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"A waste treatment system"

Introduction

The invention relates to a method an apparatus for treating sludge-type waste material having a
5 solids content of from 6% to 25%.

Large quantities of sludge with low levels of solids present major treatment and disposal
problems for a wide range of industries and public authorities. Various treatment systems are
used, however in general these are either very costly or do not efficiently and effectively deal
10 with the waste material.

This invention is directed towards providing an improved method and apparatus to effectively
and efficiently treat such waste materials.

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Statements of Invention

According to the invention there is provided a method for treating waste material having a solids
content of less than about 22% comprising the steps of:-

- 20 directing waste having a solids content of less than 22% into an infeed tank;
- conveying the waste in the tank to an outlet from the infeed tank using a screw conveyor;
- conveying the waste from the outlet of the infeed tank to a feed hopper using a screw
25 conveyor;
- delivering the waste from the feed hopper onto a conveyor;
- exposing the waste on the conveyor to microwaves;
- 30 applying heat to the waste on the conveyor to evaporate moisture;
- collecting the evaporated moisture;

filtering the evaporated moisture; and

discharging the dried waste.

- 5 In one embodiment the waste has a solids content of at least 10%. Usually the waste has a solids content of about 15%.

In one embodiment the waste is directed from a trailer into the infeed tank. Preferably the waste is directed from a trailer by gravity into the infeed tank.

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In one embodiment the method comprises coarse filtering the waste prior to delivery into the infeed tank.

15 The waste in the infeed tank may be conveyed to the infeed tank outlet by a plurality of screw conveyors.

The method may comprise spreading the waste across the conveyor for exposure to microwaves. In one arrangement the conveyor comprises an infeed conveyor and a main conveyor and the method comprises spreading the waste across the infeed conveyor.

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In one embodiment the method comprises the step of in-line cleaning the conveyor after discharge of dried waste. The conveyor is preferably cleaned by leading the conveyor over a brush means.

- 25 In one embodiment the evaporated moisture is passed through a filtration bed. The method preferably comprises collecting condensate from the filtration bed and treating the collected condensate. In one arrangement the filtration bed is supported on a mesh floor through which evaporated moisture is led.

- 30 In one embodiment dried waste is discharged into a trailer. Dried waste may be discharged directly from the heater into a trailer.

In another aspect the waste has a solids content of less than 15% and the method comprises the steps of:-

delivering the waste into a separator; and

5 separating the proportion of the moisture from the waste to increase the solids content of the waste prior to delivery into the infeed tank.

In this case the solids content of the waste from the separator may be at least 18%. Waste may be delivered to the separator from a tanker. In one case waste is delivered directly from the tanker into the separator.

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In a further aspect the invention provides a waste treatment system for treating waste material with a solids content of less than about 22% comprising:-

15 an infeed tank for waste having a solids content of less than 22%, the infeed tank having an inlet and inlet feed conveying means comprising a screw conveyor for conveying waste to an outlet of the tank;

a feed hopper;

20 waste conveying means comprising a screw conveyor for conveying waste from the infeed tank outlet to the feed hopper;

delivery means for delivering waste from the feed hopper to a conveyor;

25 microwave means for exposing waste on the conveyor to microwaves;

heating means for heating the microwaved waste;

filtration means for filtering evaporated moisture removed from the waste; and

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discharge means for discharge of dried waste.

The inlet feed screw conveyor may be located at a base of the tank for delivery of waste to the outlet of the infeed tank.

In one embodiment the inlet feed conveying means comprises a plurality of screw conveyors.

5 In one embodiment the infeed tank comprises a base, sidewall means extending upwardly from the base, and a top defining a waste inlet opening which is closable by a lid. The sidewall means adjacent the top opening is preferably sloped to direct waste to the base of the infeed tank.

In one embodiment a coarse filter is provided at the infeed tank inlet.

10 The system may comprise ram means for operating the lid and interlock means to prevent unauthorised opening of the lid.

In one embodiment the base is sloped upwardly from the inlet end to the outlet from the infeed tank.

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The invention also provides an infeed tank for a waste treatment plant, the infeed tank having at least some of the features herein described.

The invention also provides dried waste when treated by a method of the invention.

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Brief Description of the Drawings

The invention will be more clearly understood from the following description of an embodiment thereof, given by way of example only, in which: -

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Fig. 1 is a plan view of a waste treatment system according to the invention;

Fig. 2 is a side cross sectional view of an infeed tank used in the system of the invention;

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Fig. 3 is a top plan view of a portion of the infeed tank of Fig. 2;

Fig. 4 is a perspective view of portion of the inlet of the infeed tank;

Fig. 5 is a perspective view of waste being delivered to a conveyor for exposure to microwaves;

Fig. 6 is a perspective view illustrating the cleaning of the microwave conveyor belt;

Fig. 7 is a perspective view illustrating the discharge of dried waste; and

Fig. 8 is a perspective view of an evaporated moisture treatment unit used in the system of the invention.

Detailed Description

Referring to the drawings and initially to Fig. 1 there is illustrated a system 1 and method for treating waste material with a high moisture content. The solids content of the waste sludge is typically less than 22% and may be as low as 6%.

In the case of waste with a solids content of typically 15% to 22% the waste is delivered to the treatment facility by a trailer 2 which discharges the waste into an infeed tank 3. Dried waste material treated by the system and method of the invention is preferably discharged directly into an outfeed trailer 4 to be transported to a disposal or further treatment location. The system 1 ensures that the waste is quickly and efficiently handled and treated and is processed without a requirement for storage facilities at the treatment location.

The waste is processed by first treatment in multiple stages with microwaves which kill substantially all pathogens and the waste is then dried in a direct heater 10 prior to discharge directly into the output trailer 4. Steam generated in the microwave and drying stages is directed to a separation and filtration unit 15.

Referring to Fig. 2, the infeed tank 3 a large capacity tank (about 45 tons) and is generally rectilinear in plan view and comprises a base 20 and side walls which define a top at the upper edge thereof. The top has a sludge inlet 22 closable by a ram operated lid 23. An interlock is provided to prevent unauthorised opening of the lid such as by operation of the ram. Sludge is delivered into the infeed tank 3 in the direction of the arrows from a tipper trailer 2. The tank 3 is below ground level so that the truck 2 can reverse up to the top of the tank and, an opening of

the lid 23, deliver sludge into the tank 3. The sludge inlet 22 is covered by a coarse filter 21 to ensure that no debris enters the infeed tank 3. The side wall 25 closest to the sludge inlet 23 is sloped to ensure free flow of sludge to the base of the tank 3. The base 20 is sloped upwardly from the inlet end towards the outlet 28. Six discharge screw conveyors 27 are located at the bottom of the tank 3 to deliver the sludge to a discharge outlet 28 from which the sludge is delivered on demand by another series of screws 29a, 29b, 29c to an intermediate feed hopper 30 from which the sludge is delivered to the treatment system.

Waste from the feed hopper 30 is delivered onto an infeed conveyor belt 31 by a screw conveyor 32. The waste is spread evenly across the infeed conveyor belt 31 which delivers the waste onto a main conveyor belt 33. The waste on the conveyor 33 is led through multiple, in this case six, microwave treatments 35. A microwave treatment system is described in detail in US 6,618,957. The microwaves subject the waste material to high frequency radio waves in the ultra high frequency band. The pathogens and polar water molecules in the waste material attempt to align themselves with the oscillating electric field at a frequency of 915 MHz. However, the pathogens or molecules within the pathogens cannot align themselves synchronously with a resultant atmosphere of excitement which causes the pathogens to explode structurally. Water molecules attached to the pathogens are released in the form of water vapour into a heated chamber.

After microwave treatment as described, the conveyor 33 delivers waste to the direct heating station 10 at which heat is directed to the waste to dry the waste.

The main conveyor 33 is in the form of a belt comprising a number of interlinked sections for ease and economic replacement. After discharge of dried waste the belt is cleaned by passing it over brushes 50 [Fig. 6].

Referring in particular to Fig. 8, there is illustrated the separation and filtration unit 15 used in the waste treatment system of the invention. Steam generated during the treatment process is collected and delivered by a delivery pipe 55 to the bottom of the filtration unit 15. A filtration medium in the form of a bed of activated carbon is supported on a mesh floor (not shown) above a lower steam inlet 56. Condensate is collected for further treatment.

In the case of sludge with a solids content of 6% to 15%, the sludge is delivered by a pump directly from a tanker into a pre-treatment separator which may be in the form of a decanter or centrifuge. The separator processes the sludge to increase the solids content to above 15%, typically from 16% to 22%. The pre-treated waste is discharged from the separator onto a
5 conveyor which delivers the waste into the infeed tank 3.

The invention provides a waste treatment system and method which is highly efficient at killing pathogens and drying the waste. The system is capable of handling waste with a wide range of solids content and the resultant waste is substantially free from pathogens and is dried to
10 typically an 80% solids content. Incoming untreated waste and outgoing treatment waste is quickly and efficiently received and discharged, respectively so that on-site storage is minimised.

The invention is not limited to the embodiments hereinbefore described which may be varied in detail.

Claims

1. A method for treating waste material having a solids content of less than about 22% comprising the steps of:-

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directing waste having a solids content of less than 22% into an infeed tank;

conveying the waste in the tank to an outlet from the infeed tank using a screw conveyor;

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conveying the waste from the outlet of the infeed tank to a feed hopper using a screw conveyor;

delivering the waste from the feed hopper onto a conveyor;

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exposing the waste on the conveyor to microwaves;

applying the heat to the waste on the conveyor to evaporate moisture;

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collecting the evaporated moisture;

filtering the evaporated moisture; and

discharging the dried waste.

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2. A method as claimed in claim 1 wherein the waste has a solids content of at least 10%.

3. A method as claimed in claim 1 or 2 wherein the waste had a solids content of about 15%.

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4. A method as claimed in any preceding claim wherein the waste is directed from a trailer into the infeed tank.

5. A method as claimed in claim 4 wherein the waste is directed from a trailer by gravity into the infeed tank.
6. A method as claimed in any preceding claim comprising coarse filtering the waste prior to delivery into the infeed tank.
7. A method as claimed in any of claims 1 to 6 wherein the waste in the infeed tank is conveyed to the infeed tank outlet by a plurality of screw conveyors.
8. A method as claimed in any preceding claim comprising spreading the waste across the conveyor for exposure to microwaves.
9. A method as claimed in claim 8 wherein the conveyor comprises an infeed conveyor and a main conveyor and the method comprises spreading the waste across the infeed conveyor.
10. A method as claimed in any of claims 1 to 9 comprising the step of in-line cleaning the conveyor after discharge of dried waste.
11. A method as claimed in claim 10 wherein the conveyor is cleaned by leading the conveyor over a brush means.
12. A method as claimed in any preceding claim wherein the evaporated moisture is passed through a filtration bed.
13. A method as claimed in claim 12 comprising collecting condensate from the filtration bed and treating the collected condensate.
14. A method as claimed in claim 12 or 13 wherein the filtration bed is supported on a mesh floor through which evaporated moisture is led.
15. A method as claimed in any preceding claim wherein dried waste is discharged into a trailer.

16. A method as claimed in claim 15 wherein dried waste is discharged directly from the heater into a trailer.

17. A method as claimed in claim 1 wherein the waste has a solids content of less than 15% and the method comprises the steps of:-

delivering the waste into a separator; and

separating the proportion of the moisture from the waste to increase the solids content of the waste prior to delivery into the infeed tank.

18. A method as claimed in claim 17 wherein the solids content of the waste from the separator is at least 18%.

19. A method as claimed in claim 17 or 18 wherein waste is delivered to the separator from a tanker.

20. A method as claimed in claim 19 wherein waste is delivered directly from the tanker into the separator.

21. A method for treating waste substantially as hereinbefore described with reference to the accompanying drawings.

22. A waste treatment system for treating waste material with a solids content of less than about 22% comprising:-

an infeed tank for waste having a solids content of less than 22%, the infeed tank having an inlet and inlet feed conveying means comprising a screw conveyor for conveying waste to an outlet of the tank;

a feed hopper;

waste conveying means comprising a screw conveyor for conveying waste from the infeed tank outlet to the feed hopper;

delivery means for delivering waste from the feed hopper to a conveyor;

microwave means for exposing waste on the conveyor to microwaves;

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heating means for heating the microwaved waste;

filtration means for filtering evaporated moisture removed from the waste; and

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discharge means for discharge of dried waste.

23. A waste treatment system as claimed in claim 22 wherein the inlet feed screw conveyor is located at a base of the tank for delivery of waste to the outlet of the infeed tank.

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24. A waste treatment system as claimed in claim 22 or 23 wherein the inlet feed conveying means comprising a plurality of screw conveyors.

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25. A waste treatment system as claimed in any of claims 22 to 24 wherein the infeed tank comprises a base, sidewall means extending upwardly from the base, and a top defining a waste inlet opening which is closable by a lid.

26. A waste treatment system as claimed in claim 25 wherein the sidewall means adjacent the top opening is sloped to direct waste to the base of the infeed tank.

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27. A waste treatment system as claimed in claim 25 or 26 wherein a coarse filter is provided at the infeed tank inlet.

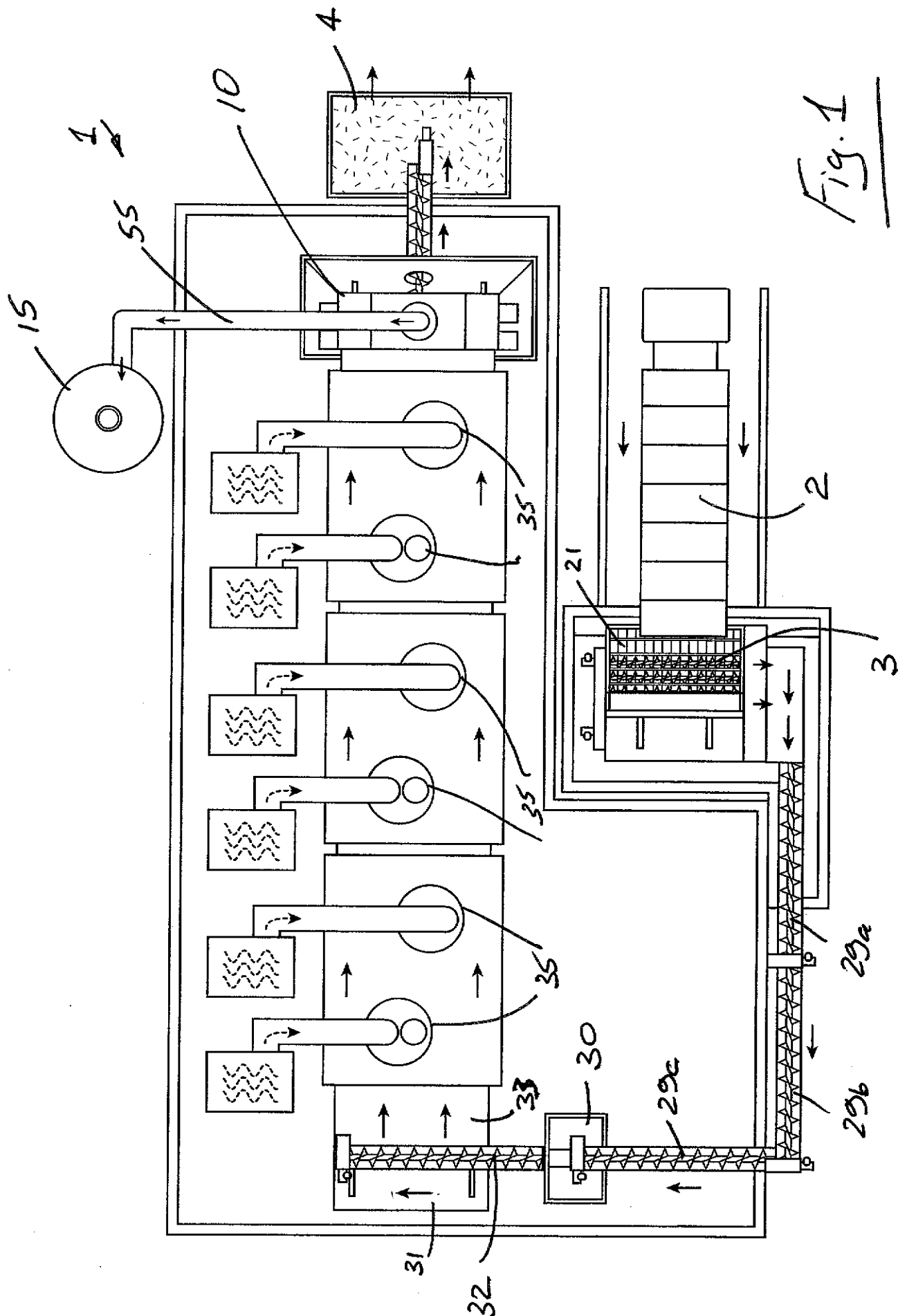
28. A waste treatment system as claimed in any of claims 25 to 27 comprising ram means for operating the lid and interlock means to prevent unauthorised opening of the lid.

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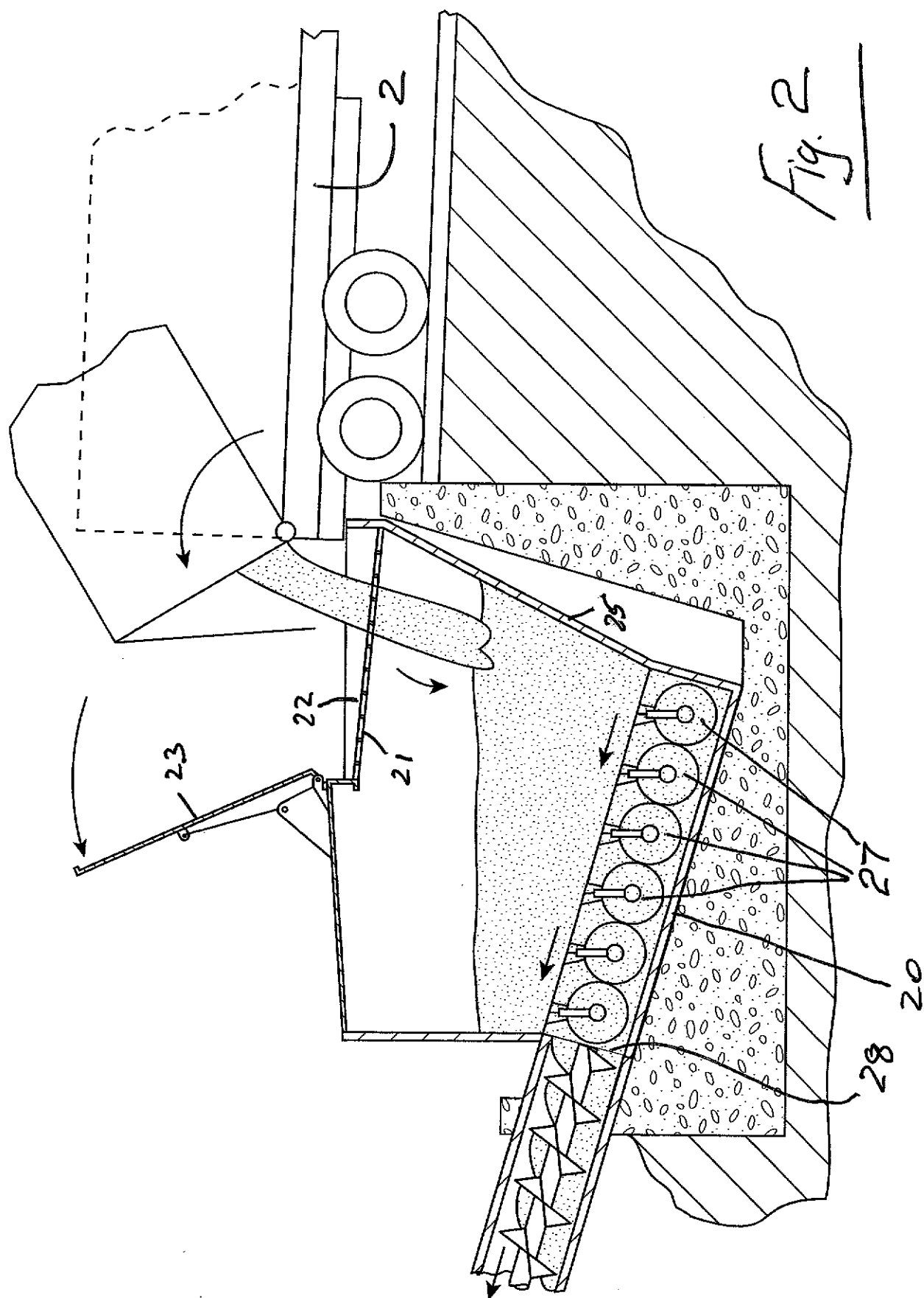
29. A waste treatment system as claimed in any of claims 25 to 28 wherein the base is sloped upwardly from the inlet end to the outlet from the infeed tank.

30. A waste treatment system substantially as hereinbefore described with reference to the accompanying drawings.

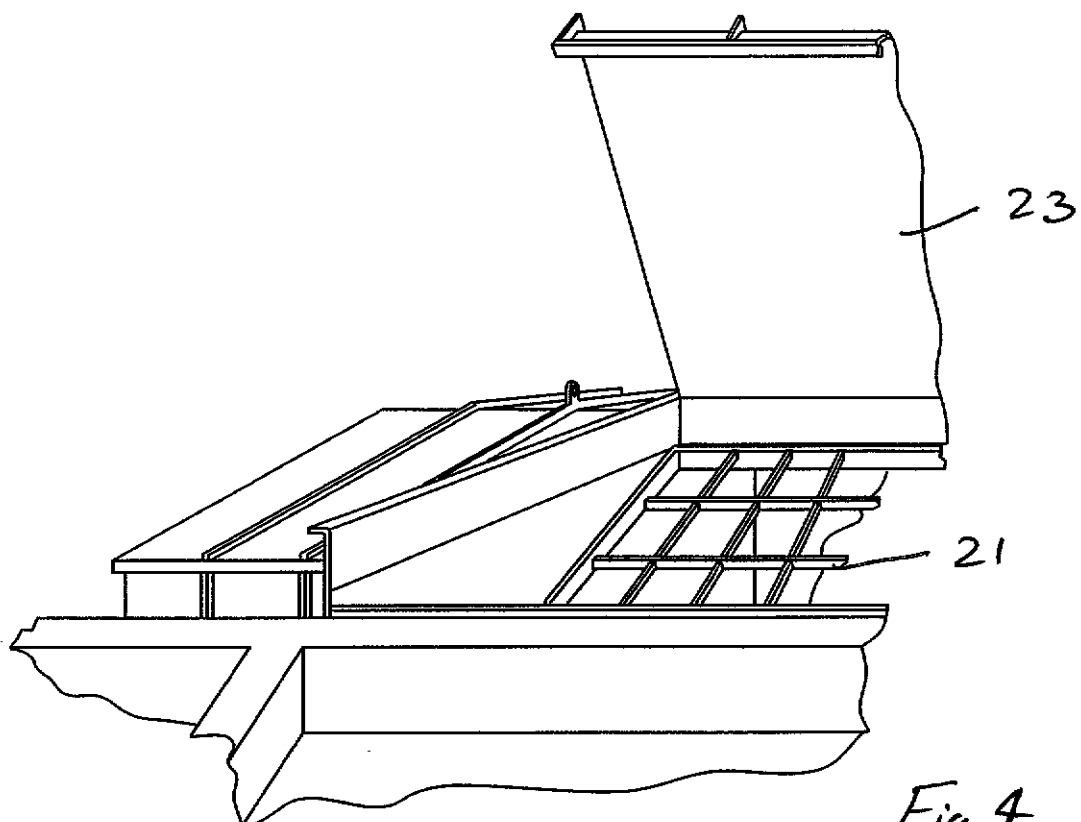
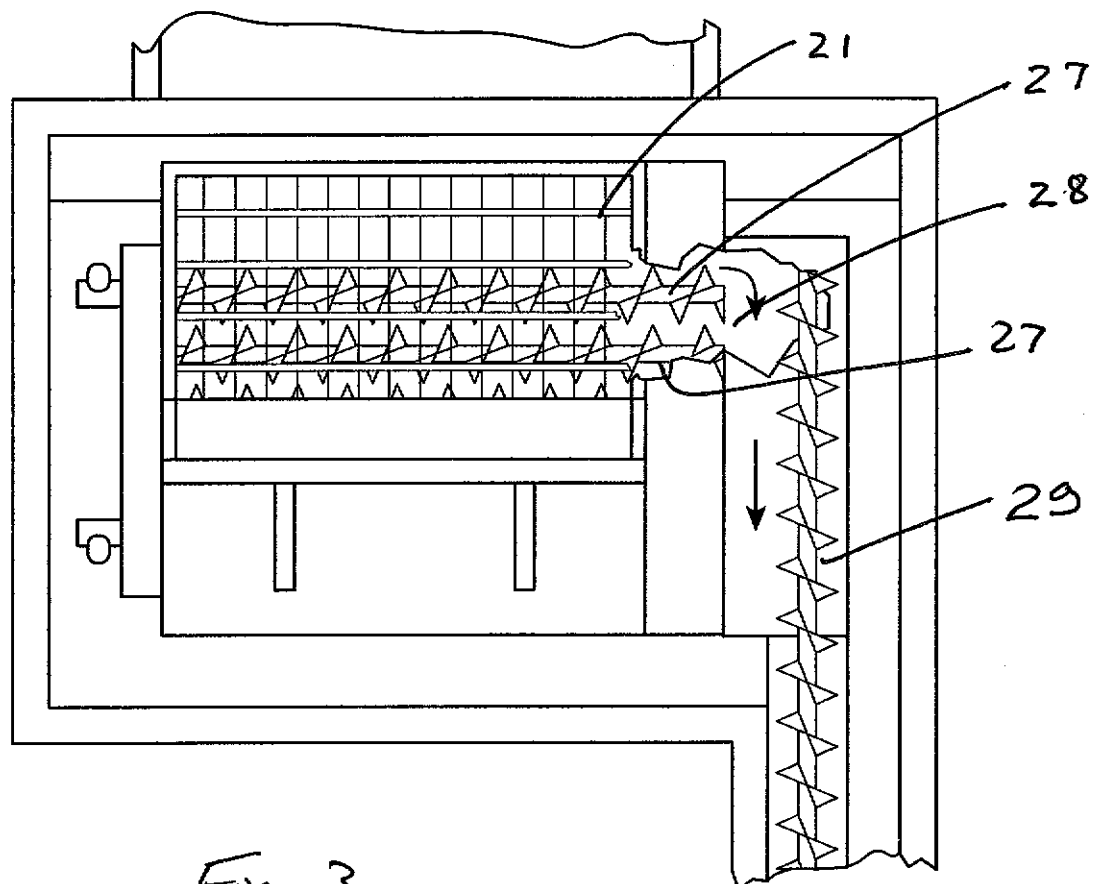
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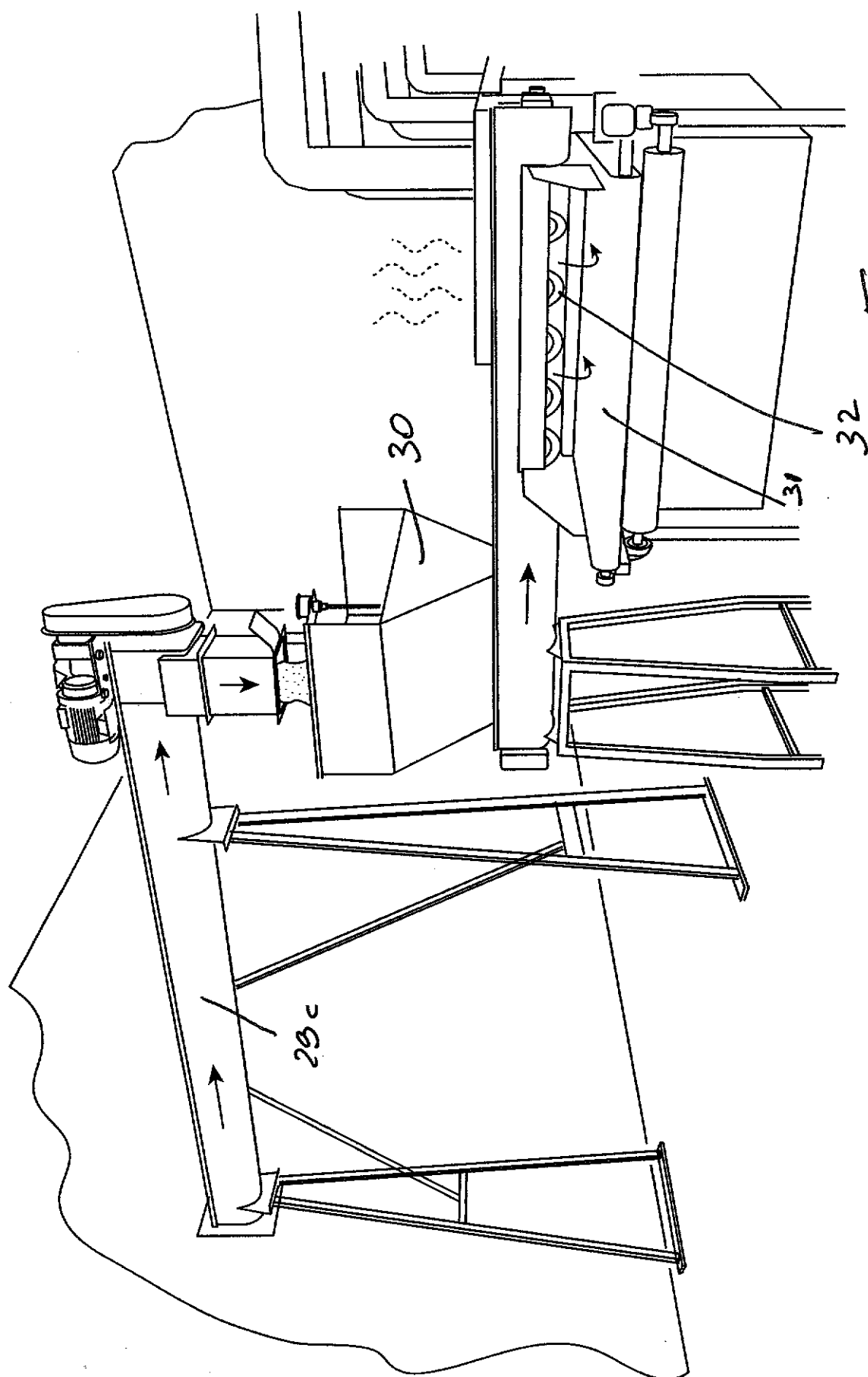
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Fig. 4Fig. 3

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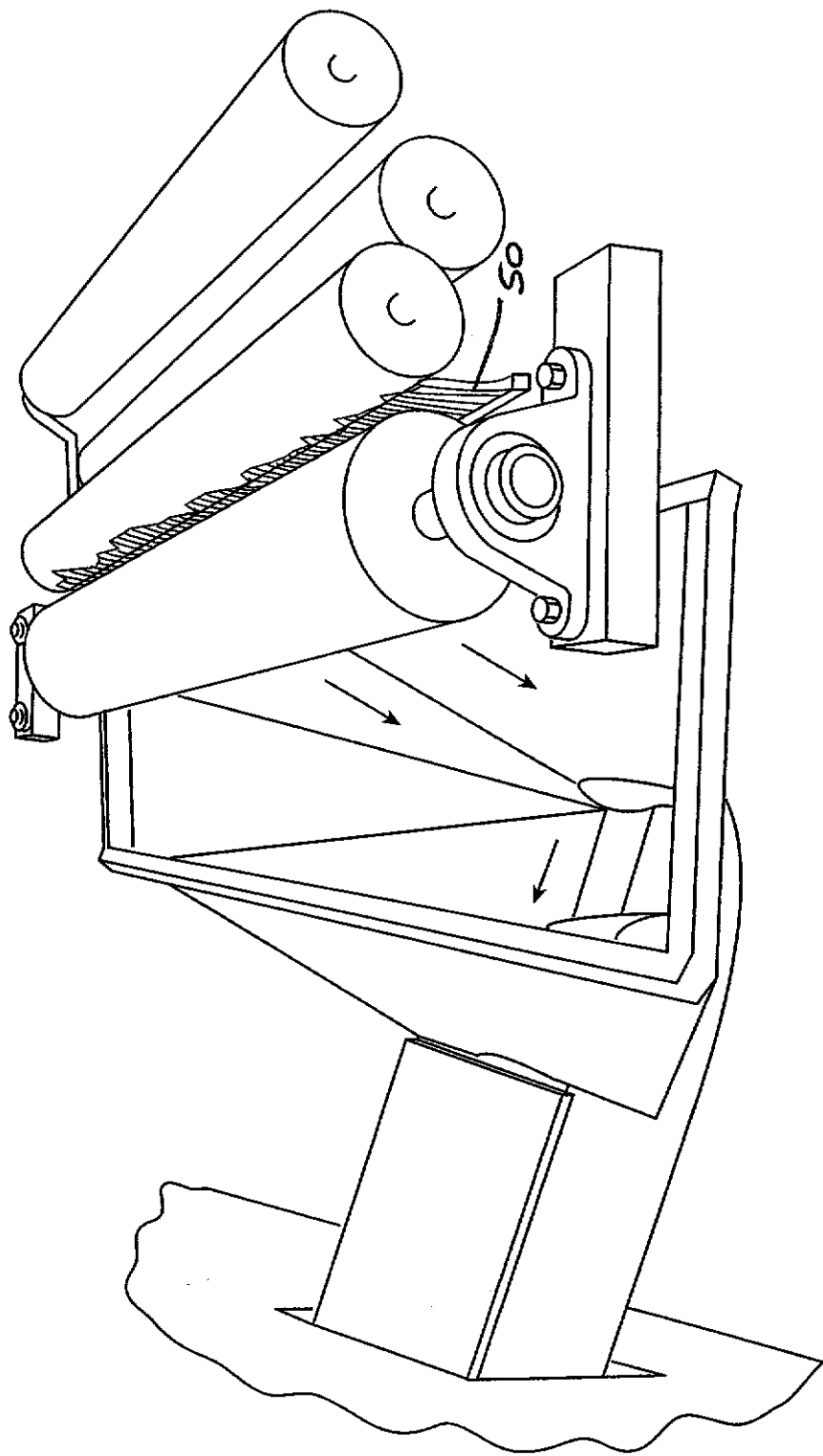
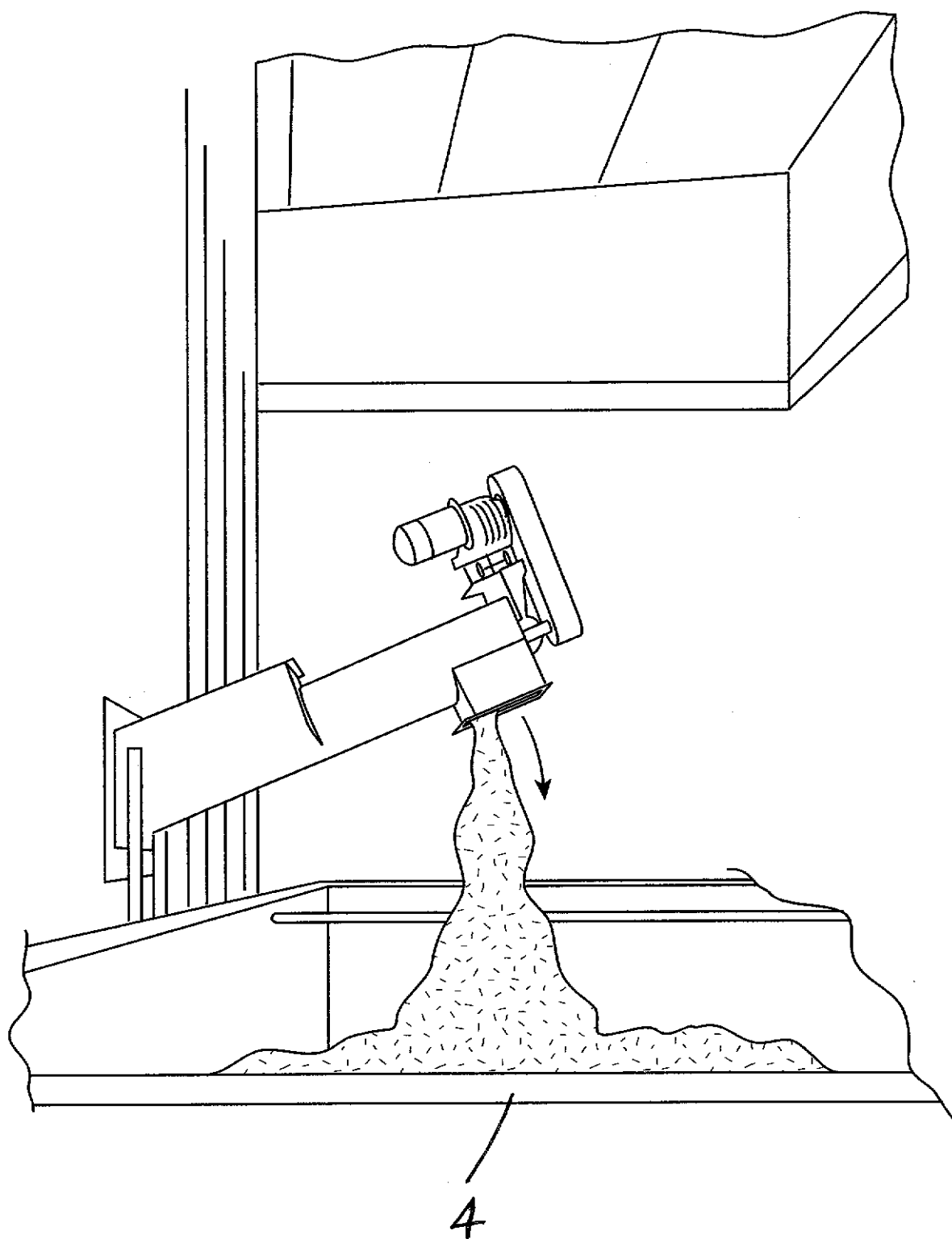
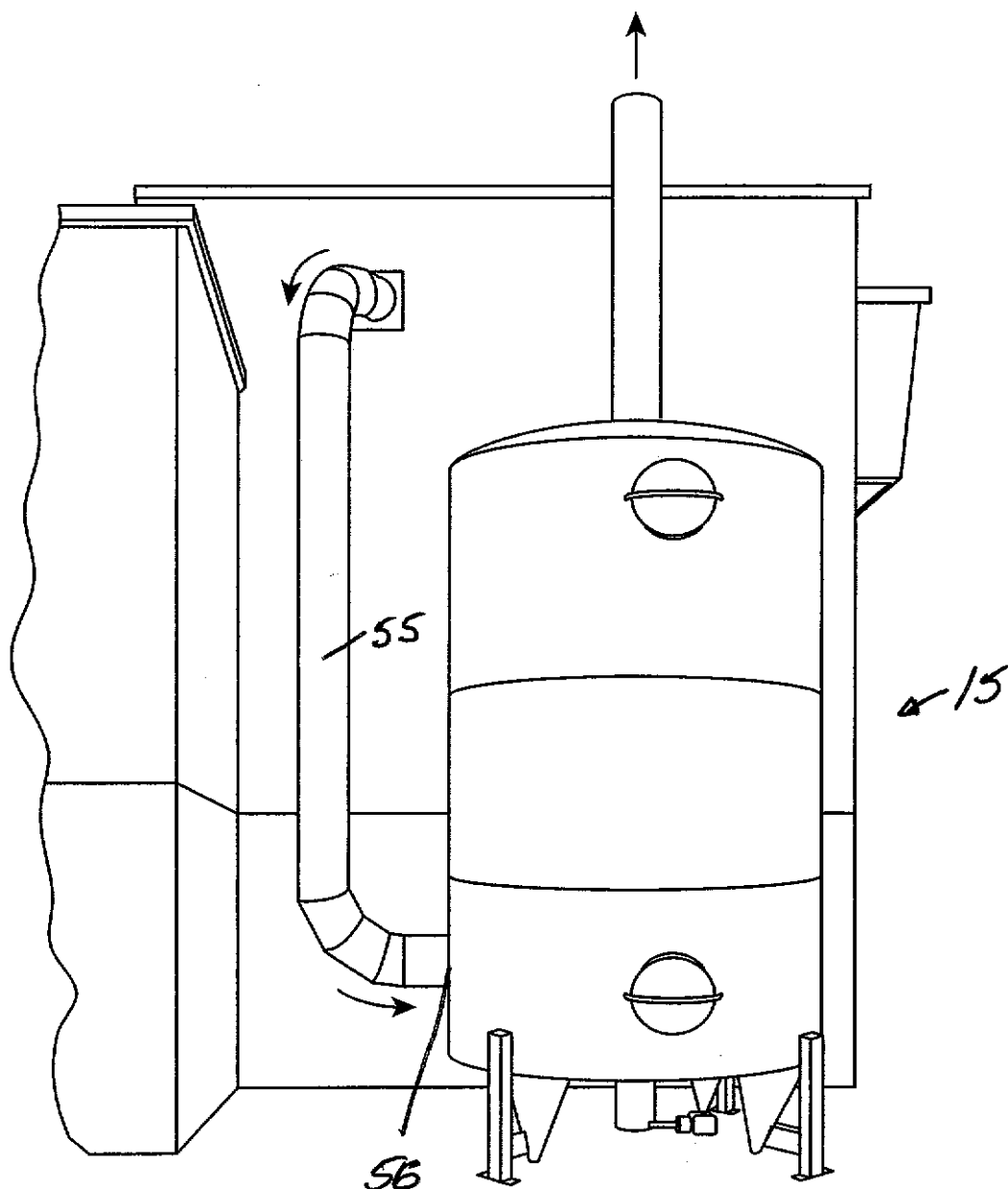


Fig. 6.

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Fig. 7

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Fig. 8