593635

COMMONWEALTH OF AUSTRALIA

Patents Act 1952

CONVENTION APPLICATION FOR A STANDARD PATENT

I/WE, FRIED. KRUPP GESELLSCHAFT MIT BESCHRANKTER HAFTUNG, a limited liability company of Altendorfer Strasse 103, D-4300 Essen 1, Federal Republic of Germany

hereby apply for the grant of a Standard Patent for an invention entitled
FILLER DEVICE FOR A TUBULAR DRIER

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MAIL OFFICER.....

which is described in the accompanying complete specification.

This application is made under the provision of Part XVI of the Patents Act 1952 and is based on an application for a patent or similar protection made

in Federal Republic of Germany on 16 May 1986
No. (P36 16 564.6)

in on
No. (

LODGED AT SUB-OFFICE
23 APR 1987
Sydney

My/Our address for service is: F.B. RICE & CO.,
28A Montague St,
Balmain N.S.W. 2041

Dated this 22nd day of April 1987

FRIED. KRUPP GESELLSCHAFT MIT BESCHRANKTER HAFTUNG

By: _____
Registered Patent Attorney

APPLICATION ACCEPTED AND AMENDMENTS ALLOWED 1.12.89

TO: The Commissioner of Patents,
COMMONWEALTH OF AUSTRALIA

Commonwealth of Australia
The Patents Act 1952
DECLARATION IN SUPPORT

In support of the (Convention) Application made by:
FRIED. KRUPP GESELLSCHAFT MIT BESCHRANKTER HAFTUNG, of Altendorfer Strasse 103, D-4300 Essen 1, Federal Republic of Germany
for a patent for an invention entitled:
Filler device for a tubular drier

I (We) Dipl.Ing. W. Dehmer and Mr. Ludger Frieling
of and care of the applicant company do solemnly and sincerely declare as follows:

---

a) I am (We are) the applicant(s) for the patent

b) I am (We are) authorised by the applicant(s) for the patent to make this declaration on its behalf.

Delete the following if not a Convention Application.

The basic application(s) as defined by section 141 (1) of the Act was (were) made

in Federal Republic of Germany on 16 May 1986

by the present applicant company

The basic application(s) referred to in this paragraph is (are) the first application(s) made in a Convention country in respect of the invention the subject of the application.

---

a) I am (We are) the actual inventor(s) of the invention

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all of the Federal Republic of Germany

is (are) the actual inventor(s) of the invention and the facts upon which the applicant company is (are) entitled to make the application are as follows:
the applicant is a person who would if a patent were granted upon an application made by the actual inventors, be entitled to have the patent assigned to it.

Declared at Essen this 5th day of March 19 87

FRIED. KRUPP GMBH

Signed [signature] Status Director / Assessor

Declarant's Name Dipl.-Ing. W. Dehmer Mr. Ludger Frieling

F. B. RICE & CO PATENT ATTORNEYS

This form is suitable for any type of Patent Application. No legalisation required.

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(54) Title
FEEDER FOR TUBULAR DRIER

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(56) Prior Art Documents
AU 55957/59 F23K
AU 51808/59 F23K

(57) The invention is based on the task to further develop a filling device of the initially mentioned type in such a manner, that the motion of the material to be dried is facilitated in the vicinity of the tubular drier and assisted. Consequently, the filling device should therefore be constructed in such a manner, that it contributes to a loosening up of the material to be dried, at least in the vicinity of the inlet end wall of the tubular drier.

CLAIM

1. A filler device for a tubular drier rotating around a stationary shaft, with a chute pivotable, in front of a tubular drier inlet end wall, between two lateral guide walls, with a control gate which is retained in a height adjustable manner above the chute and with a floor wall which screens off the region between the guide walls and the inlet end wall in a downward direction underneath the chute, whereby the distance between the chute and the control gate, seen over the width of these components, can

be adjusted, characterized in that the chute incorporates a blower unit which protrudes beyond an end section of the chute and faces the drier with blower openings of the blower unit pointing towards and adjustably spaced from the inlet end wall.

10. A device in accordance with Claim 9, characterized in that the hollow beam is attached and is movable in the longitudinal direction of the chute by means of guide elements.

COMMONWEALTH OF AUSTRALIA **593635**

Patent Act 1952

COMPLETE SPECIFICATION

(ORIGINAL)

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Related Art :

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Actual Inventor : Sonnhart Gauch, Maternus Rosellen, Hans-Joachim Seidel

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Complete Specification for the invention entitled:

FILLER DEVICE FOR A TUBULAR DRIER

The following statement is a full description of this invention including the best method of performing it known to us:-

The invention concerns a filler device for a tubular drier rotating around a stationary shaft, intended particularly for brown coal, with a chute pivotable in front of the inlet end wall between two lateral guide walls, with a control gate which is retained in a height adjustable manner above the chute and with a floor wall, which screens off the region between the guide walls and the inlet end wall in a downward direction underneath the chute, whereby the distance between the chute and the control gate (seen over the width of these components) can be adjusted.

Filler devices of the type stated above, to which the material to be dried (particularly brown coal) is being conveyed for example from a closeable filler funnel are to ensure, that the material to be dried enters the area of the inlet end wall of the tubular drier with the smallest possible sliding speed and subsequently enters into the heated drying tubes emanating from it.

Besides the variability of the inclination angle of the chute, the sliding behaviour of the material to be dried can also be influenced by the height adjustment of the associated control gate: bringing it closer to the chute will result in a reduction of the flow cross sectional area, through which the material to be dried travels towards the inlet end wall.

A further possibility of influencing the sliding behaviour is given by the fact, that the distance between the chute and the control gate (seen over the width of these components) is made adjustable. Particularly, the two nominated components can be mutually set with respect to each other in such a manner, that their mutual spacing in the direction of the tubular drier shaft diminishes. Notwithstanding the adjustability of the chute and of the control shutter operating in conjunction with it, it is not possible to avoid difficulties while feeding of the material to be dried particularly in that case if it has a tendency towards caking. Because of the generated plugs, entry into the drier tubes of the material being dried can be severly impeded under certain circumstances and the drying capacity reduced.

Similarly, the proposal to loosen up the material to be dried by means of a so-called fluidised bed, that is through the injection of compressed air from the direction of the floor partition towards the end section of the chute which points towards the drier, has not resulted in a number of cases in the desired sliding behaviour of the material to be dried.

The invention is based on the task to further develop a filling device of the initially mentioned type in such a manner, that the motion of the material to be dried is facilitated in the vicinity of the tubular drier and assisted. Consequently, the filling device should therefore be constructed in such a manner, that it contributes to a loosening up of the material to be dried, at least in the vicinity of the inlet end wall of the tubular drier.

The present invention comprises a filler device for a tubular drier rotating around a stationary shaft, with a chute pivotable, in front of a tubular drier inlet end wall, between two lateral guide walls, with a control gate which is retained in a height adjustable manner above the chute and with a floor wall which screens off the region between the guide walls and the inlet end wall in a downward direction underneath the chute, whereby the distance between the chute and the control gate, seen over the width of these components, can be adjusted, characterized in that the chute incorporates a blower unit which protrudes beyond an end section of the chute and faces the drier with blower openings of the blower unit pointing towards and adjustably spaced from the inlet end wall.

The basic concept of the invention consists therefore, to install on the chute in the transfer region, that incorporates in the area of its end section facing the drier, a blower unit which also extends the chute.

Its blower openings which point towards the inlet end wall of the tubular drier can be adjusted with respect to their position relative to the inlet end wall. There, the arrangement and construction of the blower openings shall be such, that they will drive the material to be dried into the drier tubes and will cause at the same time a loosening up of the layer of material to be dried, which forms in the area between the terminal section facing the drier and the inlet end wall.

In a further development of the subject of the invention, the blower openings of the blower unit are located underneath (of the roof-like straight line extension) the chute.

The desired acceleration in the direction towards the tubular drier of the material to be dried can be achieved by the means of constructing the blower openings as slots (in a form similar to a venetian blind) and that they are mutually displaced in the direction toward the inlet end wall in the manner of a venetian blind. For preference, construction of the blower unit is such, that the angular position of the blower openings can be adjusted with respect to the inlet end wall. Consequently and if need be, the blower openings can be brought into an angular position, which will result to an increased extent for the flow of gas to be directed in an upwards direction.

The configuration of the blower unit may be of such a type that an extension line through the blower unit which includes the blower openings, forms an acute angle with the inlet end wall and/or in which the blower openings (seen from the side) are aligned approximately perpendicular to the inlet end wall.

For the purpose of ensuring a uniform pressurised gas supply over the width of the chute, the blower openings, when viewed over the width of the chute, are partitioned into mutually independent sectors, and/or the amount of

air flowing through each blower opening is independently controllable. The separation into groups is necessary for the purpose of matching the effect of the blower unit to the drier tubes which rotate at various circumferential velocities. So for example the gas quantity flowing through per unit of time (corresponding to the number of drier tubes passing through per unit of time) must be increased with increasing distance from the rotation shaft of the tubular drier. The quantity of air that needs to be fed into the region of the drier tubes located at the periphery can thus be several times the amount of air, which needs to be put through in the region of the drier tubes located near the centre, in the vicinity of the rotation shaft.

The subject of the invention can be further refined in that the blower unit contains a hollow beam incorporating the blower openings, the width of which corresponds approximately to that of the chute and is movably attached to the latter by means of guide elements in a sliding manner in the longitudinal direction of the chute. Through displacement of the hollow beam on the chute, the position of the blower openings with respect to the inlet end wall of the tubular drier facing it can be adjusted within very fine limits to match the operating conditions, particularly the properties of the material to be dried.

The effect of the blower openings onto the material to be dried can be possibly changed additionally by the means that the hollow beam is attached to the chute in a hinged manner. This is understood to cover particularly such an arrangement, in which the hollow beam hinges around a hinge axis running parallel with the transverse direction of the chute and can be locked in various positions of deflection.

A preferred implementation of the subject of the

invention is characterised in that the hollow space of the hollow beam incorporates several, mutually separated, sectors located side by side, which may be connected by means of individual feeder lines, each equipped with its throttling valve, to a pressure medium source. By means of suitably adjusting the throttling valve, air quantities of various magnitudes can be made to act upon the material to be dried through the various sectors of the hollow beam. If need be, the effect of the filling device can be improved further by the means that measured quantities of pressurised gas may be injected through the floor wall which incorporates, at least in the area underneath the end section of the chute pointing towards the drier, drilled holes pointing upwards into the area located above. In such an implementation form of the subject of the invention, the effect of the blower unit is therefore assisted by means of the fluidised bed mentioned previously.

connected by means of individual feeder lines, each equipped with its throttling valve, to a pressure medium source (Claim 12). By means of suitably adjusting the throttling valve, air quantities of various magnitudes can be made to act upon the material to be dried through the various sectors of the hollow beam. If need be, the effect of the filling device can be improved further by the means that measured-out quantities of compressed air may be injected through the floor plate which incorporates upwards pointing drilled floor holes at least in the area underneath the end section of the chute facing the drier, into the region located above (Claim 13). In such an implementation form of the subject of the invention, the effect of the blower unit is therefore assisted by means of the fluidised bed mentioned previously.

The invention will be explained below in detail with the assistance of the drawings which show in a greatly simplified, sketch-like manner two implementation examples of the subject of the invention. There:

Figure 1 shows a vertical section through a filling device installed in series ahead of the tubular drier together with a part of the inlet end wall of the tubular drier.

Figure 2 shows a section along line II - II in Figure 1,

Figure 3 shows a view from above of the end section of the chute shown in Figures 1 and 2 facing the drier and the associated blower unit and

Figure 4 shows to a modified scale a vertical part section through the filling device in accordance with Figure 1 in the area of the end section of the chute facing the drier together with the pivotably supported blower unit.

The filling device installed in series ahead of a tubular drier (1) incorporates as known principal components a plate-shaped chute (2) with two guide walls (3) delimiting its sides and above the chute (2) a regulating (control) gate (4) operating in the manner of a weir, which is maintained adjustably at a specific height in the direction of the double arrow (6) in the guides (5) between the guide walls (3).

The chute is hinged to the guide walls (3) (and to the accessories attached to it) within the direction of the double arrow (7) around a pivot axis (8) which is perpendicular to the drawing plane.

The lower end section (2a) of the chute (2) faces the inlet end side (9) of the tubular drier (1), which has a drum-like external shape. The drying tubes (10) emanating from the inlet end wall are rotating together with it in a clock-wise direction (arrow (11) in Figure 2) around a stationary supporting shaft (12), which is inclined, in the same manner as the drier tubes, ~~under an flat~~ at an acute angle with respect to the horizontal. Heating of the drier tubes is achieved by means of a gaseous medium, which is being injected in the region of the supporting shaft (12) and flows past the drying tubes within the inner space of the tubular drier - drum body.

The guide walls (3) which are only pivotable terminate at a short distance in front of the rotating inlet end wall (9).

The angle of incline of the chute (2) with respect to the horizontal is being adjusted by means of the pivot arm (8a) acting upon it (as well as the guide walls (3)) to such ~~a flat~~ an acute angle, that the material to be dried (for example wet brown coal B, B') still reaches the inlet end wall (9) reliably with the smallest possible sliding velocity and slides from there into the drier tubes (10), where the drying process takes place. The sliding process may be influenced there by the lifting or the lowering of the control gate (4): its movement will cause an increase or a reduction of the available flow cross sectional area. In the vicinity of the inlet end wall, the brown coal is subjected to loosening up. This area is designated with B'. In the implementation example shown (see Figure 2), the components 2 and 4 are mutually associated in such a manner, that their mutual distance diminishes in the direction towards the rotation axis (12) of the tubular drier. In the case of a horizontal arrangement of the lower edge (4a) of the control gate, the chute (2) will rise ~~under a flat~~ to form an acute angle in the direction towards the rotation shaft (12). It is envisaged therefore, that the chute (2) be ~~shaft (12), can therefore be also~~ constructed in a hinged manner with reference to a plane, which is perpendicular to the plane of the drawing.

A bottom wall (13) is attached between the guide walls (3), which screens off the area between the guide walls and the inlet end wall (9 underneath the chute in a down wards direction (see also Figure 1). It will yet be described, that the bottom wall may be utilised, if required, for the generation of a so-called fluidised bed.

To improve the effect of the filling device with the principal components (2, 3, 4, 13) and thus to improve the economics of the tubular drier (1) as well, a blower unit (14) is fitted to the underside of the chute (2),

which incorporates a hollow beam (15) equipped with blower openings(15a) in the end region of the chute (2a) facing the drier. This protrudes in the manner of an extension beyond the end section (2a) facing the drier and is dimensioned with respect to its length in such a manner, that it extends at least approximately over the whole width of the chute (2) (that is in Figure 1 transversely to the plane of the drawing).

The external contour (15b) of the hollow beam facing the inlet end wall (9), which is also formed by the blower openings (15a) runs in accordance with Figure 1 approximately in parallel with the chute (2) and includes with the inlet end wall an acute angle α .

A fine adjustment of the position of the hollow beam (15) is made possible with respect to the components (2) and (9) in that the hollow beam is attached to guide rods (16) (see Figure 3) which themselves (for example by means of a toothed rack and pinion drive or actuator assemblies) are retained longitudinally movable within guide consoles (17) underneath the chute (2). The thus resulting displacement of the hollow beam (15) is indicated in Figure 1 by a double arrow (18).

By moving the hollow beam (15) in parallel with the chute (2), the distance between the blower openings (15a) (which, in the side view are pointing approximately perpendicularly to the inlet end wall (9)), can be adjusted with fine adjustment for the purpose of matching the respective operating conditions, particularly for the purpose of matching the properties of the brown coal to be dried.

The blower openings (15a) of the hollow beam (15) are constructed for preference in the shape of slots and are mutually displaced (in the manner of a Venetian blind)in the direction towards the inlet end wall (9) of the tubular drier (1) facing them, in the manner of shelves. This results in that the lower opening protrudes further in the direction towards the inlet end wall than the adjacent blower opening located immediately above (see in that respect also particularly Figures 3 and 4).

The rotational movement of the tubular drier (1) in the direction of the arrow (11) (Figure 2) results in that, if the inlet end wall surface (9) is uniformly covered with drier tubes (10), considerably more drier tubes enter the area of the blower openings in the outer area than in the vicinity of the rotational shaft (12). An essential characteristic of the subject of

the invention consists in that the blower unit be matched to the described conditions by the means, that the hollow space of the hollow beam (15) is subdivided by partition walls (15c) (see Figure 3) into adjacent, mutually independent sectors (15d) to (15g). Each sector may be connected by means of its own supply line (20) which is equipped with a throttling valve (19), to a source of pressure medium.

It is also possible, by means of different settings of the throttling valves (19), to feed diminishing quantities of air in the direction toward the rotational shaft (12) through the associated sectors (15d) and (15g).

Additionally or instead, the blower openings of the individual sectors may also be constructed differently. This can be achieved in a simple manner by the means, that the cross sectional blower areas available for the individual sectors are becoming smaller from one sector to another in the direction towards the rotational shaft (12).

As a result of using the blower unit (14) and the fact already mentioned, that the blower openings are pointing approximately perpendicularly to the inlet end wall (9), the brown coal to be dried is not only being loosened up in the transfer region of the chute (2) that is in the area in of the end section (2a) facing the drier, but also accelerated, particularly in the direction towards the inlet end wall and the drier tubes (10) emanating from it. The formation of caking or of plugs in the particularly endangered transfer region is thus extensively counteracted.

The source of pressure medium, through which the supply lines (20) are being supplied with compressed gas (normally air), is designated in Figure 1 (in a purely schematic manner) with (21).

The filling equipment in accordance with the invention can be further equipped in the manner, that the floor wall (13) incorporates in the area underneath the end section (2a) of the chute (2) facing the drier, holes (13a) drilled through the floor and pointing upwards and forms there also a pressure plenum (22). This can be fed with compressed gas in a measured-out manner through a pressure line (23) and a throttling valve (24), which may be supplied in particular from a pressure source (21) (Figure 1). For the purpose of matching different operating conditions, the pressure plenum (22) (corresponding to the construction of the hollow plenum (15)), can be subdivided into several mutually separated sectors located side by side, whereby these may incorporate mutually variously constructed and/or variously arranged drilled holes (13a) in the bottom.

In the implementation example of the subject of the invention described so far, the hollow beam (15) can only be displaced with respect to the chute (2) in the longitudinal direction of this latter.

An additional possibility for adjusting the position of the slot-like blower openings (15a) can be brought about by the means of suspending the hollow beam (15)(in accordance with Figure 4) in a hinged manner around the axle (25) from the guide rods (16) and by equipping the components (15), (16) with suitable locking elements. The hinged arrangement of the hollow beam is of course conditional upon the supply lines (20) being constructed at their point of connection with the hollow beam in an adequately movable or resilient manner.

By pivoting the hollow beam (15) with respect to the chute (2) it is possible to alter the angle α between the external contour (15b) and the inlet end wall (9) with the result, that there will also be a change in the direction of the blower openings (15a) with respect to the inlet end wall (9). In this manner it will be possible to exert an additional influence of the effect of the blower unit (14) onto the brown coal which is to be transferred into the tubular drier and in particular by the means of setting a gas flow (in the general case of an air flow) which is directed upwards to a greater or a lesser degree.

The claims defining the invention are as follows:-

1. A filler device for a tubular drier rotating around a stationary shaft, with a chute pivotable, in front of a tubular drier inlet end wall, between two lateral guide walls, with a control gate which is retained in a height adjustable manner above the chute and with a floor wall which screens off the region between the guide walls and the inlet end wall in a downward direction underneath the chute, whereby the distance between the chute and the control gate, seen over the width of these components, can be adjusted, characterized in that the chute incorporates a blower unit which protrudes beyond an end section of the chute and faces the drier with blower openings of the blower unit pointing towards and adjustably spaced from the inlet end wall.

2. A device in accordance with Claim 1 characterized in that the blower openings are located underneath the chute.

3. A device in accordance with Claims 1 or 2 characterized in that the blower openings are constructed as slots and are arranged mutually displaced in the direction of the inlet end wall in the manner of a venetian blind.

4. A device in accordance with any one of the Claims 1 to 3 characterized in that an angular position of the blower openings with respect to the inlet end wall, is adjustable.

5. A device in accordance with any one of the Claims 1 to 4, characterized in that an extension line through the blower unit, which includes the blower openings, forms an acute angle with the inlet end wall.

6. A device in accordance with any one of the Claims 1 to 5 characterized in that the blower openings, when viewed from the side, are aligned approximately perpendicular to the inlet end wall.

7. A device in accordance with any one of Claims 1 to 6, characterized in that the blower openings, when viewed over the width of the chute, are partitioned into mutually independent sectors.

8. A device in accordance with any one of the Claims 1 to 7, characterized in that the amount of air flowing through each of the blower openings when viewed over the width of the chute, is independently controllable.

9. A device in accordance with any one of the Claims 1 to 8, characterized in that the blower unit incorporates a hollow beam incorporating the blower openings, the width of this hollow beam corresponding approximately to that of the chute.

10. A device in accordance with Claim 9, characterized in that the hollow beam is attached and is movable in the longitudinal direction of the chute by means of guide elements.

11. A device in accordance with Claim 9 or 10, characterized in that the hollow beam is attached in a pivotable manner to the chute.

12. A device in accordance with any one of the Claims 9 to 11, characterized in that the hollow space of the hollow beam incorporates several mutually separated sectors located side by side, which may be connected through individual feeder lines equipped with throttle valves to a pressure source.

13. A device in accordance with any one of the Claims 1 to 12, characterized in that measured quantities of pressurized gas may be injected through the floor wall, which incorporates at least within the region underneath the end section of the chute pointing towards the drier, drilled holes in the floor pointing upwards, into the area located above.

14. A device in accordance with any one of the preceding claims wherein brown coal enters the drier via the device.

15. A device as described herein with reference to the drawings.

16. A method of controlling the speed of entry of material into a drier comprising feeding the material through a device as defined in any one of the preceding claims and controlling the angle of the chute, the distance between the chute and the control gate, the space between the blower openings and the inlet end wall and the amount of air flowing through the blower openings, to give a desired speed of entry of material.

17. A method of feeding a material into a drier substantially as described herein with reference to the drawings.

DATED this 16 day of November 1989

FRIED KRUPP GESELLSCHAFT MIT BESCHRANKTER HAFTUNG
Patent Attorneys for the Applicant:
F.B. RICE & CO.

71918/87

FIG. 1

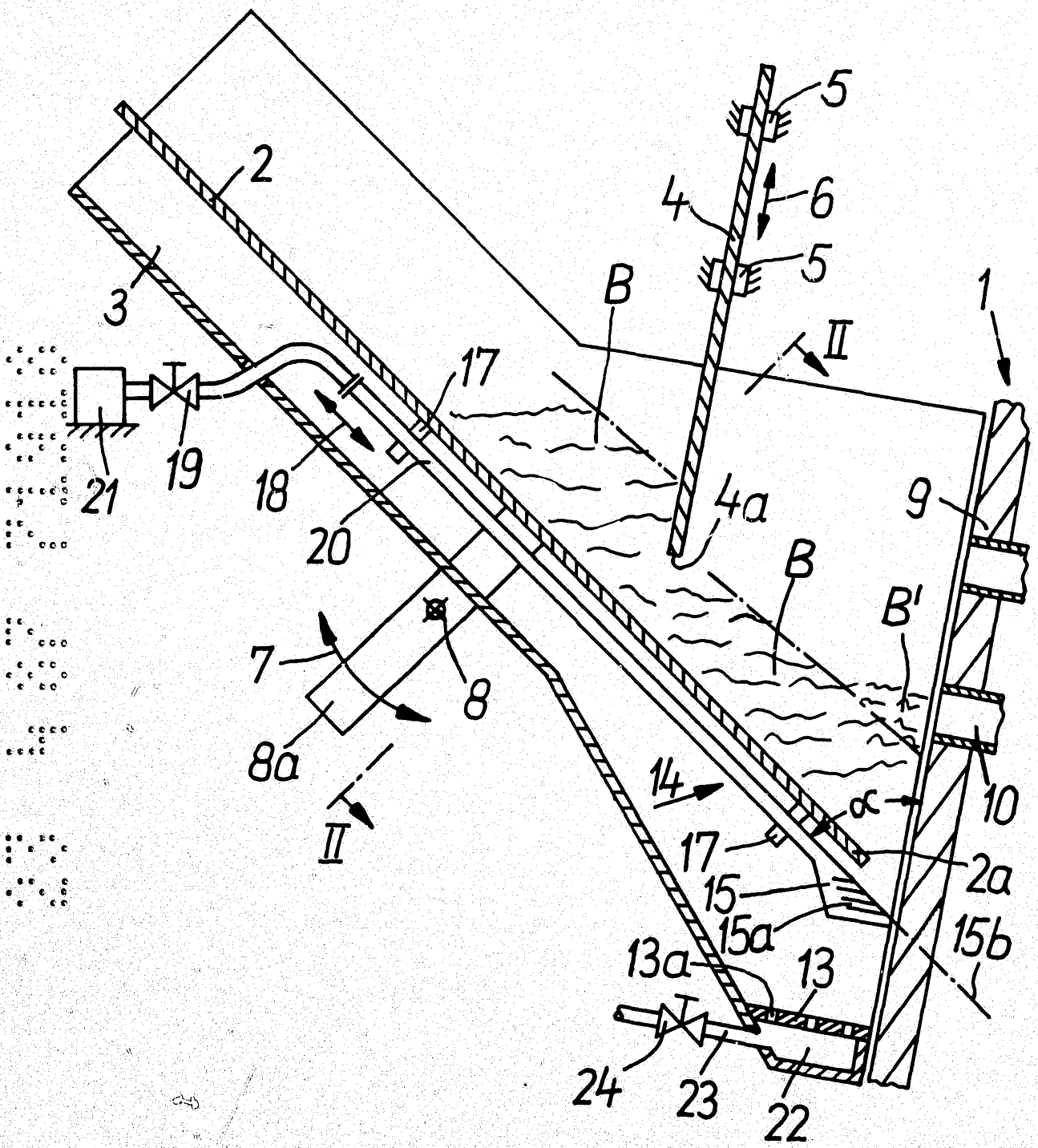

FIG. 2

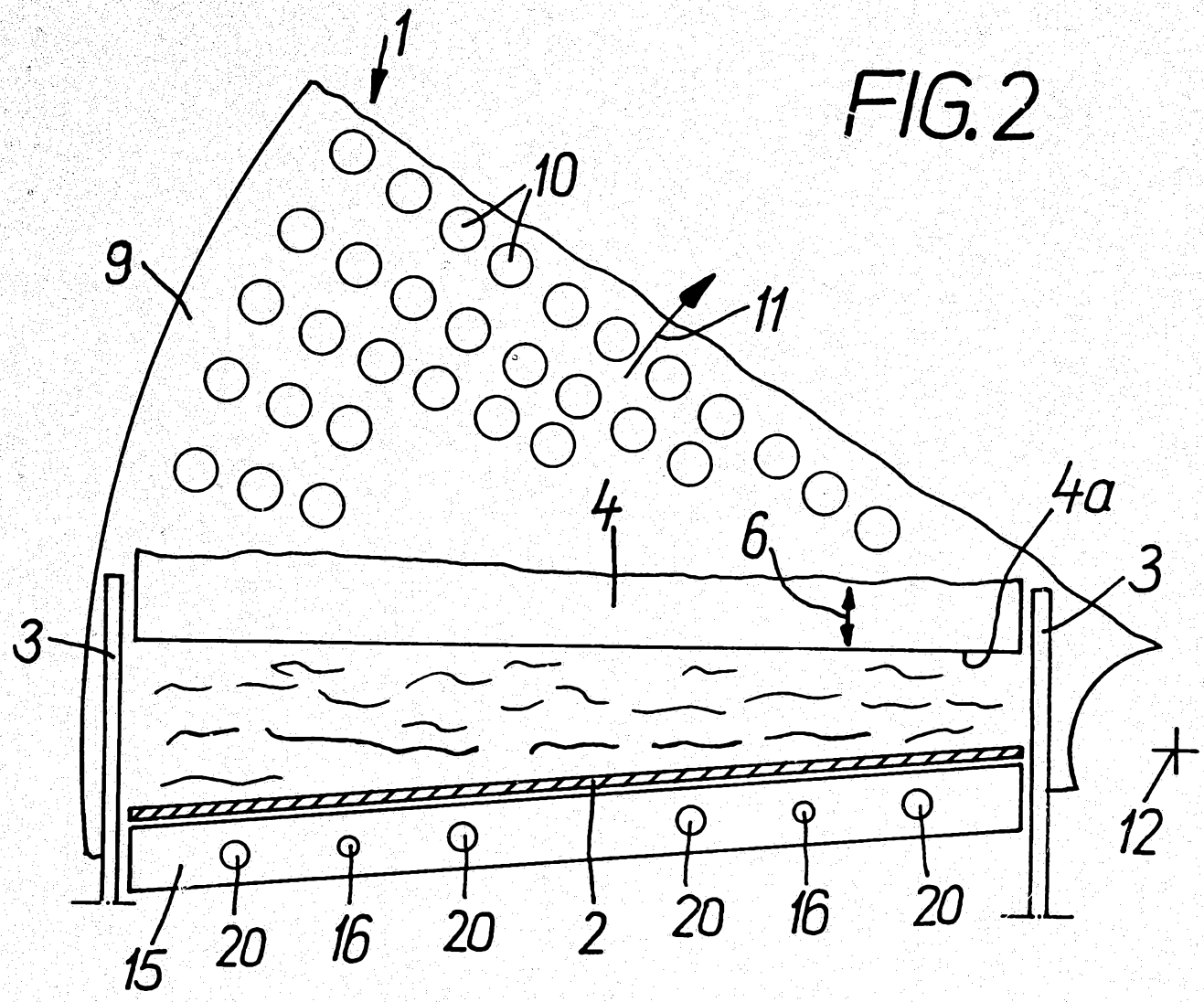

FIG.3

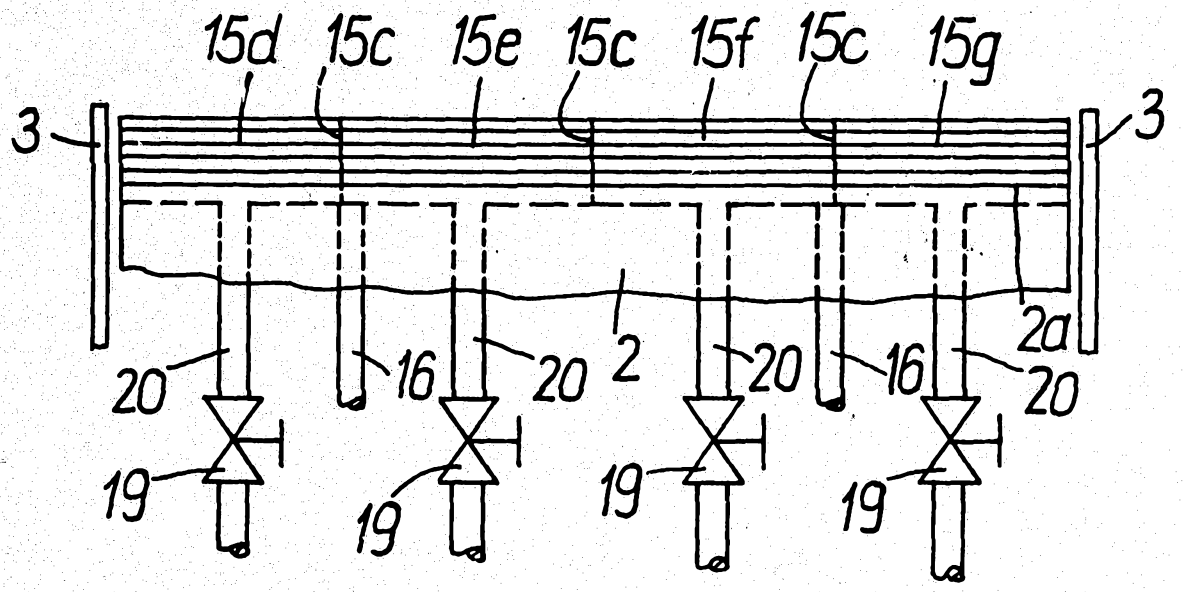
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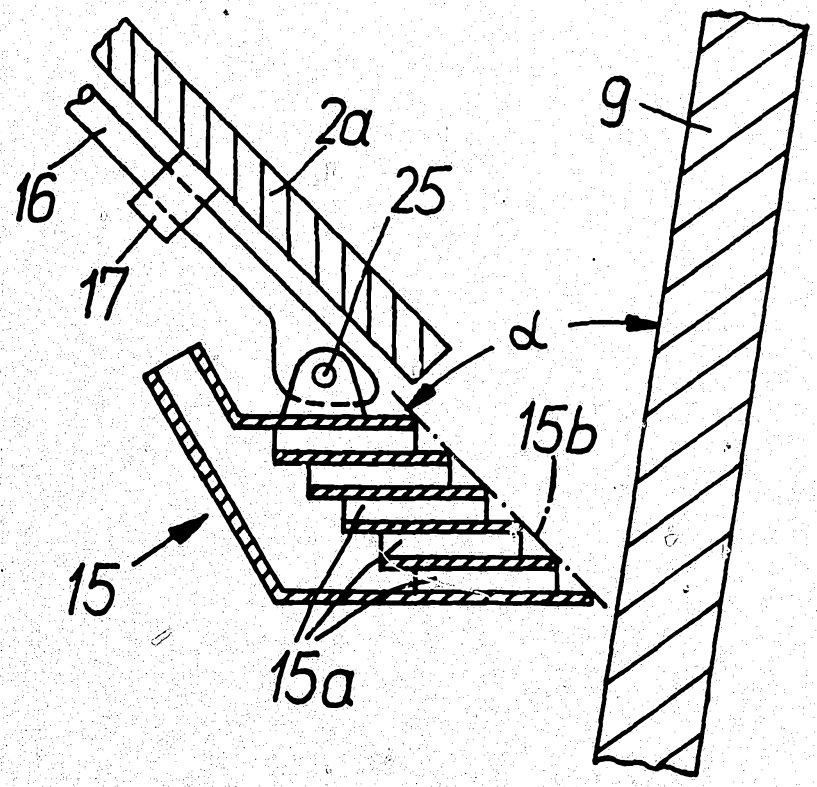
FIG.4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