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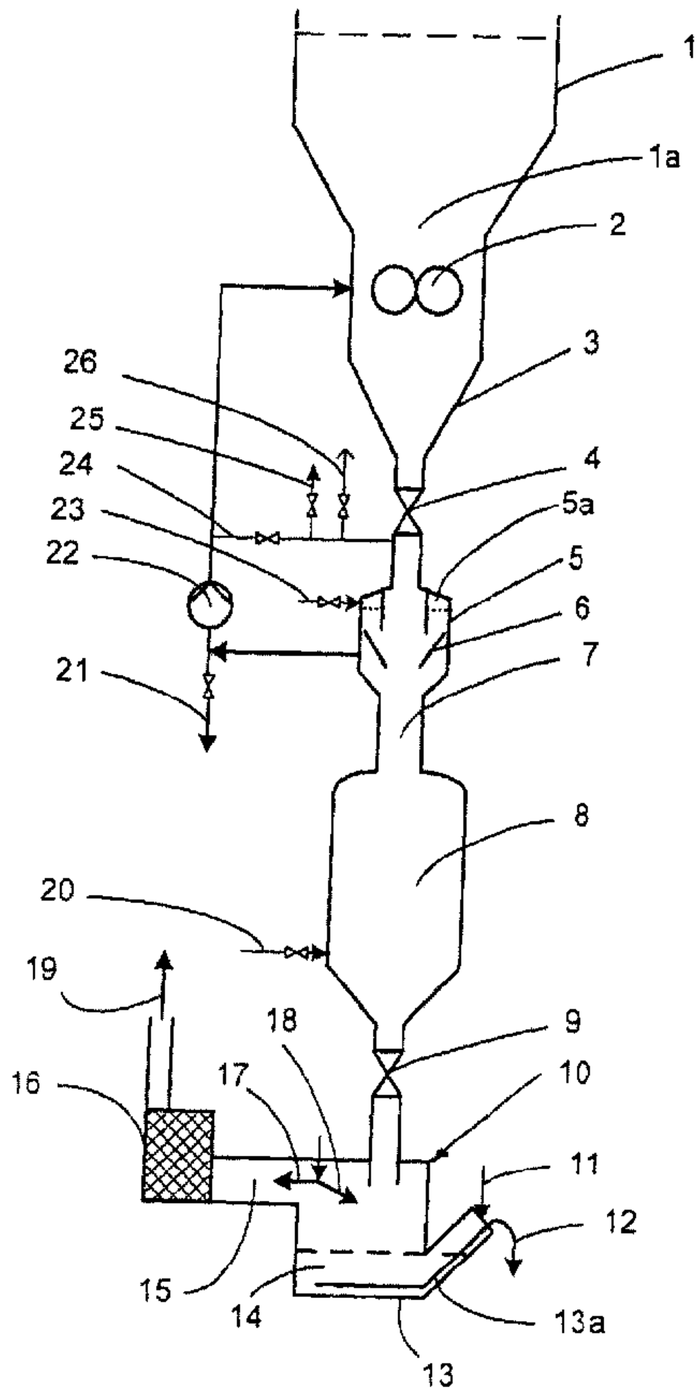
(54) **Titre : METHODE ET INSTALLATION SUPPRIMANT L'ACCUMULATION DE LAITIER, EN PARTICULIER PENDANT LA RECUPERATION DES GAZ DE SYNTHESE D'UN RECIPIENT DE BAIN LAITIER**

(54) **Title: METHOD AND PLANT FOR REMOVING SLAG ACCUMULATING IN PARTICULAR DURING SYNTHESIS GAS RECOVERY FROM A SLAG BATH CONTAINER**



(57) **Abrégé/Abstract:**
A method for removing slag accumulating in particular during synthesis gas recovery from slag present in a pressurized container bath in a collecting tank for the slag, in the direction of gravity under the slag bath, wherein optionally a mechanism for breaking the

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(57) **Abrégé(suite)/Abstract(continued):**
slag is provided under the slag bath and a sluice valve is provided between the containers, is to clearly improve the corresponding processes and plants of the relevant kinds by improving withdrawal of slag and by preventing environmentally harmful exhaust vapors or waste gases. This is achieved in that a space that is in contact with the liquid in the containers and is filled with a gas bubble is provided, in particular an annular space or a separate container, in which the pressure of the gas bubble is controlled by gas supply such that at least part of the water present in the slag sluice/collection space flows through the slag bath valve against the direction of gravity in the direction of the slag bath when the slag bath valve is opened.

Abstract

A method for removing slag accumulating in particular during synthesis gas recovery from slag present in a pressurized container bath in a collecting tank for the slag, in the direction of gravity under the slag bath, wherein optionally a mechanism for breaking the slag is provided under the slag bath and a sluice valve is provided between the containers, is to clearly improve the corresponding processes and plants of the relevant kinds by improving withdrawal of slag and by preventing environmentally harmful exhaust vapors or waste gases. This is achieved in that a space that is in contact with the liquid in the containers and is filled with a gas bubble is provided, in particular an annular space or a separate container, in which the pressure of the gas bubble is controlled by gas supply such that at least part of the water present in the slag sluice/collection space flows through the slag bath valve against the direction of gravity in the direction of the slag bath when the slag bath valve is opened.

"Method And Plant For Removing Slag Accumulating In Particular During Synthesis Gas Recovery From A Slag Bath Container"

The invention relates to a method for removing slag accumulating in particular during synthesis gas recovery from a slag bath present in a pressure container in a collecting tank for the slag, in the direction of gravity under the slag bath, wherein optionally a mechanism for breaking the slag is provided under the slag bath and a sluice valve is provided between the containers, as well as a plant for carrying out said method.

Slag accumulates, in particular, during the production of synthesis gas during the partial combustion of carbonaceous fuels, said slag being quenched and cooled in a water reservoir. It is thereby also known to comminute large slag parts in said quenching bath by means of corresponding devices. In particular, DE 26 06 039 A1, DE 28 29 629 C2, DE 31 44 266 A1, DE 600 31 875 T2, EP 0 290 087 A2, EP 0 113 469 B1 or US 4,852,997 are noted as prior art in this respect.

To improve the withdrawal of the slag or the flow through the corresponding sluice areas, it is known to pump water that is low in solids from a collecting tank which is downstream in the system and usually arranged in the direction of gravity under the other containers into the container above it, in order to in this way improve the flow through the narrow passages or a valve when it is being opened. This flow formation between the container situated downstream and the container situated upstream can take place e.g. by pumping, as shown in DE 600 31 875 T2 or described in DE 31 44 266 A1. However, it can also be produced by a low-pressure gas bubble in the top region of the downstream container, as described

in EP 0 290 087 A2, which, with the gas bubble in the vacuum, forces the water/slag flow through the valve region while increasing the flow rate.

In addition to the problem of the slag settling in constrictions or in the valve region, there is another problem in that environmentally harmful vapors can leave the system.

Starting at this point, the object of the invention is to clearly improve the corresponding processes and plants of the relevant kinds by improving the withdrawal of slag and by preventing environmentally harmful exhaust vapors or waste gases.

This object is solved according to the invention with a method of the aforementioned type in that a space that is in contact with the liquid in the containers and is filled with a gas bubble is provided, in particular an annular space or a separate container, in which the pressure of the gas bubble is controlled by gas supply such that at least part of the water present in the slag sluice/collection space flows through the slag bath valve against the direction of gravity in direction of the slag bath when the upper slag bath valve is opened.

It was shown that possibly occurring bridges comprised of compressed, keyed slags or large particles can come loose to ensure an optimum flow by means of an intensive gas or water countercurrent that is short, e.g. lasting a few seconds, through the upper sluice valve.

Further improvements of the flow are produced e.g. by built-ins

allocated to the slag sluice collecting tank with which the slag/water flow is altered.

Depending on the process conditions, it is possible that temperatures are already in the saturation range, e.g. at 200°C, in the first container that forms the granulated material of the slag, said temperatures leading at the end of the system at low cooling to a considerable vapor formation which, as already noted above, should be avoided.

Here, an embodiment of the invention provides that a narrowed flow channel is provided following the constriction in which the slag/water flow is cooled and/or that a countercurrent against the slag flow is produced in the slag collection/sluice tank by supply of colder water. A tangential or secantial supply of the water is advantageous in order to generate torque and improve the cooling.

An especially advantageous procedure, in particular at the end of the slag treatment process, is that the temperature is set by supply of fresh water to empty the slag collection/sluice tank and that an outlet valve is opened after the desired temperature has been reached and the water/slag mixture is supplied to an encased settling pan or the like, wherein the encased settling pan is furnished with mechanisms for discharging the settled slag and with mechanisms for drawing off vapors.

The aforementioned object is solved with a plant which consists of a slag bath container with optionally a mechanism for breaking the accumulating slag, to which a sluice is allocated at the bottom in direction of gravity, said sluice being connected with a slag

collection/sluice container and which is distinguished in that a receptacle for a gas bubble is provided under the inlet valve of the sluice, the pressure of which is controllable via a filling valve and which interacts with the liquid in the collecting tank.

Some embodiments of the invention provide for a method for removing slag from a slag bath present in a pressure container into a collecting tank for the slag, in the direction of gravity under the slag bath, the method comprising: providing a space, which is in contact with the liquid in the container and filled with a gas bubble; and controlling the pressure of the gas bubble by the supply of gas such that at least part of the water present in the slag sluice/collection tank flows through a slag bath valve against the direction of gravity in the direction of the slag bath when the slag bath valve is opened, wherein built-ins are allocated to the slag sluice/collection tank with which the slag/water flow is altered.

Some embodiments of the invention provide for a plant for carrying out a method for removing slag from a slag bath present in a pressurized container into a collection tank for the slag, in the direction of gravity under the slag bath, wherein a receptacle for a gas bubble is provided under the sluice valve, the pressure of which can be controlled by a filling valve and which interacts with the liquid in the collection tank, wherein flow-accelerated built-ins are provided in the slag collection/sluice tank.

The invention is described in greater detail in the following by way of example with reference to the drawings, in which

Figs. 1 and 2 each show a simplified plant diagram of two embodiments of the invention.

With reference to Fig. 1 which only shows the area of a synthesis gas recovery plant that deals with the disposal of the slag and which schematically illustrates all elements of the plant, this container for the slag bath provided is also drawn in, the slag bath itself with quenching zone and collection space for the slag 1a.

Slag breakers, which may be found in a tapered space of the slag bath container 1, are only symbolically reproduced with 2. Under these slag breakers, a constriction 3 leads to a sluice valve designated with 4 which leads into a tubular element that, in turn, conveys the slag/water flow into a separating tank designated with 5 when the valve 4 is opened, said separating tank being furnished with a constriction 6 in order to facilitate the slag separation.

As shown, an annular space filled with a gas bubble 5a is produced

in the top region in said separating tank 5, the volume of which can be maximum 20% of the sluice volume. The gas supply line in this annular space is designated with 23.

As can be seen, this gas bubble 5a is in active contact with the liquid play in the separating tank 5, wherein the gas pressure can be set via the line 23 such that such an excess pressure prevails that, once the sluice 4 is opened, it results in an abrupt short-term backflow of the liquid mixture from the separating tank 5 through the valve 4 into the funnel area 3 of the slag bath 1 in order to optionally loosen keyed slag bridges there.

In the example of Fig. 1, the separating tank 5 is followed by a narrowed flow channel 7 which is then led to a slag/sluice collection space 8, on the end of which there is an outlet valve 9 for discharging the slag accumulating there. The flow channel 7 and the container 8 may be furnished with outer cooling coils in order to clearly cool the slag/water flow flowing through it.

For further cooling, if necessary, a feed of cold water can be provided to this sluice container 8, which is designated with 20 in Fig. 1, wherein a cooling, circulating flow can be set. A corresponding flow line is designated with 21 in Fig. 1 which can be connected with the line 20, optionally via a slag/water treatment (not shown in greater detail here) to form an annular flow.

The discharge valve 9 leads into an encasement, designated with 10, of a slag receptacle 13 which may be furnished with a slag

discharge mechanism, e.g. a scraper conveyor 13a, wherein the slag discharge (designated with 12) can, in addition, be acted upon with liquid via a spray device 11 to prevent the discharge of pollution into the environment.

In order to be able to discharge the cooled vapors from the encasement 10, a vapor outlet 15 is provided which opens into a mist eliminator 16, wherein 17 indicates a conveying device, e.g. a water jet pump, that can also be simultaneously operated with a further spray device 18 in order to spray the slag falling in which then settles in the pan, which is designated with 14. The exhaust outlet from the mist eliminator 16 is designated with 19.

The water jet pump 17 and the spray device 18 require a high water flow which is similar in magnitude to the slag/water flow from the container 8 during emptying through the valve 9, e.g. 12 m^3 in two minutes, i.e. 0.1 m^3/s. To avoid a large-sized water supply (*inter alia* water line, pump), water from a pressure storage vessel 27 (indicated in Fig. 2) is used for the water jet pump 17 and the spray device 18 and optionally also for the rinsing 20 during the filling process of the container 8 with slag.

The excess pressure is generated with a pressure pad. Preferably, a higher pressure than that of the water bath is used, so that the water can first be used for the rinsing 20 under high pressure and then for the water jet pump 17 and the spray device 18 when the container is being emptied. A similarly high water flow is also required for filling the empty container 8 in a pressure-free state. This water requirement can be covered by a low-cost,

pressure-free supply tank that can be housed above the container 8 (not shown), so that the water can only be transferred with aid of the hydrostatic pressure. Both containers are supplied with water with a relatively small water flow during the entire cycle, e.g. one hour. The supply tanks also enable the use of continuously accumulating or treated and cooled process water.

In addition, Fig. 1 also shows the device for forming an annular flow promoting the slag flow with extraction of the liquid from the separating tank 5 via a circulating pump 22 into the slag bath container 1 below the liquid level. 24 indicates a line for returning displaced water, 25 a possible diversion of the displaced water depending on the supply of fresh water, e.g. via the line 20, whereby 26 indicates an exhaust line.

A slightly modified embodiment of the plant is shown in Fig. 2, wherein the effectively same elements have the same reference numbers as in Fig. 1, however, in this case, the separation tank 5 is configured with built-ins 6 and the slag/sluice collection space 8 as a structural unit and designated with 5, 8 in Fig. 2. This is especially suitable when the slag bath can be operated at relatively low temperatures, so that an intensive washing away, possibly via a cooling stretch 7, is unnecessary.

Fig. 2 also shows some additional plant parts, thus, for example, a fresh water supply tank 27 which is furnished with a gas buffer 28, as well as a slag/water treatment system, generally designated with 29, which can be supplied from the individual system parts slag/water, and optionally conveyed again as filtrate to the

slag bath container 1 via a line 30.

Of course, the embodiments of the invention described may be modified in numerous ways without forsaking the basic idea. In particular, therefore, the invention is not restricted to a specific form of the individual components, also not to the type of slag breaker 2, the special type of cooling of the cooling stretch 7 and the treatment of the slag water, to name only a few examples. In the example described in the figures, only one sluice is provided, e.g. for comparatively low slag output (e.g. 10 t/h). With higher slag output (e.g. 40 t/h), two parallel sluices can, for example, be provided with all components, i.e. from valve 4 to valve 9, in duplicate.

CLAIMS:

1. A method for removing slag from a slag bath present in a pressure container into a collecting tank for the slag, in the direction of gravity under the slag bath, the method comprising:

providing a space, which is in contact with the liquid in the container and filled with a gas bubble; and

controlling the pressure of the gas bubble by the supply of gas such that at least part of the water present in the slag sluice/collection tank flows through a slag bath valve against the direction of gravity in the direction of the slag bath when the slag bath valve is opened, wherein built-ins are allocated to the slag sluice/collection tank with which the slag/water flow is altered.

2. The method according to claim 1, wherein the method is for removing slag accumulating during synthesis gas recovery.

3. The method according to claim 1 or 2, further comprising: providing a mechanism for breaking the slag under the slag bath and providing a sluice valve between the containers.

4. The method according to any one of claims 1 to 3, wherein the space is an annular space or a separate container.

5. The method according to any one of claims 1 to 4, further comprising: providing a constricted flow channel following the built-ins; and cooling the slag/water flow in the constricted flow channel.

6. The method according to any one of claims 1 to 5, further comprising: generating a countercurrent against the slag flow in the slag collection/sluice container by feeding colder water.

7. The method according to any one of claims 1 to 6, further comprising: setting the temperature during the filling process and prior to emptying the slag collection/sluice container by supply of fresh water and, once the desired temperature has been reached, opening an outlet valve and conveying the water/slag mixture to an encased settling pan, wherein the encased settling pan is equipped with devices for discharging the settled slag and with devices for drawing off vapors.

8. A plant for carrying out a method for removing slag from a slag bath present in a pressurized container into a collection tank for the slag, in the direction of gravity under the slag bath, wherein a receptacle for a gas bubble is provided under the sluice valve, the pressure of which can be controlled by a filling valve and which interacts with the liquid in the collection tank, wherein flow-accelerated built-ins are provided in the slag collection/sluice tank.

9. The plant according to claim 8, wherein the plant is for removing slag accumulating during synthesis gas recovery.

10. The plant according to claim 8 or 9, wherein a mechanism for breaking the slag is provided under the slag bath and a sluice valve is provided between the containers.

11. The plant according to any one of claims 8 to 10, wherein the flow-accelerated built-ins are followed by a

constricted flow channel in which the slag is cooled by water in the countercurrent.

12. The plant according to claim 11, wherein the constricted flow channel and/or the subsequent container is furnished with cooling devices for cooling the water/slag flow.

13. The plant according to claim 12, wherein the cooling devices are cooling coils.

14. The plant according to any one of claims 8 to 13, further comprising a slag receptacle which is provided with a gas-tight encasement.

15. The plant according to claim 14, wherein the encased slag receptacle is furnished with discharge means for the cooled slag and/or with a vapor-exhaust device with mist eliminator.

16. The plant according to any one of claims 8 to 15, further comprising at least one fresh water tank with gas buffer for filling the container with water after it has been emptied and/or for washing with hydraulic water and/or for spraying the slag when emptying the container with additional water.

17. The plant according to any one of claims 8 to 16, wherein the sluice tank is provided with a cold or fresh water feed which is aligned tangentially such that a rotating flow is formed in the container when the fresh water is supplied.

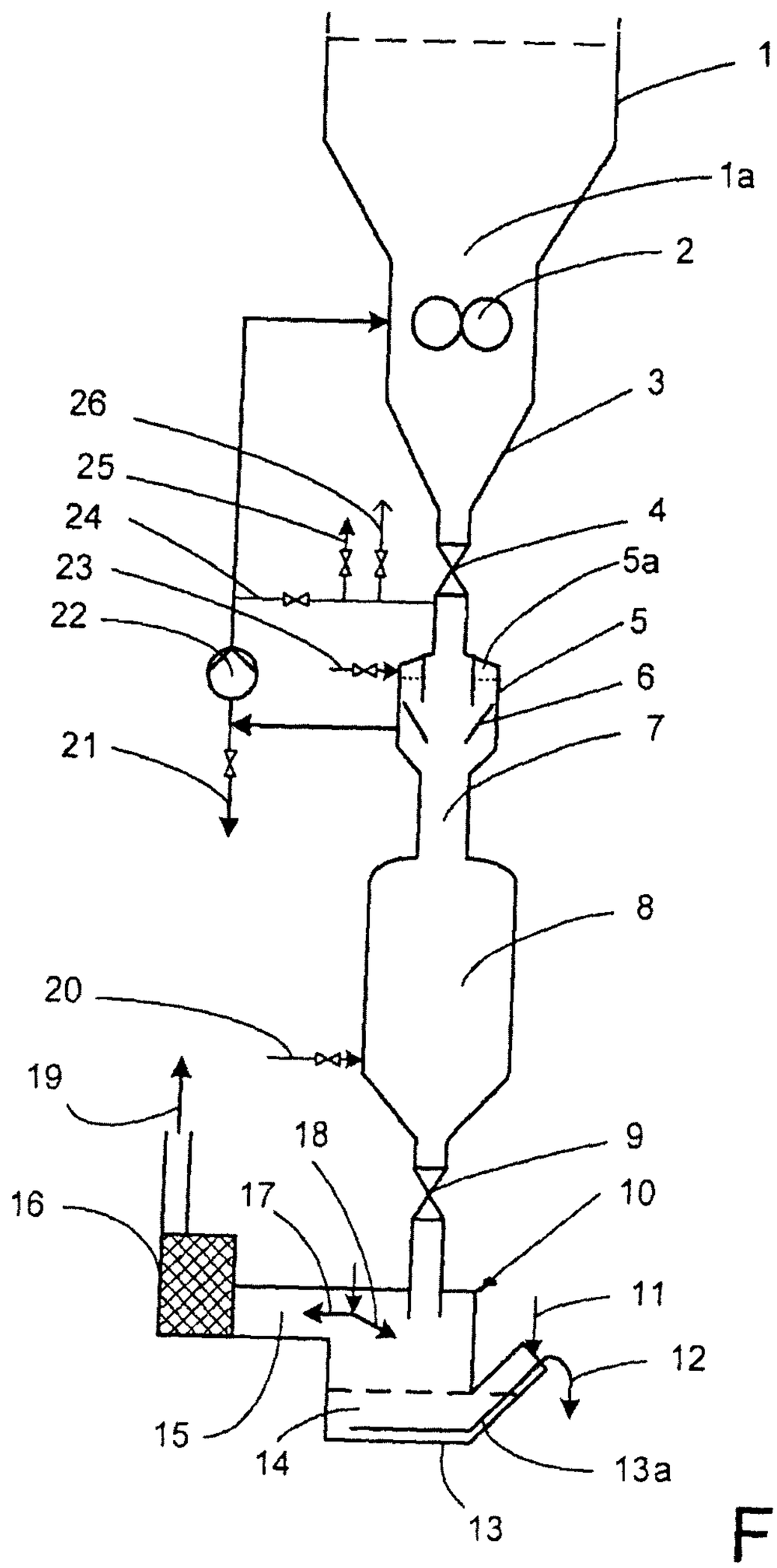
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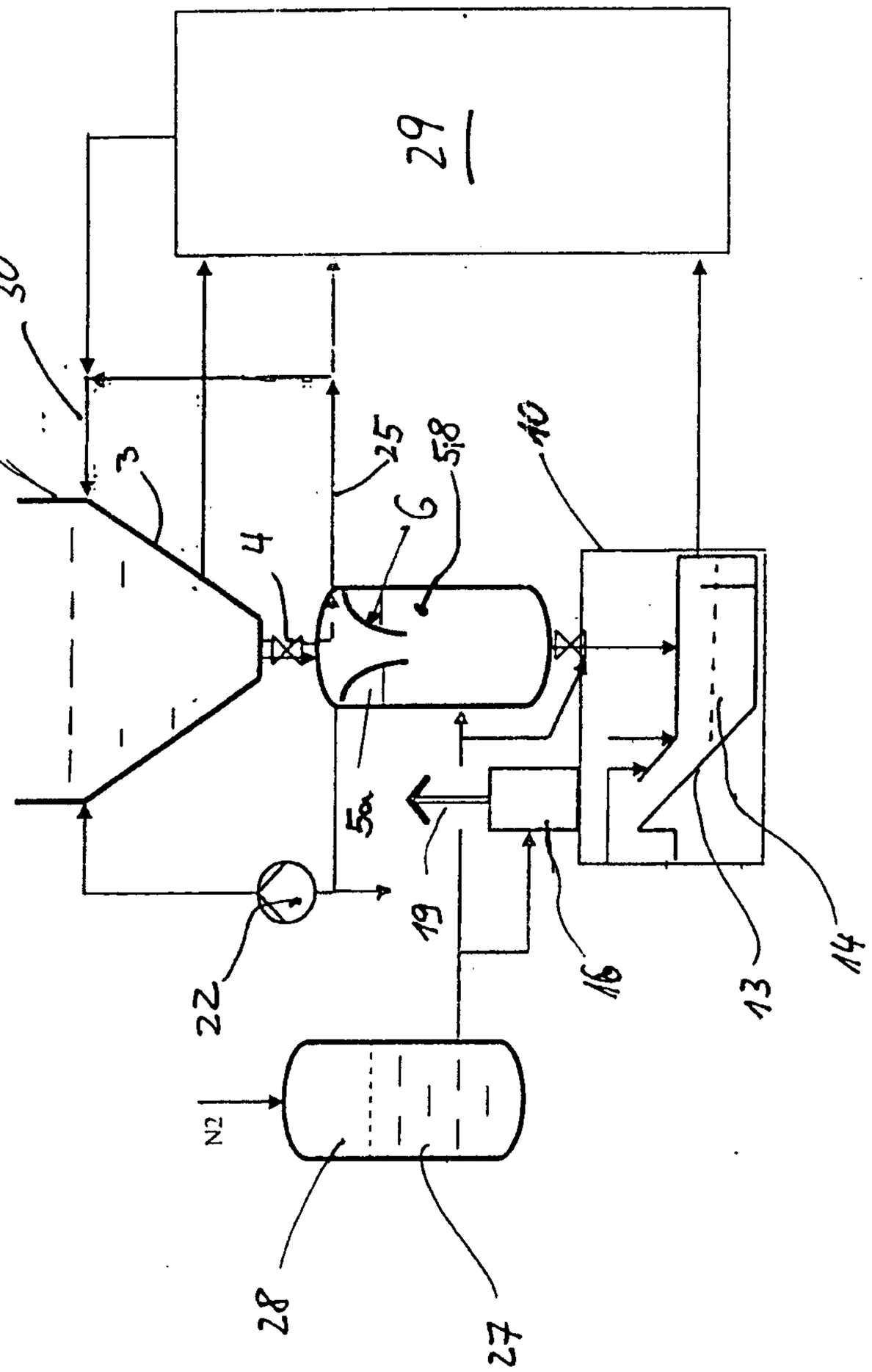
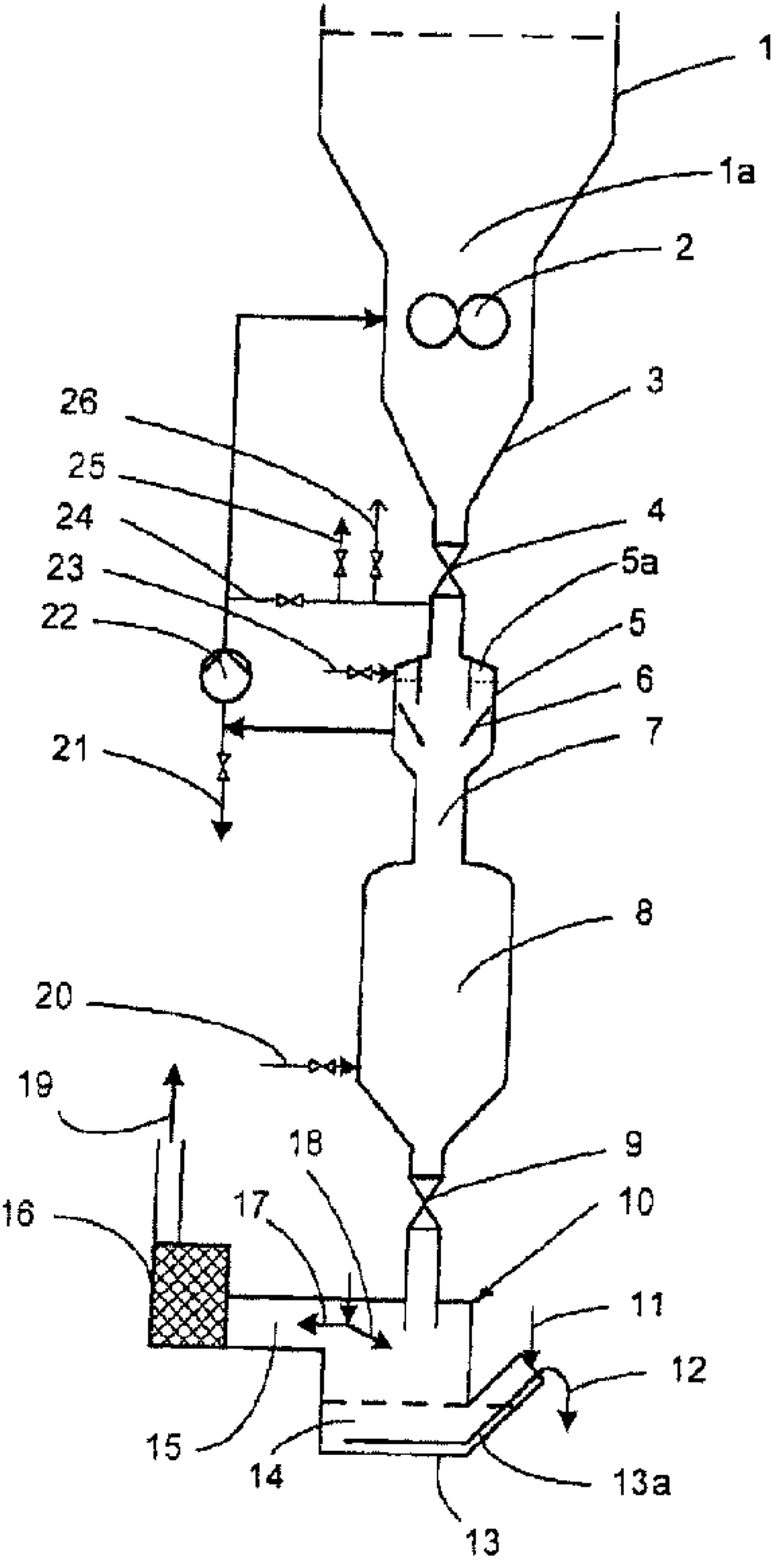
Fig. 1

Fig. 2

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