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(72) Calmes, Marc, LU
(72) Andonov, Radomir, LU
(72) Lonardi, Emile, LU
(73) Paul Wurth S.A., LU

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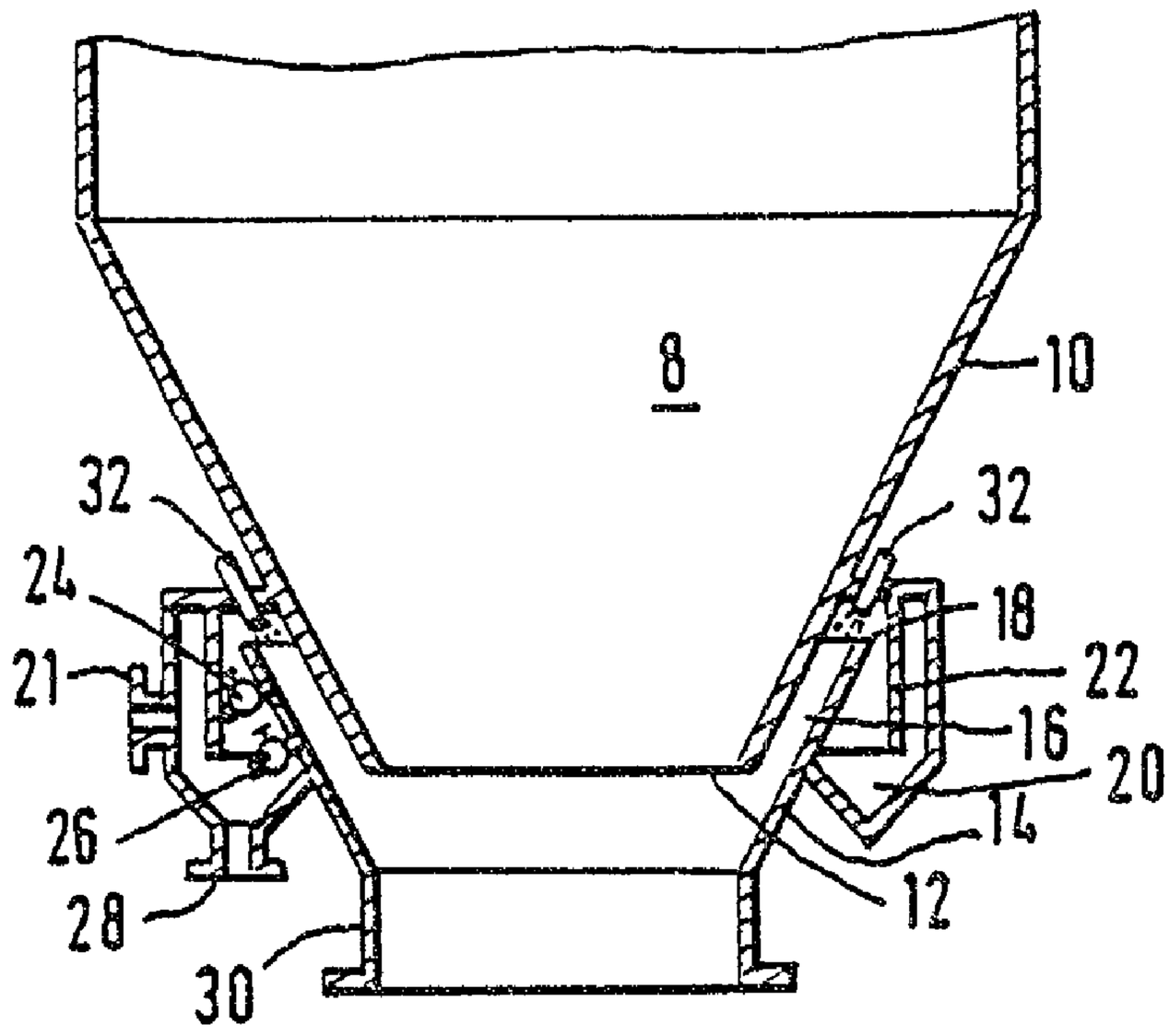
(54) **DISPOSITIF POUR L'ASSECHEMENT DES SABLES A SCORIES**

(54) **APPARATUS FOR DEWATERING SLAG SAND**



(57) Provided below the funnel-shaped outlet opening of a receptacle filled with wet slag sand is an outlet funnel which is closed to begin with and forms a conical annular gap around the receptacle. This gap fills with slag sand, as a result of which dewatering occurs according to the principle of the siphon effect.

ABSTRACT

Apparatus for dewatering slag sand

Provided below the funnel-shaped outlet opening (12) of a receptacle (8) filled with wet slag sand is an outlet funnel (14) which is closed to begin with and forms a conical annular gap (16) around the receptacle (8). This gap (16) fills with slag sand, as a result of which dewatering occurs according to the principle of the siphon effect.

Figure 1

P-PWU-221

APPARATUS FOR DEWATERING SLAG SAND

The invention relates to an apparatus for dewatering slag sand, in particular blast-furnace slag sand located in a receptacle.

In the prior art, the slag flowing out of a shaft furnace, for example a blast furnace, is quenched by means of water jets emerging from nozzles in such a way that the liquid slag turns into a more or less fine slag sand. So that this slag sand can be used further in a profitable manner, the mixture of slag sand and water, the slag mash, which results from the said spraying must as far as possible be largely dewatered.

According to the prior art, this dewatering takes place without exception by wall sections of a receptacle for the wet slag sand being designed as filtering surfaces permeable to water. To this end, the vertical side walls, for example of a cylindrical receptacle, can be designed entirely or partly as filter surfaces, or even only the conical outlet area of such a receptacle.

In the first case, the filtering surfaces can certainly be designed to be relatively large, but the portion of slag sand located in the bottom, for example conical, outlet is left without being dewatered; whereas in the second case, dewatering of this portion certainly takes place, but the filtering surface remains relatively small. In both cases, but especially in the last mentioned case, the filter surfaces are exposed to high mechanical compressive stress from the contents of the receptacle so that these filter wall sections must be of appropriately resistant, that is expensive, construction.

A particularly serious disadvantage of both constructions (or a combination of the two) consists in the fact that the said filter surfaces become clogged by slag sludge after relatively short use and thus become ineffective. To remove the sludge from the filter surfaces, injection of water, for example by means of nozzles, from outside through the filter surfaces towards the interior of the receptacle is known in the prior art.

To avoid these disadvantages of the prior art, it is therefore the object of the invention to propose an apparatus of the generic category mentioned at the beginning for dewatering slag sand, which apparatus does not need any filter surfaces while maintaining a maximum dewatering effect.

This object is achieved by an apparatus of the generic category mentioned at the beginning which is characterised in that the bottom outlet opening of the receptacle leads into an outlet funnel which is arranged downstream of the receptacle and whose diameter in the area of the said bottom outlet opening is greater than the diameter of this outlet opening of the receptacle and whose top edge runs in such a way above the bottom outlet edge of the receptacle that a free, annular passage for rising extracted water flowing off over the said top edge is formed between the said outlet opening and the said top edge.

Exemplary embodiments of the invention are shown in the drawings and will be described in greater detail below.

In the drawings:

Figure 1 shows a schematic longitudinal section through a first exemplary embodiment of the invention having an essentially conical outlet funnel;

Figure 2 shows a schematic longitudinal section through a second exemplary embodiment of the invention similar to that in Figure 1 but having a double outlet funnel in tandem arrangement;

Figure 3 shows a schematic longitudinal section through a third exemplary embodiment similar to that in Figure 1 but additionally having a pivotable shutter for the receptacle outlet;

Figure 4 shows a schematic longitudinal section through a fourth exemplary embodiment of the invention having a cylindrical-conical profile of the outlet funnel;

Figure 5 shows a schematic longitudinal section through a fifth exemplary embodiment of the invention

similar to that in Figure 4 but having a conical widening of the receptacle outlet;

Figure 6 shows a schematic longitudinal section through a sixth exemplary embodiment of the invention, essentially consisting of a combination of the exemplary embodiments according to Figures 1 and 5;

Figure 7 shows a schematic longitudinal section through a sixth exemplary embodiment of the invention having a vertically adjustable outlet funnel.

Figure 1 shows the bottom part of a, for example cylindrical, receptacle 8 for the slag sand to be dewatered, having a preferably conical bottom outlet 10 (the slag-sand charge of the receptacle 8 is not shown further in the Figure). The outlet opening 12 of the outlet 10 is surrounded by an outlet funnel 14 arranged downstream, likewise of an essentially conical shape. The diameters of the outlet 10 in its bottom part and of the outlet funnel 14 are appropriately selected in order to create between the two a conical annular gap 16, the top edge 18 of the outlet funnel 14 being higher than the bottom edge of the outlet opening 12.

The functional principle of the apparatus according to the invention is based on the principle of communicating vessels. On the basis of this principle, the water contained in the slag sand rises in the annular channel 16 and runs off in a first stage of the dewatering over the top edge 18 of the outlet funnel 14. On account of its density and internal friction, the slag-sand portion of the slag mash does not participate in this rising of the water in the annular space 16, which results in the separation between sand and water, and with astonishing efficiency, as tests have shown. Accordingly, the slag sand itself acts as a filter mass.

In the said first stage of the dewatering, the water is allowed to flow off over the top edge 18, since a good separating action between water and any entrained sludgy sand constituents takes place over the relatively large distance thereby provided between outlet 12 and this top edge 18, in particular because substantial

slowing-down of the water velocity takes place when the water rises in the widening annular gap 16.

The water flowing over the edge 18 is caught in an encircling annular space 20 and drawn off via a discharge 21.

For the purpose of further improving the separating effect between water and any entrained slag sludge, a separating and steadying wall 22 having an additional separator action can facultatively be provided in the annular space 20, in which case accumulating sludge can settle in the bottom part of the annular space 20 and, after dewatering is complete, can be drawn off through a discharge 28.

It has been found in the said tests that, in the further course of dewatering, the cleanliness of the accumulating water increases on account of the increasing filtering effect of the slag sand drying in the receptacle 8, and the accumulating water quantities naturally decrease. The invention therefore facultatively makes provision for the water, as water purity increases and water quantity decreases, to be allowed to flow off first of all through a valve 24 and later through a valve 26 in an even lower position, as a result of which the dewatering process is shortened. During the dewatering operation, the flow of slag sand is blocked by the cylindrical run-off connection piece 30, for example by means of a squeezing valve (not shown) which is known per se and is attached below the connection piece 30 in the adjoining discharge pipe (not shown).

Finally, the invention facultatively provides water injection nozzles 32 in any number which are arranged all around at the top part of the annular space 20 and serve to clean the outlet funnel 14 if the receptacle 8 is completely emptied at any time between two dewatering operations.

Figure 2 shows an embodiment variant of the invention in which two outlet funnels 34, 36 connected one behind the other in tandem arrangement are provided. In this way, not only is the intended separating effect

according to the invention between slag sand and water improved even further, but the portions of slag sand otherwise not participating in the separation operation (that is, for example in Fig. 1, the quantities of slag sand located below the outlet opening 12) are also reduced to a minimum. The bottom funnel 36 is used for this purpose by opening its water outlet 37 when the top funnel 34 has performed its function.

Figure 3 shows a constructional example having a pivotable shutter 38 at the outlet 40 of the receptacle 8. The squeezing valve (not shown) is relieved of the weight of the receptacle charge by this shutter 38. But the shutter also helps to reduce to a minimum the bottom quantity of slag sand already reduced with the arrangement according to Figure 2 and not dewatered.

Figure 4 shows a construction in which an outlet funnel 42 according to the invention is not designed so as to run continuously in a conical manner to the top (as, for example, in Figure 1), but its top part 44 has essentially cylindrical forms. To make this possible, the outlet of the receptacle 8 has a corresponding cylindrical connection piece 46. This configuration ensures that small quantities of slag sand cannot possibly be floated off to the top along a continuously sloping funnel wall (see 14 in Fig. 1) but are retained in the bottom part of the funnel 42 on account of their density.

In Figure 5, in an extended construction of Figure 4, an outlet connection piece 48 of the receptacle 8 is provided at the bottom with a conical skirt 50 widening towards the bottom. This configuration creates a relatively narrow annular gap 54 between the skirt 50 and the outlet funnel 52, with the effect that not only is slag sand restrained in a purely mechanical manner from floating up, but in addition a further separation effect also results due to the water-velocity gradient in the gap 54 and the annular space 56 located above it.

The construction according to Figure 6 puts into concrete form an extension of the idea of the separation effect by means of a water-velocity gradient in the

annular gap 58, widening to the top, between the outlet skirt 62 of the receptacle 8 and the funnel wall 66, which is again of conical design. Due to the considerable cross-sectional increase in this annular gap 58, which reaches a maximum at the top edge 64 of the funnel 66, and the deceleration in the water velocity accompanying this reduction, the said separation effect is substantially assisted by decantation.

Figure 7 shows an extension of the inventive alternative shown in Figure 6 by the outlet funnel 68 according to the invention being designed to be vertically adjustable with accessories. Encircling bellows 70 permit a corresponding vertical movement of the system, this vertical displacement being brought about with the aid of means (not shown) known per se.

If the funnel 68 is displaced upwards, the gap 72 narrows while at the same time the water volume located above it increases and the end edge 74 is lifted higher, which, as follows from the above explanations, results in optimum cleaning effects. This vertical adjustment enables the apparatus to be optimally adapted to various grades of sand.

For the purpose of further optimising the cleaning effect, the invention facultatively provides an annular encircling filter element 78 between the outlet connection piece 76 of the receptacle 8 and the outlet funnel 68. In contrast to the filter elements mentioned at the beginning according to the prior art, this filter element 78, which preferably acts as a retaining screen, is not exposed to any great mechanical stress together with corresponding wear and in particular does not have to bear the weight of the receptacle contents.

CLAIMS

1. Apparatus for dewatering slag sand, comprising:

a receptacle for receiving said slag sand, said receptacle having a bottom end with a bottom outlet opening;

a first outlet funnel, said first outlet funnel surrounding said bottom end of said receptacle, so that said bottom outlet opening discharges into said first out funnel, and said first outlet funnel defines with said bottom end of said receptacle a first free annular passage for rising extracted water therein, wherein said first outlet funnel has a free top edge surrounding said bottom end of said receptacle and vertically spaced from a bottom end of said first outlet funnel;

an annular trough surrounding said free top edge for catching the water flowing over said free top edge;

first water discharge means connected to said annular trough;

a slag sand outlet for discharging slag sand through said first outlet funnel after the dewatering operation; and

a valve for closing said slag sand outlet during dewatering operation.

2. Apparatus according to claim 1, wherein said first outlet funnel has a side wall, and wherein dewatering drain valves are provided in said side wall at various heights above said bottom outlet opening.

3. Apparatus according to claim 1 or 2, comprising a vertically extending separator wall provided within said annular trough.

4. Apparatus according to any one of claims 1 to 3, wherein said first water discharge means comprises a first discharge opening located in a bottom wall of said annular trough and a second discharge opening located in a side wall of said annular trough.

5. Apparatus according to any one of claims 1 to 4, comprising water-injection nozzles arranged around said first free annular passage.

6. Apparatus according to any one of claims 1 to 5, wherein

said slag sand outlet is formed by a second outlet funnel surrounding the bottom end of said first outlet funnel, so that said first outlet funnel discharges into said second outlet funnel, and said second outlet funnel defines with said first outlet funnel a second free annular passage for rising extracted water therein; and

second water discharge means are associated with said second outlet funnel.

7. Apparatus according to any one of claims 1 to 6, characterized by a pivotable shutter for opening and closing said bottom outlet opening of said receptacle.

8. Apparatus according to any one of claims 1 to 7, wherein said bottom end of said

receptacle is designed as a cylindrical pipe connection piece, and a top part of said first outlet funnel is likewise cylindrical.

9. Apparatus according to claim 8, wherein said cylindrical pipe connection piece is extended by a skirt widening conically downwards.

10. Apparatus according to any one of claims 1 to 7 and 9, wherein said first outlet funnel is widening conically upwards.

11. Apparatus according to any one of claims 1 to 10, wherein said first outlet funnel is vertically adjustable relative to said receptacle.

12. Apparatus according to any one of claims 1 to 11, comprising an annular filter element disposed between said first outlet funnel and said bottom end of said receptacle.

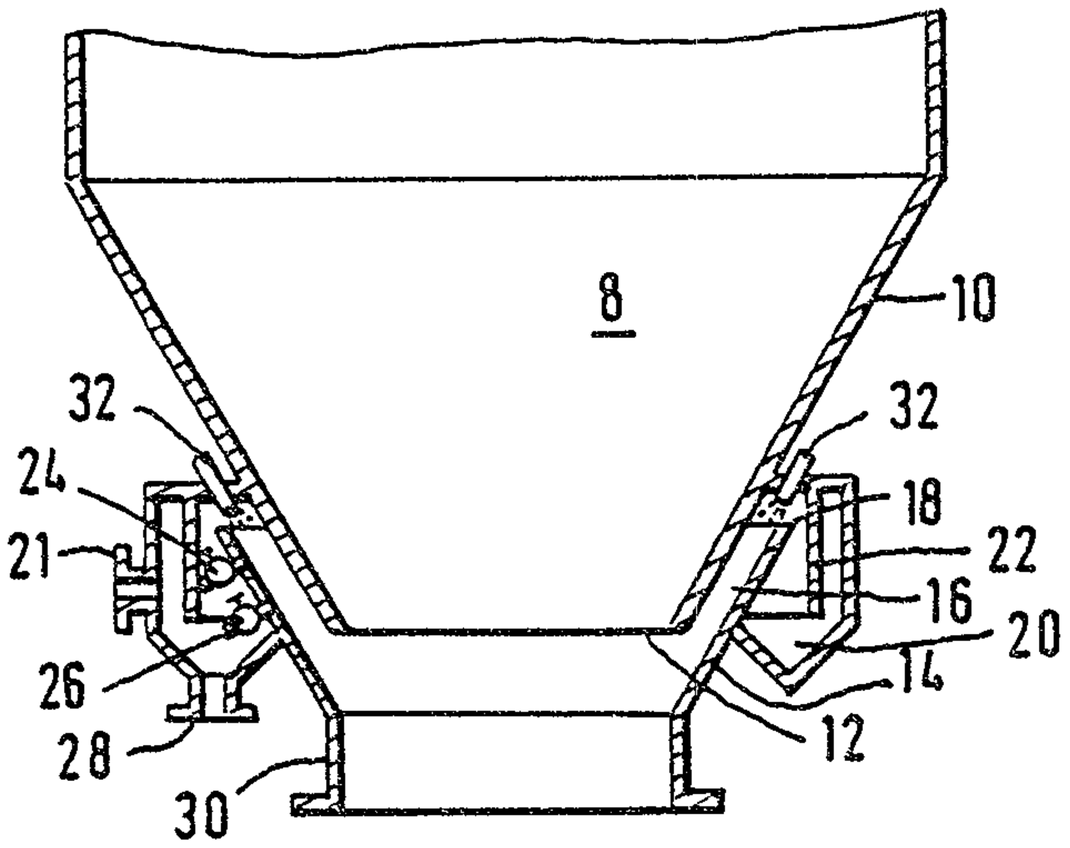


FIG. 1

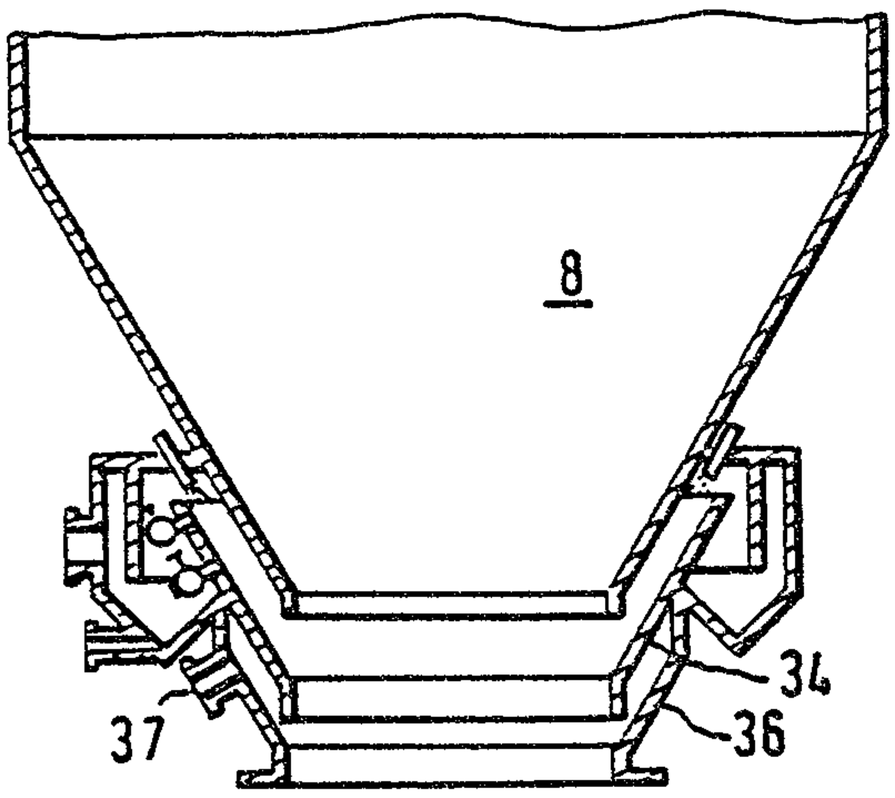


FIG. 2

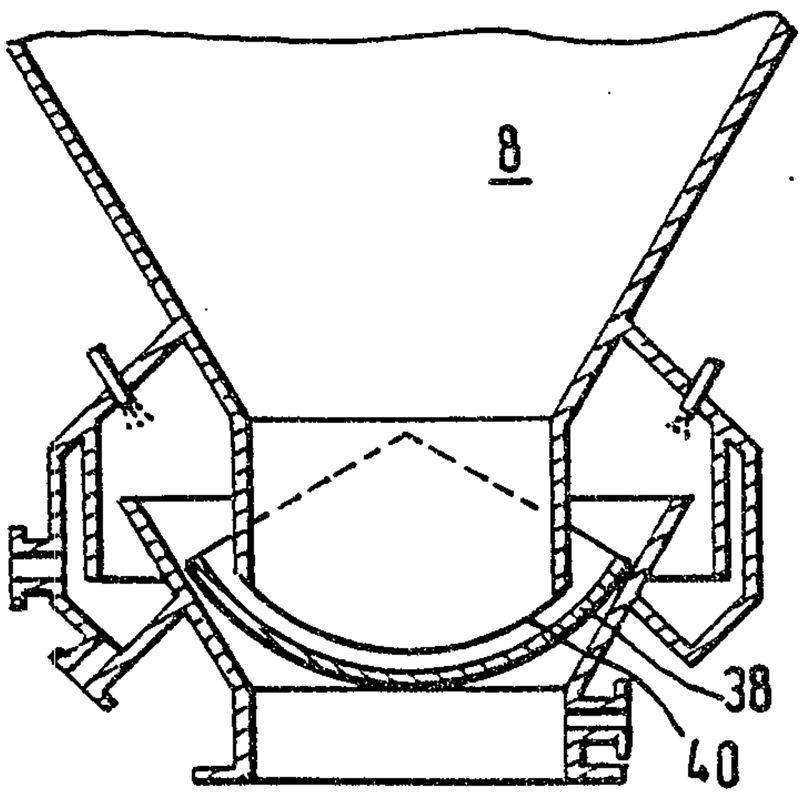


FIG. 3

Agents for the Applicant/s

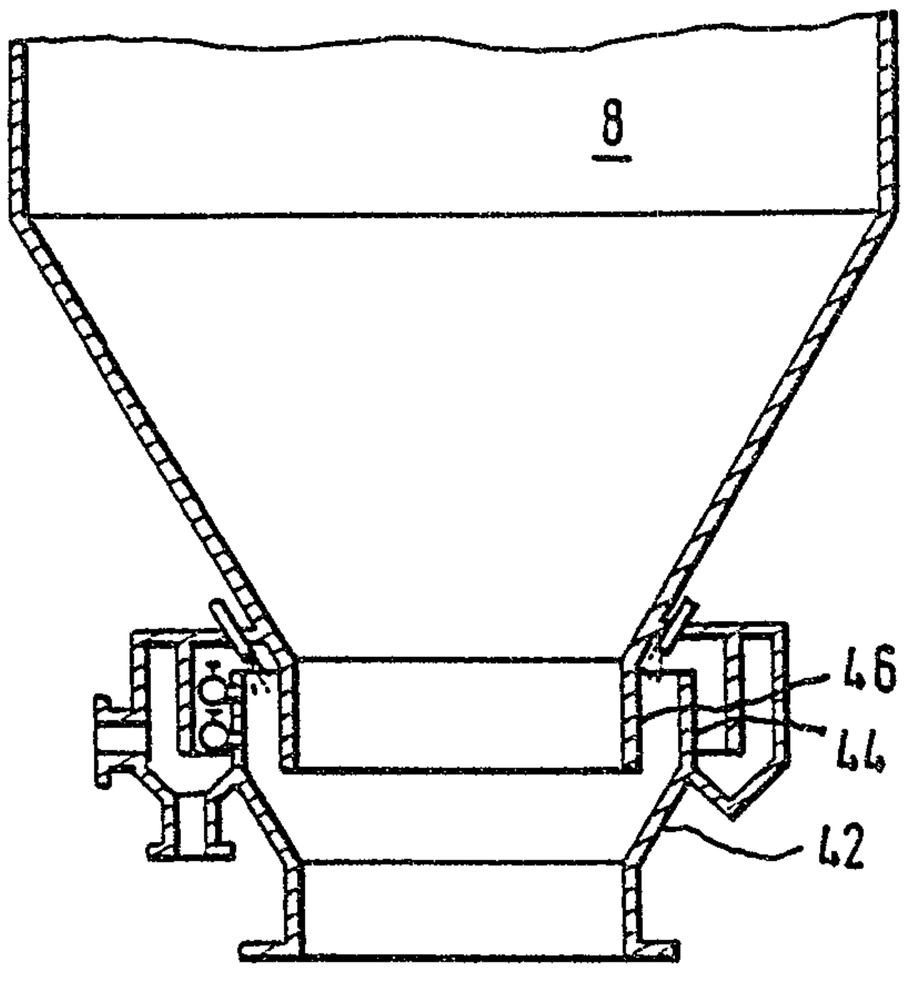


FIG. 4

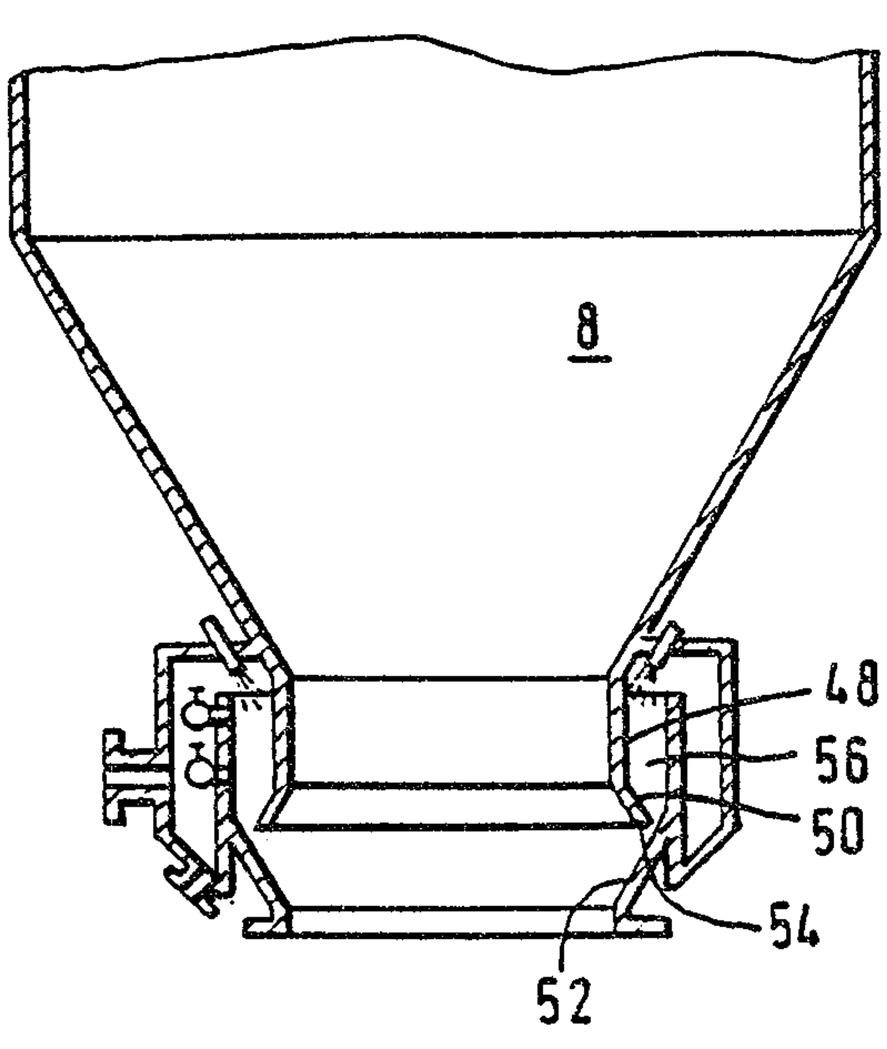


FIG. 5

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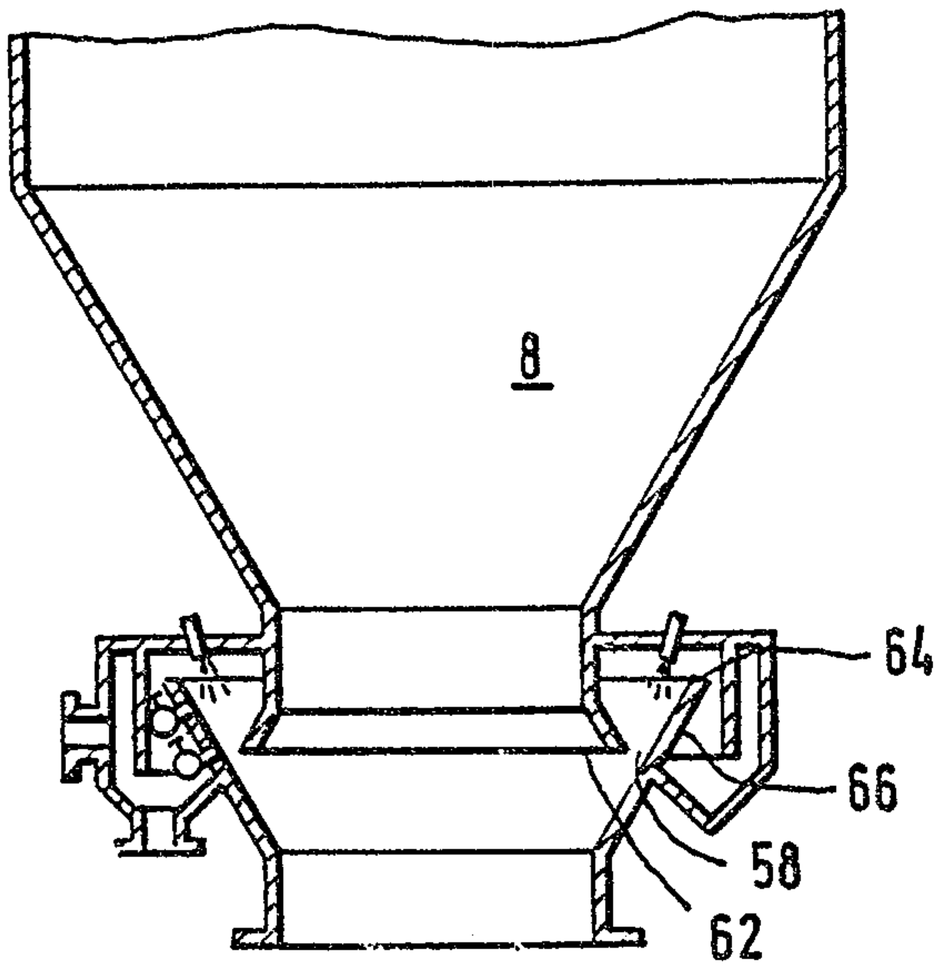

FIG.6

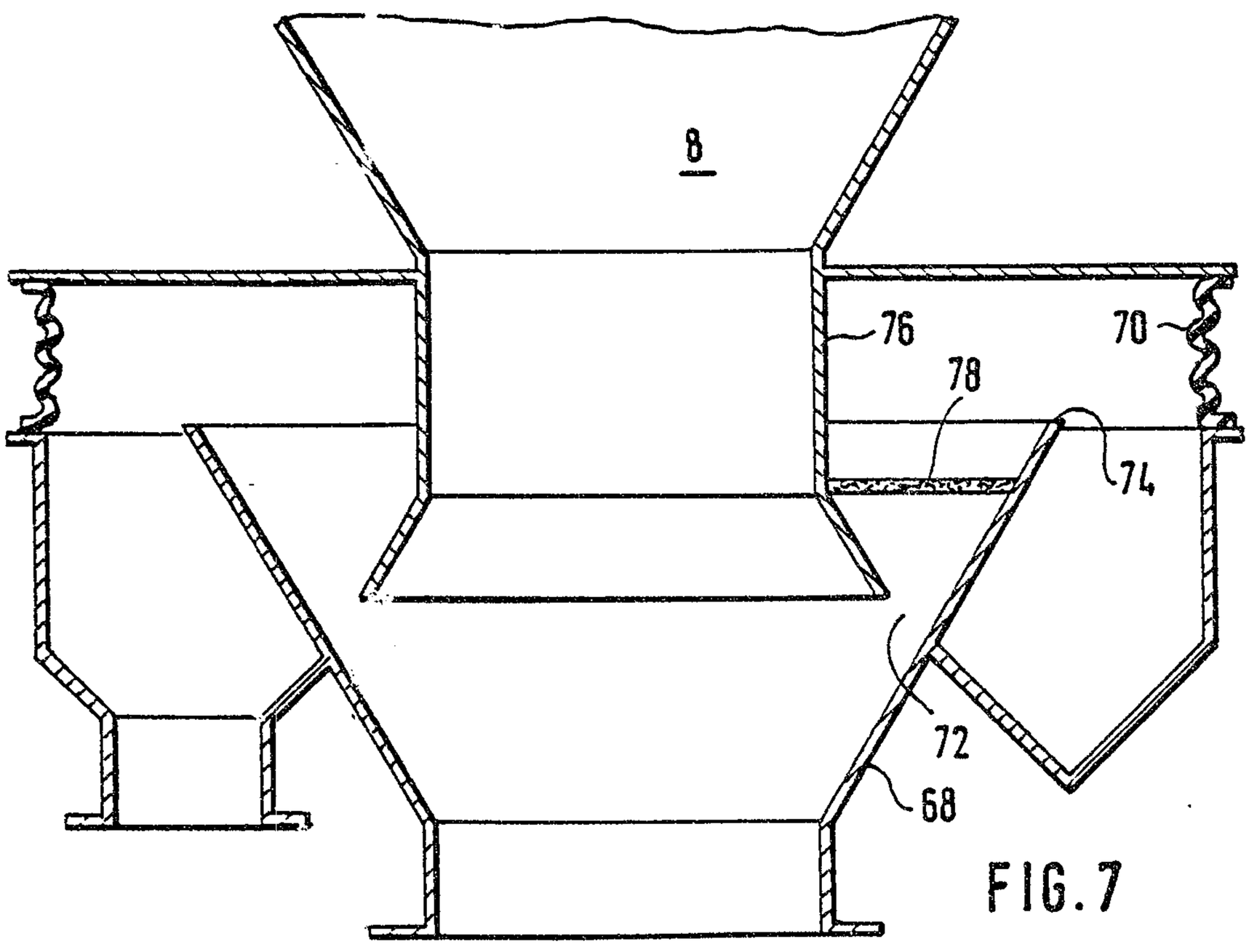

FIG.7

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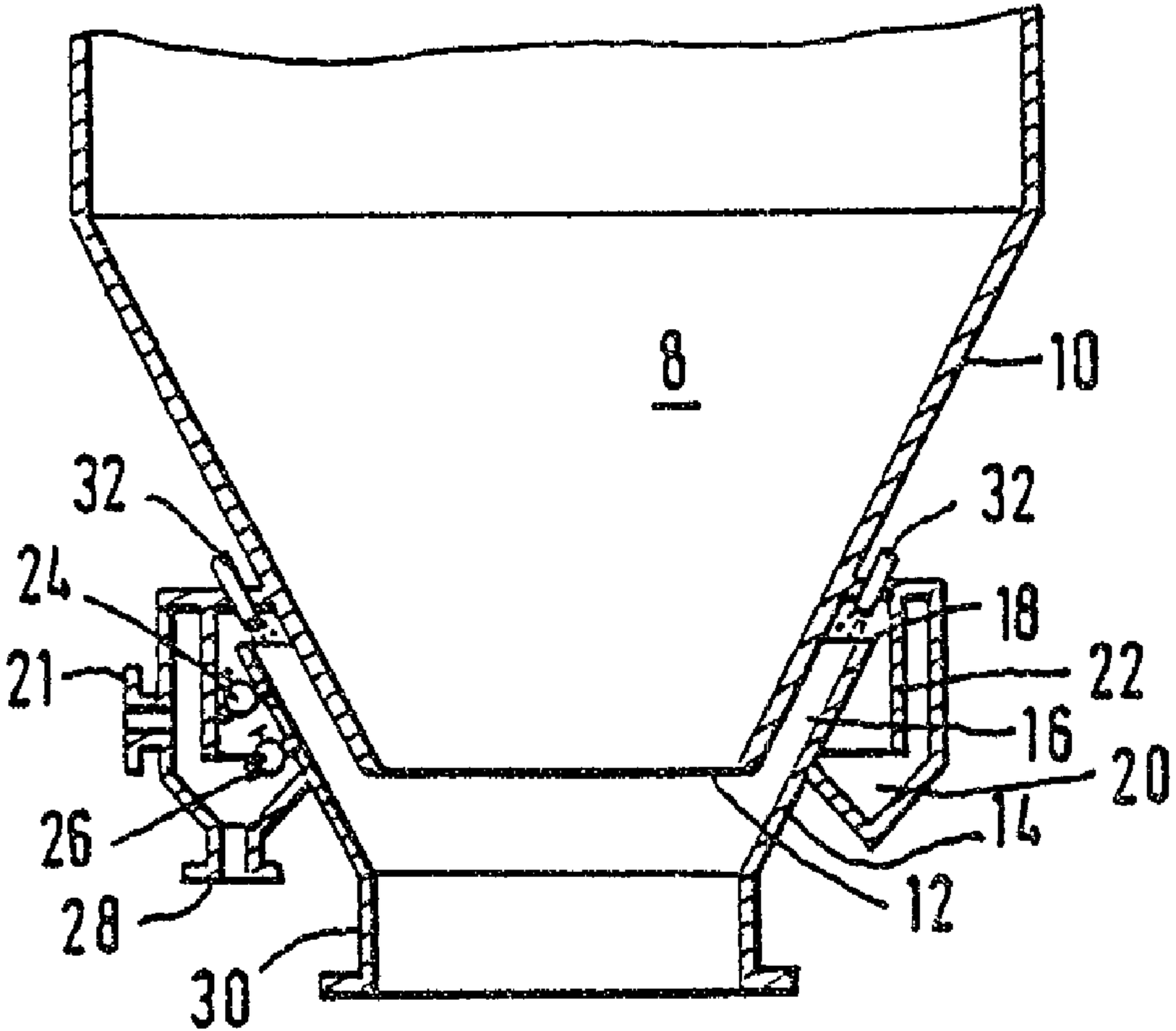
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