably greater than 0.5 to 1 mm, in particular greater than 0.1 mm. The fine material has a grain size which is less than 5 mm, preferably less than 0.5 to 1 mm, in particular less than 0.1 mm.

The classifying device 26 is for example a gas stream screen in which the material is exposed to a gas stream such that in particular the dispersible fine material is separated from the in particular non-dispersible coarse material. For example, the material is exposed to a gas stream in a vertical pipeline in a counterflow configuration, wherein the pipeline is exited by the heavier coarse material counter to the gas stream and by the fine material with the gas stream. It is likewise conceivable for the classifying device 26 to be designed as a dynamic or static screen. Further configurations of the classifying device 26 are described with reference to Figures 2 to 5.

The coarse material exiting the classifying device 26 is supplied to the coarse-material cooler 28, which is arranged downstream of the classifying device 26. The coarse-material cooler 28 comprises for example a fluidized-bed cooler or a fixed-bed cooler, such as for example a push-grate cooler, through which cooling air flows. The fine material exiting the classifying device 26 is supplied to the fine-material cooler 30, which is arranged downstream of the classifying device. The fine-material cooler 30 is arranged parallel to the coarse-material cooler 28 and comprises for example a fluidized-bed cooler or one or more cyclone coolers, the latter being connected in series. A combination of a fluidized-bed cooler and one or more cyclone coolers is also possible. In the coarse-material cooler 28 and the fine-material cooler 30, the coarse material and the fine material respectively undergo further cooling.

The cooled coarse material is conveyed to a grinding device 38 by means of a coarse-material conveying device 32. The grinding device comprises for example a ball mill or a vertical roller mill, in which the cooled coarse material is comminuted. A screening device 40 is arranged downstream of the grinding device 38. The screening device 40 is for example a static or dynamic screen, or a combination of these. The cooled fine material is supplied to the screening device 40 by means of a fine-material conveying device, wherein a bringing-together of the coarse and fine materials and joint delivery to the mill is also conceivable. In the screening device 40, the material, in particular the fine material and the coarse material comminuted by means of the mill 38, is screened into finished material 42 and coarse screened material. For example, the screening device 40 is integrated into the mill 38, wherein the coarse screened material screened by the screening device 40 is delivered into the mill 38 for further comminution.

Figure 2 shows an exemplary embodiment of a classifying device 26 in a detail of an installation for producing cement, wherein identical reference signs have been used for the components corresponding to Figure 1. The installation has a cooling device 20 which comprises for example a fluidized-bed cooler or a push-grate cooler and on which material for cooling, illustrated by the shaded regions, rests. The material is conveyed in the cooling device 20 in the conveying direction, wherein the conveying direction runs from left to right in Figure 2. The cooling device 20 has a cooler 22 which cools the material, in particular the cement clinker which has exited the furnace 18 in Figure 1. The material resting in the cooler 22 for cooling comprises both coarse material and fine material and is flowed through by cooling air transverse to the conveying direction from the bottom upwards. The cooling device 20 comprises a plurality of fans 54 of different power, which guide cooling air to a plurality of gas inlets, with the result that the material is flowed through by the gas stream. In the conveying direction, the cooler 22 is adjoined by the classifying device 26, in which the material is flowed through in the cooling device 20 by a gas stream entering the classifying device 26 through the gas inlet 64, said gas stream having a higher flow speed than the gas stream which flows through the material in the cooler 22. The increased flow speed of the gas stream ensures that the fine material is captured by the gas stream and is conveyed with the latter from the cooling device. The installation furthermore has a gas vent 56, 58, wherein Figure 2 shows by way of example two gas vents 56, 58. The gas vent 56, 58 is arranged above the classifying device 26, so that the classifying device 26 is arranged between a gas inlet 64 and the gas vent 56, 58. The gas vent 56, 58 comprises for example a fan 52 by means of which the fine material is extracted by the cooling device 60 through the gas vent 56, 58.

In the conveying direction of the material to be cooled, the classifying device 26 is adjoined by a coarse-material cooler 28. In the coarse-material cooler 28, the coarse material 48 is cooled to a temperature of less than 100°C and subsequently exits the cooling device 20.

The fine material is transported through the gas vent 56, 58 to a fine-material cooler 30, in which the fine material is cooled to a temperature of less than 100°C. The fine-material cooler 30 comprises at least one cyclone cooler or fluidized-bed cooler, in which the fine material 46 is separated from the gas stream. After the fine-material cooler, the gas stream is guided via a line 50 to the gas inlet 64 of the classifying region 26.

Classification of the material prior to complete cooling offers the advantage that the separate cooling of the fine material and the coarse material entails a saving of the electrical energy expenditure required for cooling. The cooling of the fine material necessitates a much shorter residence time compared with the cooling of the coarse material. Furthermore, cooling of the coarse material by a gas flow is considerably facilitated if the fine material placed between the coarse grains has been separated from the coarse material, because a heat transfer of the heat of the coarse material to the gas stream is considerably simplified.

Figure 3 shows an exemplary embodiment of a classifying device 26 in a detail of an installation for producing cement, wherein identical reference signs have been used for the components corresponding to Figures 1 and 2. The installation has a breaker 24 which is arranged after the cooler 22 for cooling the unclassified material, such that, after the cooling in the cooler 22, the material is delivered into the breaker 24. The breaker 24 is, by way of example, a roller breaker having three breaker rollers. The classifying device 26 is arranged below the breaker 24 such that the material comminuted by the breaker 24 passes into the classifying device 26 under the action of gravitational force. The classifying device 26 furthermore has a gas inlet 64 and a gas vent 56, 58 arranged above the latter, wherein the gas vent 56, 58 is arranged below the breaker 24. A plurality of guide elements 66 is arranged between the gas inlet 64 and the gas vent 56, 58, said guide elements having by way of example a triangular cross section in Figure 3. The guide elements 66 are arranged such that the flow speed of the gas flow exiting the gas inlet 64 is increased by the guide elements 66. The guide elements 66 are arranged substantially at a height level relative to one another, wherein, between two guide elements 66, gas passages are formed in each case. The guide elements 66 are arranged with respect to one another such that the gas passages are widened in the flow direction of the gas flow from the gas inlet 64 to the gas vent 56, 58, with the result that the gas flow is accelerated locally.

The coarse-material cooler is arranged below the classifying device 26 such that the coarse material classified in the classifying device 26 falls to the coarse-material cooler 28 under the action of gravitational force and is cooled by said cooler. The fine material is, by means of the gas flow of the classifying device 26, transported to the gas vent 56, 58 and to the fine-material cooler 30, and is cooled by the latter. The fine-material cooler 30 comprises a cyclone cooler, with the result that the gas stream is separated from the fine material and the gas stream is supplied to the gas inlet 64 of the classifying device 64 via the line 50. For example, a dedusting device (not illustrated in Figures 2 to 5) for dedusting the gas flow is arranged in the line 50.

Figure 4 shows an exemplary embodiment of a classifying device 26 in a detail of an installation for producing cement, wherein the installation corresponds substantially to the installation in Figure 3. The classifying device 26 in Figure 4 has, by contrast to Figure 3, a plurality of guide elements 68 which are arranged, offset from one another, at at least two different height levels. Illustrated by way of example in Figure 4 are three guide elements 68, which each have a substantially triangular cross section. Furthermore, a plurality of hole plates 70 is arranged between the gas inlet 64 and the gas vent 56, 58. Illustrated by way of example are six hole plates 70, which each extend between at least two adjacent guide elements 68 and form an angle of approximately 45° to the horizontal.

The material falling from the breaker into the classifying device 26 is deflected by the hole plates at an angle to the horizontal and to the falling direction such that the material is guided through a gap formed between the hole plates 68 and a guide element 68 adjacent thereto. The material is flowed against from below through the hole plates 70 when sliding over the hole plate, whereby a separation of the fine material from the coarse material is realized. The plurality of hole plates 70 and guide elements 68 furthermore brings about deagglomeration of the material in the classifying device 26, whereby the classification is additionally simplified. Furthermore, the gas flow is accelerated locally by way of the hole sheets 70 and the gap formed between the hole sheets and the guide elements 68, with the result that the classification is able to be carried out with reduced energy expenditure.

Figure 5 shows an exemplary embodiment of a classifying device 26 in a detail of an installation for producing cement, wherein the installation corresponds substantially to the installation in Figures 3 and 4, with the difference that no guide elements and hole sheets are provided. Furthermore, the gas vent 56, 58 is arranged above the breaker 24 such that the gas flow flows from the gas inlet 64 through the breaker gap formed between the breaking rollers and passes into the gas vent 56, 58. The gas flow is accelerated locally in particular within the screen and the breaker gaps, wherein the separation of the fine material from the coarse material takes place at least partially in the breaker gap.

List of reference signs

10	Raw material
12	Comminuting device
14	Thermal treatment
16	Preheater
18	Furnace
20	Cooling device
22	Cooler
24	Breaker
26	Classifying device
28	Coarse-material cooler
30	Fine-material cooler
32	Coarse-material conveying device
34	Fine-material conveying device
36	Comminuting device
38	Grinding device
40	Screen
42	Finished material
46	Fine material
48	Coarse material
50	Line/means for recirculating gas
52	Fan

54	Fan
56	Gas vent
58	Gas vent
60	Cooling device
66	Guide element
68	Guide element
70	Hole plate

Patentkrav

1. Anlæg til fremstilling af et bindemiddel, særligt cement, med en ovn (18) til termisk behandling af et materiale og en køleanordning (20) til køling af materialet, som er efterkoblet ovnen (18) i materialets strømningsretning, **kendetegnet ved, at**
køleanordningen (20) har en sorteringsanordning (26) til sortering af materialet i mindst to partikelstørrelser, grove partikler og fine partikler, hvor en grovpartikelkøler (28) til køling af grove partikler og en finpartikelkøler (30) til køling af fine partikler er efterkoblet sorteringsanordningen (26).

2. Anlæg ifølge krav 1, hvor køleanordningen (20) har en køler (22) til køling af materialet, som er forkoblet sorteringsanordningen (24).

3. Anlæg ifølge et af de foregående krav, hvor finpartikelkøleren (30) omfatter en fluid bed-køler og/eller en cyklonkøler.

4. Anlæg ifølge et af de foregående krav, hvor grovpartikelkøleren (28) omfatter en fixed bed-køler.

5. Anlæg ifølge et af de foregående krav, hvor sorteringsanordningen (26) har mindst et gasindtag (64) til indsugning af en gasstrøm i sorteringsanordningen (26).

6. Anlæg ifølge et af de foregående krav, hvor sorteringsanordningen (26) har mindst en gasudsugning (56, 58) til udskilning af de fine partikler i gasstrømmen fra sorteringsanordningen (26).

7. Anlæg ifølge krav 5 og 6, hvor sorteringsanordningen (26) mellem gasindtaget (64) og gasudsugningen (56, 58) har føringselementer (66, 68) til at føre materialet og/eller gasstrømmen.

8. Anlæg ifølge et af kravene 5 til 7, hvor sorteringsanordningen (26) mellem gasindtaget og gasudsugningen har midler, som gasformede medier kan gennemstrømme, og med en hældningsvinkel i forhold til gassens strømningsretning.

9. Anlæg ifølge et af de foregående krav, hvor anlægget har et knuseværk (24), som er forkoblet sorteringsanordningen (26).

10. Anlæg ifølge krav 9, hvor knuseværket (24) er anbragt mellem gasindtaget (64) og gasudsugningen (56, 58).

11. Anlæg ifølge et af de foregående krav, hvor anlægget har en findelingsanordning (36), som er efterkoblet sorteringsanordningen (26), til findeling af de grove partikler.

12. Anlæg ifølge krav 11, hvor findelingsanordningen (36) har en formalingsanordning (38) og en sianordning (40), som er efterkoblet formalingsanordningen (38) eller integreret i denne, og formalingsanordningen (38) er forbundet med grovpartikelkøleren (28) på en sådan måde, at materiale fra grovpartikelkøleren (28) føres ind i formalingsanordningen (38), og hvor sianordningen (40) er forbundet med finpartikelkøleren (30) på en sådan måde, at materiale fra finpartikelkøleren (30) føres ind i sianordningen (40).

13. Fremgangsmåde til fremstilling af et bindemiddel, særligt cement, med i det mindste følgende trin:

- termisk behandling af materiale i en ovn (18) og

- køling af materialet i en køleanordning (20),

kendetegnet ved, at
køleanordningen omfatter en sorteringsanordning, og materialet i sorteringsanordningen (26) sorteres i mindst to partikelstørrelser, grove partikler og fine partikler,
hvor de grove partikler køles i en grovpartikelkøler (28) og de fine partikler i en finpartikelkøler (28) efter sorteringen.

14. Fremgangsmåde ifølge krav 13, hvor sortering sker via en gasstrøm, sådan at de fine partikler adskilles fra de grove partikler.

15. Fremgangsmåde ifølge krav 14, hvor gasstrømmens hastighed øges ved hjælp af føringselementer (66, 68).

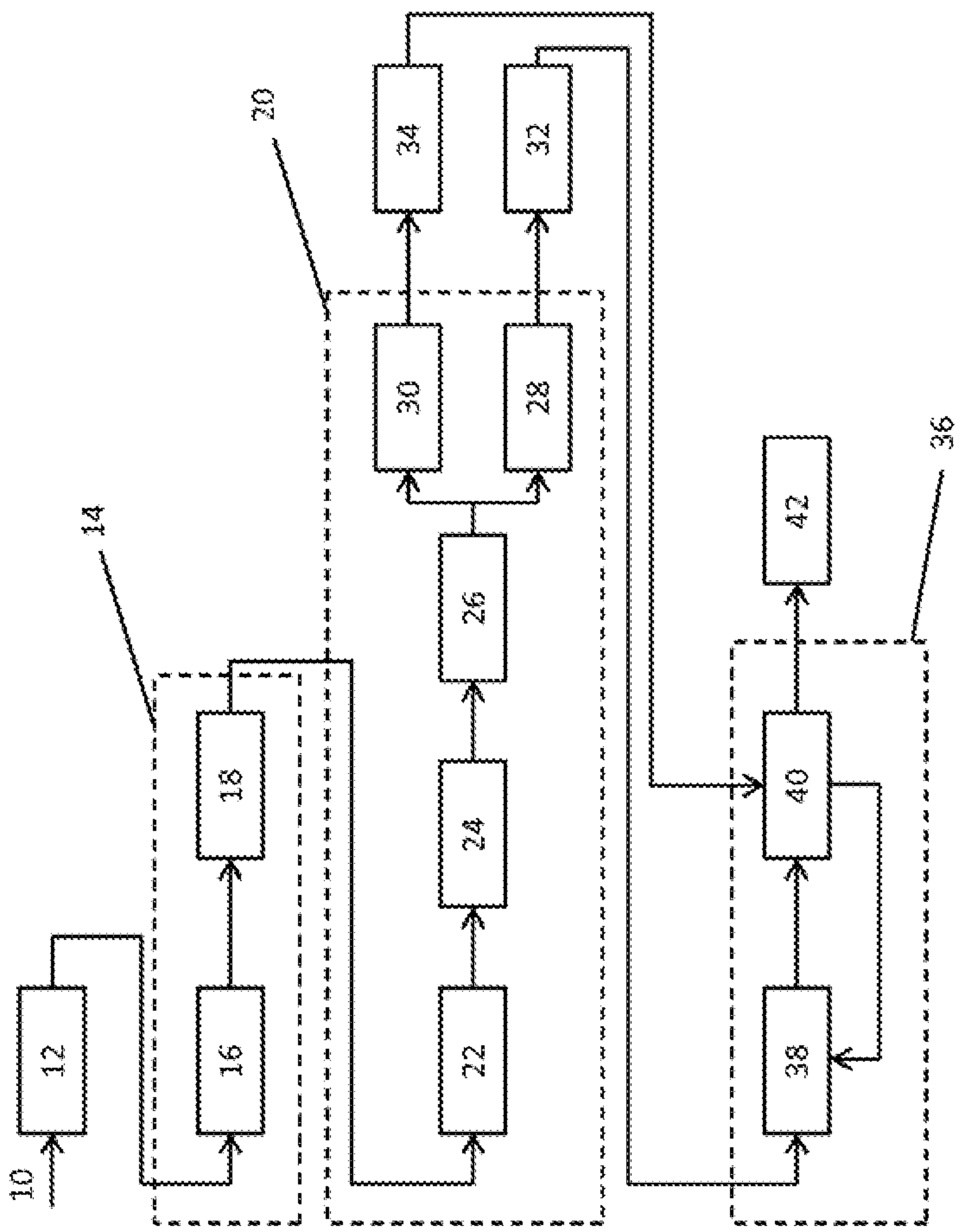

Fig. 1

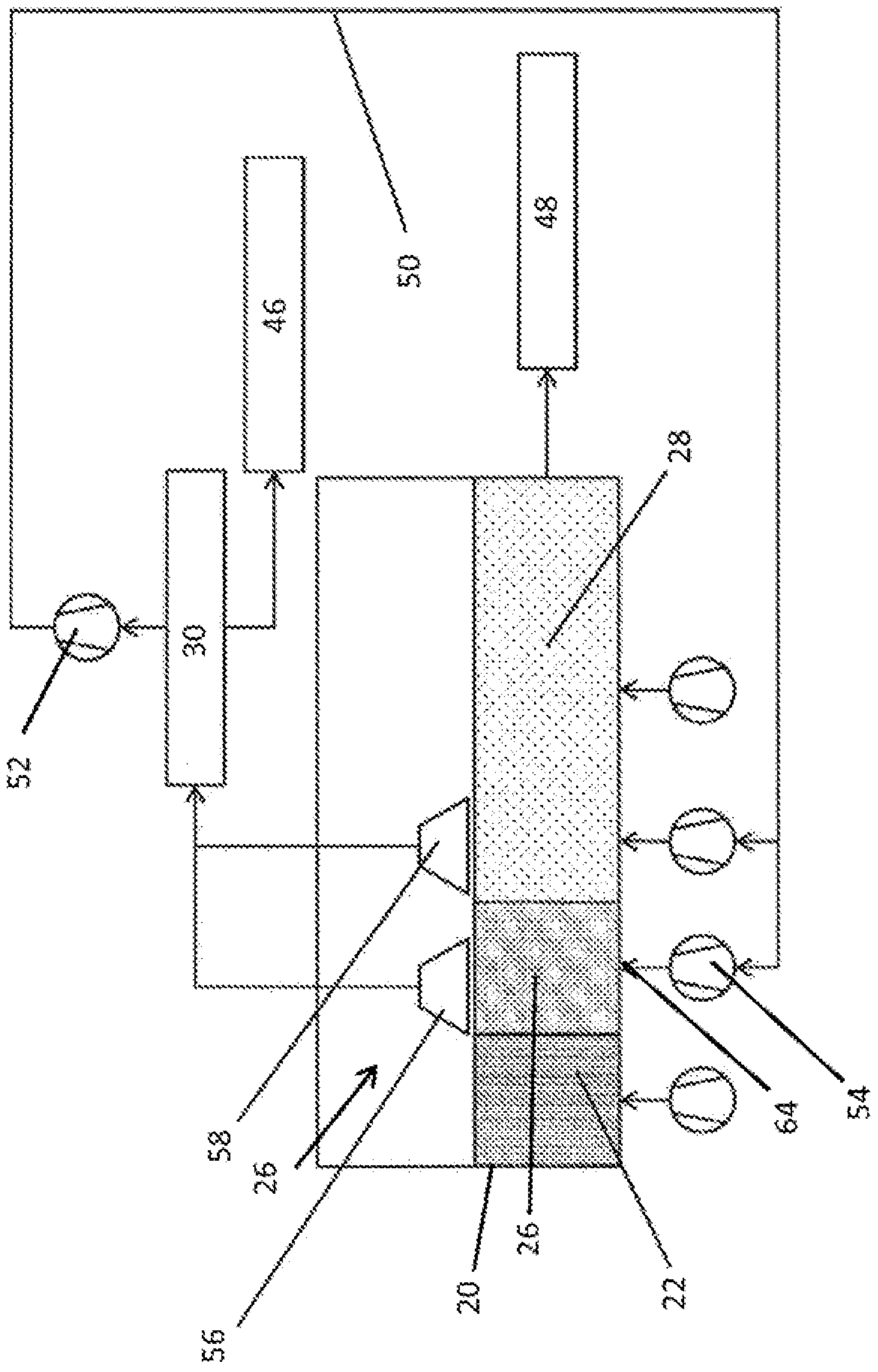

Fig. 2

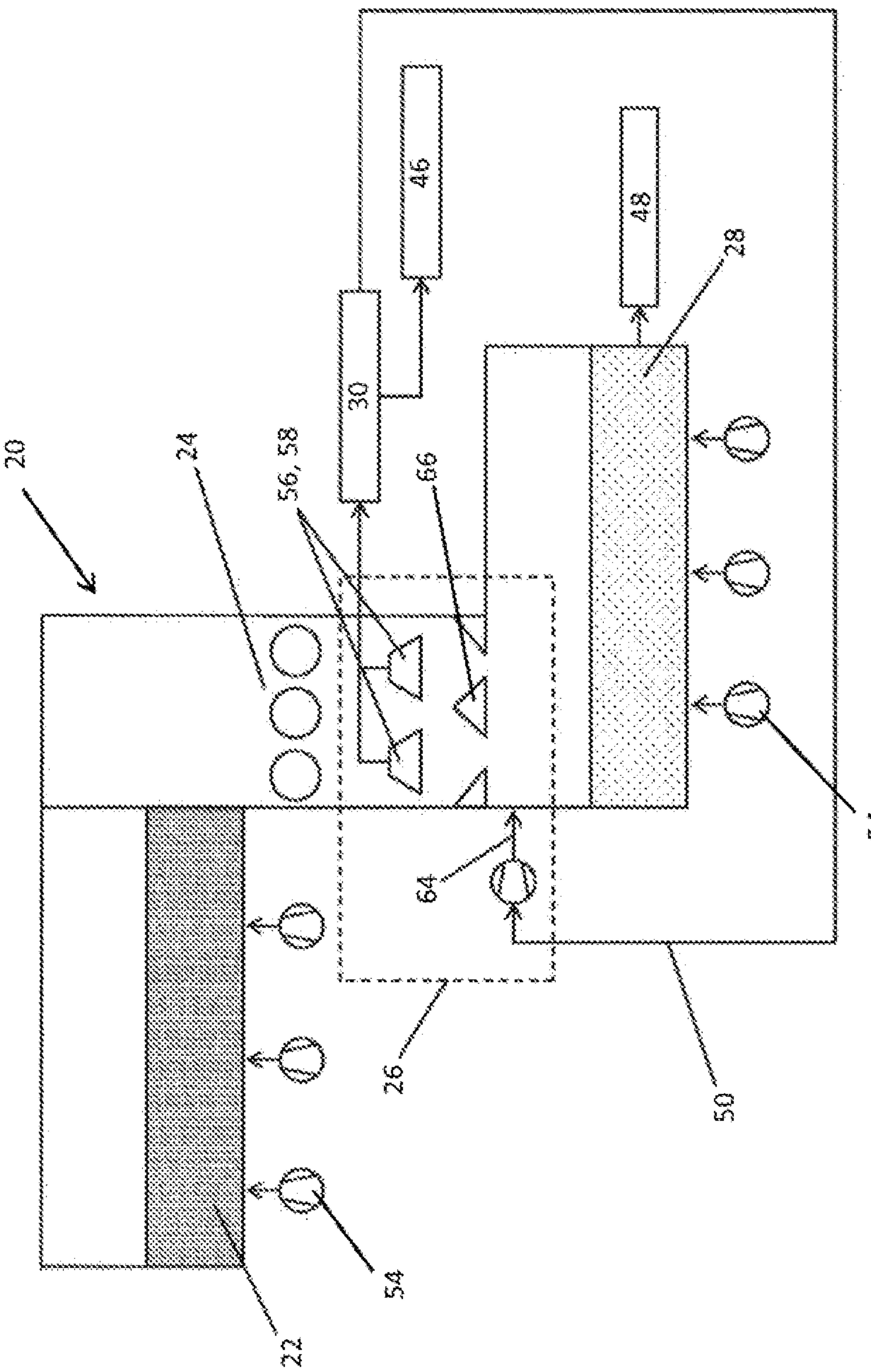

Fig. 3

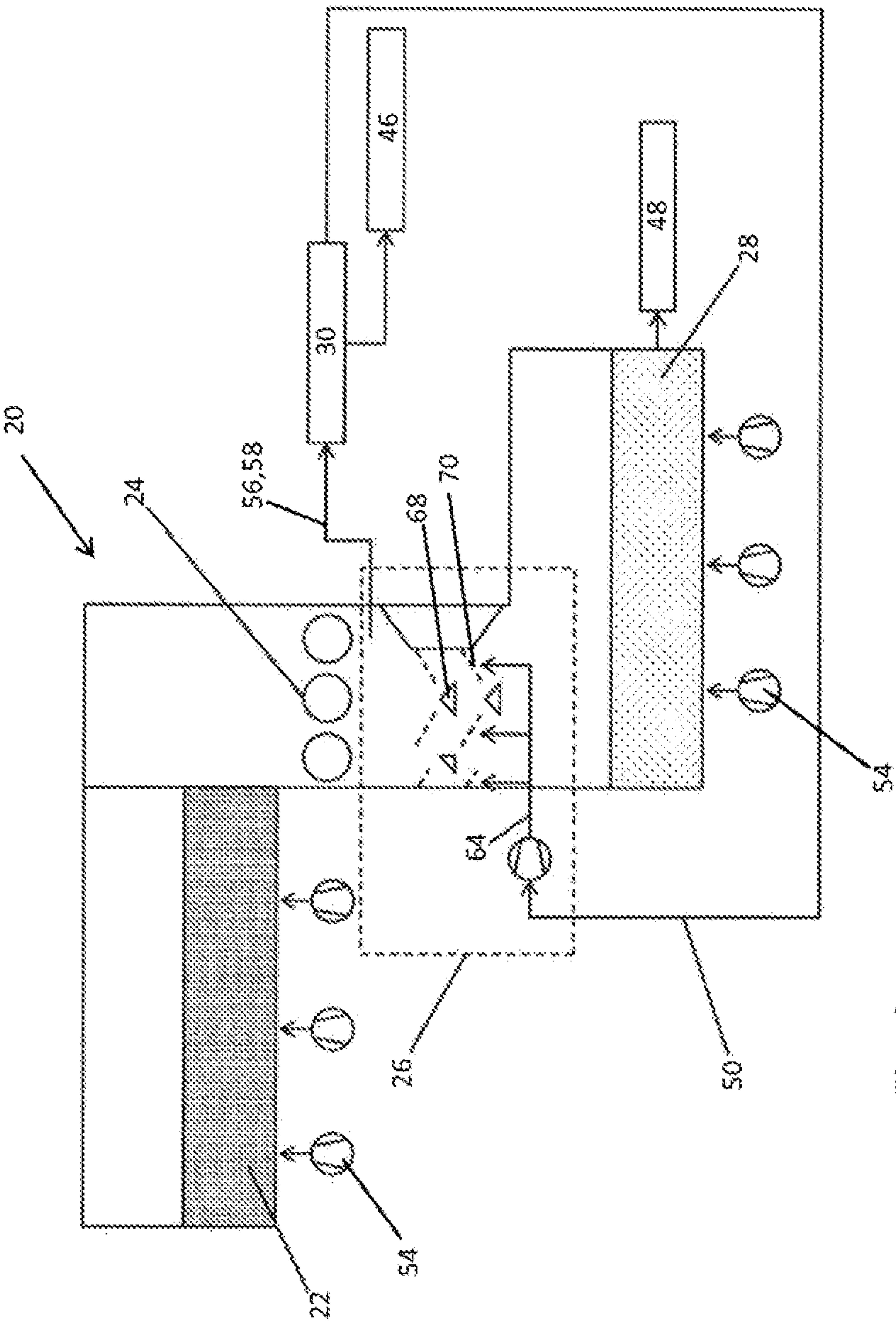

Fig. 4

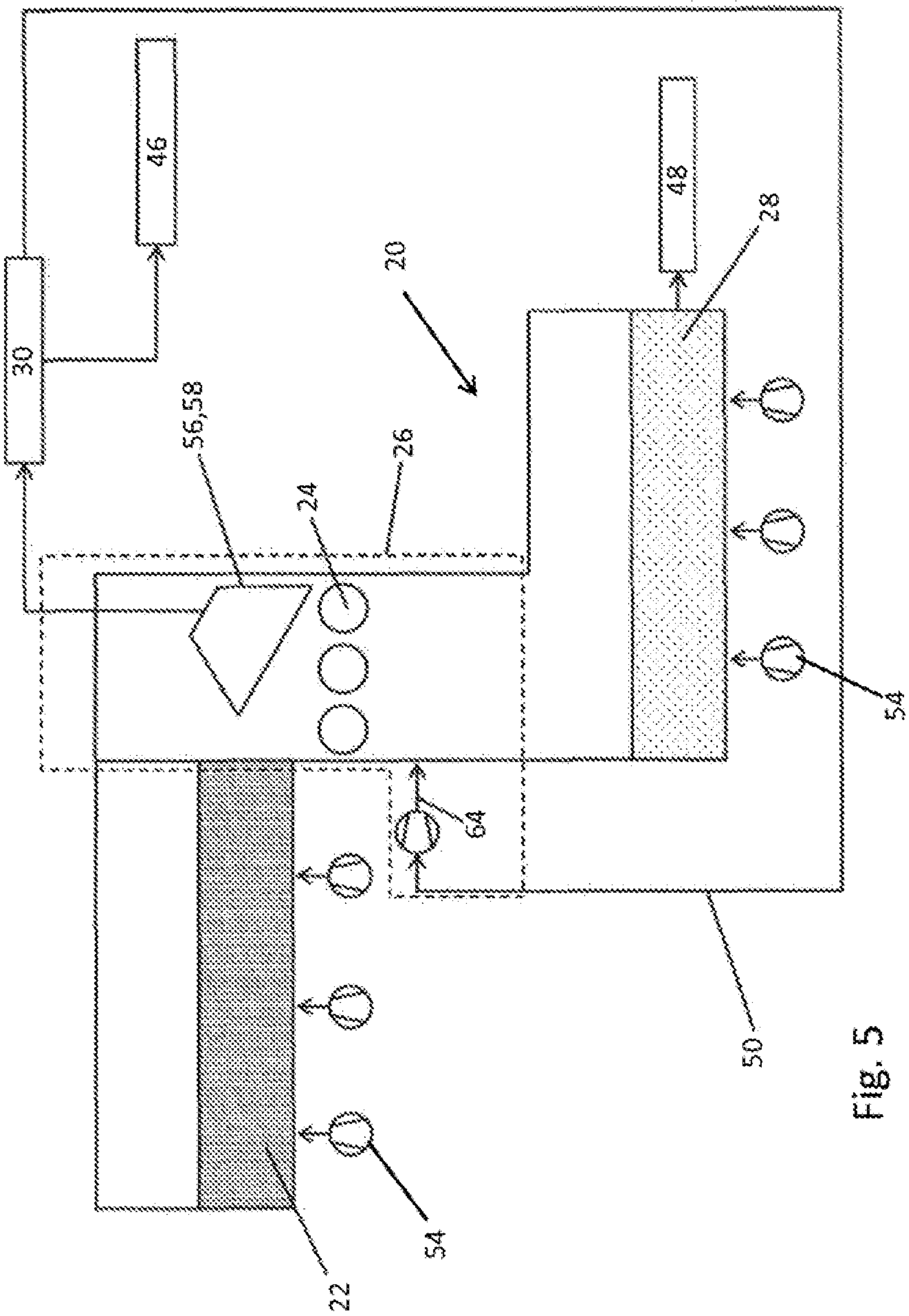

Fig. 5