(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 188 489 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
20.03.2002 Bulletin 2002/12

(51) Int Cl.[7]: **B07B 1/46**, B07B 1/15

(21) Application number: **01116909.1**

(22) Date of filing: **11.07.2001**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **13.09.2000 IT MI001996**

(71) Applicant: **Ionics Italba S.P.A.**
20126 Milano (IT)

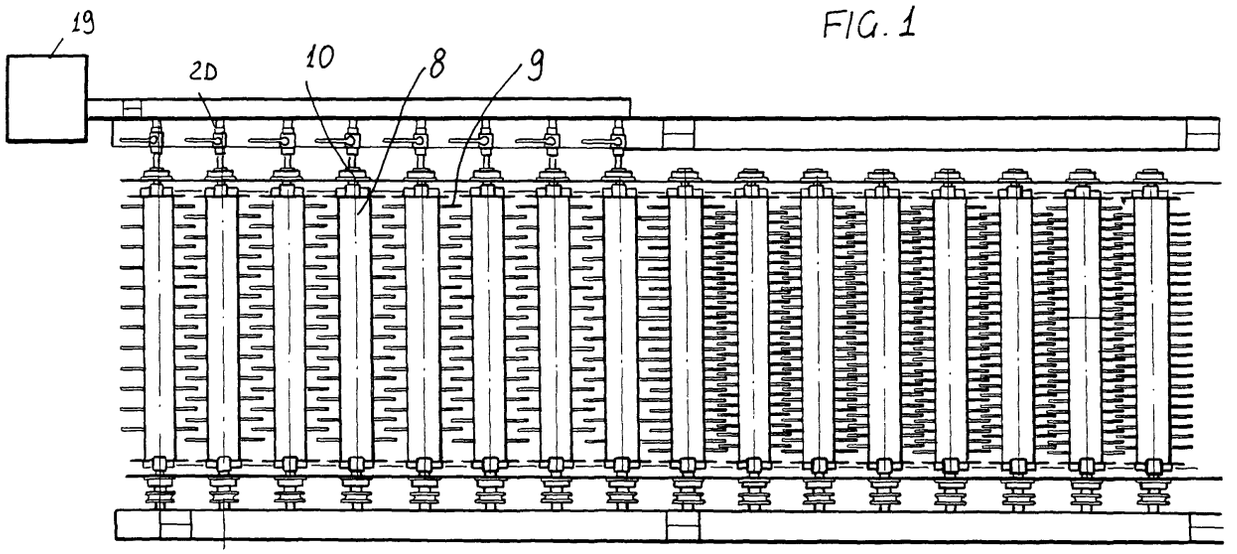
(72) Inventors:
- **Greghi, Renzo**
  20146 Milano (IT)
- **Chiesa, Fausto**
  25131 Brescia (IT)

(74) Representative: **Cicogna, Franco**
Ufficio Internazionale Brevetti
Dott.Prof. Franco Cicogna
Via Visconti di Modrone, 14/A
20122 Milano (IT)

(54) Sieving apparatus for biomass

(57) The present invention relates to a sieving apparatus for separating three fractions: a compost, a lignocellulosic material and a plastics material, deriving from a stabilizing process in which biomasses coming from a differentiated collection or other collections in general are stabilized, characterized in that said apparatus comprises a fixed construction (2), a supporting framework (3) which can be differently inclined by hydraulic cylinders (4) controlled by an hydraulic central control unit (5), a first sieving section (6), a second sieving section (7), and collecting and conveying belts (11), (12) and (13).

FIG. 1



EP 1 188 489 A2

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a sieving apparatus for separating three fractions: a compost, a lignocellulosic material and a plastics material, deriving from a stabilizing process in which biomasses coming from a differentiated collection or other collections in general are stabilized.

[0002] As is known, a very important problem in managing or handling waste in general, is that of properly sieving or sorting the collected materials, to allow the most part of said collected materials, as properly sieved, to be recycled, for saving available resources and, in a broad application, for better exploiting natural resources.

[0003] The at present adopted solutions for separating the three fractions: compost material, lignocellulosic material and plastics material, provide to use two different apparatus, arranged in a series relationship, i.e. one after the other, for performing the therein below disclosed operations.

[0004] More specifically, the first apparatus separates only the compost material or fraction from the material portion including the lignocellulosic and plastics materials.

[0005] The second apparatus processes the remaining waste and separates the lignocellulosic material fraction from the plastic material fraction.

[0006] The first apparatus conventionally consists of a sieving assembly, the sieving device of which comprises a rotary cylinder.

[0007] A conveyor belt continuously supplies the material to be sieved into the cylinder which is divided into two sections: a central sieving section and two side supporting and rolling sections, arranged at the end portions of the sieving section.

[0008] The cylinder is provided, at the sieving section, with ports therethrough the compost fraction is caused to pass.

[0009] The lignocellulosic and plastics fractions, however, do not pass through the mentioned ports and are supplied to the second apparatus to be subjected to a further separation.

[0010] The second apparatus is an air controlled separator, the sieving device of which comprises a separating chamber in which one or more fans, or one or more sucking devices, provide an upwardly directed air stream.

[0011] Under an upward flowing air stream condition, the plastics materials are separated by the lignocellulosic fraction because of a weight difference.

[0012] In particular, the separated lignocellulosic fraction will deposit on an ejector belt, removing said separated lignocellulosic fraction from said processing chamber to the outside.

[0013] However, the above prior art apparatus are affected by some drawbacks, mainly with respect to the operating standpoint.

[0014] In particular, the main difficult depends on the non homogeneous nature of the material to be processed.

[0015] In fact, the material, depending on the fact that it is derived from the biomass stabilizing process or not, has very different material features, such as moisture content, particle size and composition rates.

[0016] In order to operate in very different operating conditions, as required, it is necessary to replace the sieving cylinder of the first apparatus, in order to change the size of the supplying ports and/or that of the fittings arranged inside said cylinder.

[0017] With respect to the second apparatus, it is necessary to modify the amount of air intervening into the separating process.

[0018] The drawbacks deriving from the above mentioned modifications consist of preferably three drawbacks.

[0019] The first is that the operation of the apparatus must be stopped during the disassembling and replacing steps in which the sieving cylinder is disassembled and replaced.

[0020] The second drawback is that it is necessary to use very large amount of air which are necessary from separating the plastics fraction from the lignocellulosic fraction, which negatively affects the outside environment because of the large mass of power driven by the circulating air.

[0021] The third drawback is an immediate consequence of the preceding one, which requires the provision of a decanting chamber downstream of the air controlled separator, i.e. a calming chamber, inside of which the plastics fraction, separated from the lignocellulosic fraction, deposits and can be accordingly removed.

SUMMARY OF THE INVENTION

[0022] Accordingly, the aim of the present invention is to provide the ecologic and waste managing field with a sieving apparatus for separating the three fractions: compost, lignocellulosic and plastics materials, deriving from a biomass stabilizing process, in which biomasses coming from a differentiated collection or other collections in general are stabilized.

[0023] Within the scope of the above mentioned aim, a main object of the present invention is to provide a waste processing technology, adapted to provided a quicker and easier adjustment of the intervening elements, to greatly reduce dead times.

[0024] Another object of the present invention is to provide such an apparatus having a high sieving or sorting efficiency, without the requirement of using high amounts of air, which would negatively affect the outside environment.

[0025] Yet another object of the present invention is to reduce to a minimum the system and operating costs,

included that associated with the power consume, with respect to the present technology methods.

[0026] Yet another object of the present invention is to optimize the mechanical construction of the apparatus, to provide a very simple construction and a very high operating reliability.

[0027] Yet another object of the present invention is to provide such a sieving apparatus for separating or sorting the three fractions: compost, lignocellulosic and plastics materials, deriving from a stabilizing process carried out on biomasses coming from a differentiated collection or other collections, which is very competitive from a mere economic standpoint.

[0028] According to one aspect of the present invention, the above mentioned aim and objects, as well as yet other objects, which will become more apparent hereinafter, are achieved by a sieving apparatus for separating the three fractions: compost, lignocellulosic and plastics materials, deriving from a process for stabilizing biomasses coming from a differentiated collection or other collections in general, characterized in that said apparatus comprises a fixed construction, a supporting framework, which can be differently inclined by an hydraulic pressure system, a first sieving section and a second sieving section.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] Further characteristics and advantages of the present invention will become more apparent from the following detailed disclosure of a preferred, though not exclusive, embodiment of a sieving apparatus for separating the three fractions: compost, lignocellulosic and plastics materials, which is illustrated, by way of an indicative, but not limitative, example in the figures of the accompanying drawings, where:

Figure 1 is a top plan view of the apparatus according to the present invention;

Figure 2 is a side view of the apparatus according to the present invention and clearly shows the control devices included in said apparatus, also according to the present invention;

Figure 3 illustrates a diagram of the air distributing system included in the second operating section of the sieving apparatus according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0030] With reference to the number references of the above mentioned figures, the sieving machine for separating the three fractions: compost, lignocellulosic and plastics materials deriving from a process for stabilizing biomasses coming from a differentiated collection or other collections, according to the present invention, and being generally indicated by the reference number 1, comprises a fixed construction 2, a supporting framework 3, which can be differently inclined by hydraulic cylinder 4, driven by an hydraulic central unit 5, a first sieving section 6, a second sieving section 7, and conveyor belts 11, 12, 13.

[0031] The apparatus construction 2 is made of a strong sheet metal material, with bolted cross elements.

[0032] The sieving construction, as is clearly shown in figure 1, is made of a strong sheet metal material with cross elements bolted to the sidewalls, whereas the shafts, indicated by the reference number 8, bear, keyed thereon, a plurality of discs, indicated by the reference number 9, which form the sieving plane.

[0033] More specifically, said shafts 8 are supported by bearings, generally indicated by the reference number 10, and are suitably housed or engaged in seats provided for their rotary movement, and which are rigidly coupled to the sieving construction: said sections being indicated by the reference numbers 6 and 7.

[0034] The adjustment of the operating speed can be carried out in a continuous manner by the operator, with the apparatus being in operation.

[0035] In addition to the set value of the sieving port size, the rotary speed of the discs 9 also affects the time in which the material to be sorted is held in the sieving section and, accordingly, constitutes a parameter which directly determines the sieving efficiency of the apparatus.

[0036] Another technical approach used in designing the three-phase apparatus, in order to make it very flexible and allow to fit said apparatus to different conditions and characteristics of the materials to be sieved such as the moisture content, particle size and partial compost, plastics and lignocellulosic material fractions is the selection of a sieving plane or surface, formed by the sieving discs 9, which can be tilted or adjusted in its inclination, since it bears on the supporting framework 3, the orientation of which can be easily adjusted by the hydraulic cylinders 4 and the hydraulic pressure system under the control of the control center unit 5.

[0037] More specifically, the adjustment of the inclination is also continuous and can be performed during the operation of the apparatus by controls sent by the operator.

[0038] As the rotary speed of the discs 9, also the inclination of the supporting plane 3 is a function affecting the set size of the sieving ports.

[0039] The first sieving section 6 separates the waste materials into two fractions: the fraction called sub-sieved material, including the compost material, passing through the sieving ports, and the fraction called over-sieved material, comprising the lignocellulosic and plastics materials, which does not pass through the sieving ports.

[0040] The second sieving section 7 operates likewise the first sieving section 6, but with sieving ports the size of which are much greater and allow to process the over-sieved material and separate the plastics material fraction from the lignocellulosic material fraction.

[0041] This separation is greatly facilitated by by the use of air which is supplied in a small amount with respect to that supplied in prior similar apparatus.

[0042] This air is delivered according to a specifically designed pattern inside the sieving ports, to prevent the plastics fraction or material from passing through said ports.

[0043] The two sieving sections comprising the sieving assembly, the first of which is indicated by the reference number 6 and the second of which is indicated by the reference number 7, are arranged with a series relationship, one after the other, and are provided with differentiated passage ports, each driven by a dedicated driving motor.

[0044] The section 7, moreover, is very different from the sieving section 6, since said sieving section 7 comprises an air distributing system, for distributing air through the shafts 8.

[0045] The operating principle of this apparatus is based on a dynamic and simultaneously raising and entraining action, to which is subjected the material supplied to the apparatus.

[0046] The action provided on the material by the sieving discs 9, which are rotatively driven, is essentially that of a continuously remixing causing said material to be vibrated as it is pushed toward the outlet.

[0047] This action, moreover, provides a force driving said material upward and then causing said material to fall again on the sliding plane formed by the discs 9; thus, the fine particle size material, i.e. the compost, is forced to pass through the opening ports provided between a disc and another disc of the sieving section 6, to cause said material to be collected on the underlaying belt 11.

[0048] More specifically, the belt 11 underlaying the plane defined by the sieving discs 9 is specifically provided for collecting and conveying to the outside the compost fraction.

[0049] Likewise, the average particle size material, i. e. the lignocellulosic fraction, is forced to pass through the opening ports provided between a disc and another disc of the sieving section 7 to be collected on the underlaying dedicated conveyor belt, generally indicated by the reference number 12.

[0050] The greater size material of the sieving disc port of the sieving section 7, i.e. the plastics fraction or other unesired bodies, is frontward driven in the direction of the outlet and is conveyed on the dedicated underlaying conveyor belt, generally indicated by the reference number 13.

[0051] The above disclosed process continues to cause all the materials to pass through the sieving ports or to be discharged at the end of said sieving plane.

[0052] The air supplied into the sieving section 7 operates to prevent bidimensional bodies, such as plastics material bodies, having a less cross-section, from passing through the sieving ports.

[0053] The air is conveyed inside each shaft 8, by using a conveying lance, generally indicated by the reference number 14, the delivery sector 15 of which is upward facing.

[0054] More specifically, the air distribution or delivering section 16 is defined depending' on the designing parameters, to assure that the air flow is even and upward directed to provide a upward directed air stream sufficient to prevent said plastics material from passing through said sieving ports.

[0055] The rotary elements, that is shafts 8 and discs 9 are driven by driving means, generally indicated by the reference number 17 for the sieving section 6 and by the reference number 18 for the sieving section 7.

[0056] The air distributing section is supplied by a ventilating unit, generally indicated by the reference number 19, controlling the necessary air amount.

[0057] The air being supplied into the individual lances 14 can be modified by operating with the device, generally indicated by the reference number 20 provided for each of said air lances.

[0058] For each said control means generally indicated by the reference numbers 17 and 18, including a respective electric motor, a RPM changing device 20 is provided, to optimize the operating speed depending on the waste materials being processed.

[0059] The electric panel for controlling and driving the electric motors, which panel has been generally indicated by the reference number 19, comprises, in addition to the driving units 20 thereinabove mentioned, a programmable logic control unit, of a so-called PLC type.

[0060] The latter is adapted, based on set parameters corresponding to several operating formulations, to supply, at the output thereof, control signals for operating said motors 17, 18 by rotary frequency changers 20 and for changing the inclination of the apparatus by the central unit 5.

[0061] From the above disclosure it should be apparent that the invention fully achieves the intended aim and objects.

[0062] In particular, the fact is to be pointed out that a sieving apparatus has been provided for separating the three fractions: compost, lignocellulosic and plastics materials, deriving from a process for stabilizing biomasses coming from a differentiated collection or other collections in general, which apparatus is very reliable from a mere economic standpoint.

[0063] More specifically, the present invention provides very important advantages: a fine control, owing to the control system included in the apparatus, of the optimum operating speed, the sufficient air amount, to optimize the sieving result, as well as the inclination of the sieving sections.

[0064] This fine adjustment depends on the time during which the waste material is held in the sieving operation.

[0065] Further advantages can be mentioned such as the absence of a suction of the plastics materials and

powders, without any deleterious effect on the outside environment, the absence of a decanting chamber for depositing the plastics material and conveying said plastics materials, the absence of a powder removing section for removing powders, a greater safety in the working place since air is used in the second section in a very small amount, as well as a very reduction of the handling or driving requirements of the waste material being processed.

[0066] Moreover, the efficiency of the apparatus is very great, also due to a much less power consume.

[0067] In particular, by using the present invention, the apparatus can be continuously operated during the cylinder changes depending on the material type, and the dead times are drastically reduced, as due to cloggings of the fans of the suction devices because of plastics materials to be processed and were due to the sucked powder.

[0068] Moreover, the operating cost is greatly reduced with respect to the prior art, since a single sieving apparatus is used.

[0069] Moreover, all of the constructional details can be replaced by other technically equivalent elements.

[0070] In practicing the invention, the used materials, the constructional details as well as the contingent size and shapes can be any depending on requirements.

[0071] Actually, the subject apparatus can be subjected to several modifications and variations, without departing from the inventive idea and scope of the invention.

Claims

1. A sieving apparatus for separating three fractions: a compost, a lignocellulosic and a plastics fraction, deriving from a process for stabilizing biomasses, coming from a differentiated collection or other collections in general, **characterized in that** said apparatus comprises a fixed construction (2), a supporting framework (3) which can be differently inclined by hydraulic cylinders (4) controlled by an hydraulic central control unit (5), a first sieving section (6), a second sieving section (7), and collecting and conveying belts (11), (12) and (13).

2. A sieving apparatus for separating a collected material into three fractions, according to the preceding claim, **characterized in that** said construction (2) is made of a strong sheet metal material, provided with bolted cross elements.

3. A sieving apparatus for separating a collected material into three fractions, according to Claims 1 and 2, **characterized in that** the sieving construction is made of a strong sheet metal material with cross elements bolted to the sidewalls and being **characterized by** a sieving plane comprising the sieving section (6) and sieving section (7) having a plurality of sieving ports the size of which depends on the rotary speed of disc elements (9) keyed on shafts (8).

4. A sieving apparatus for separating a collected material into three fractions, according to one or more of the preceding claims, **characterized in that** said shafts (8) are supported by bearings (10) housed in seats for allowing said bearings to rotate and being rigidly coupled to the sieving construction.

5. A sieving apparatus for separating a collected material into three fractions, according to one or more of the preceding claims, **characterized in that** the sieving plane formed by said disc elements (9) can be inclined, or adjusted in its inclination, since it is supported by said supporting frame (3) the laying of which is set by said hydraulic cylinder (4), an adjustable hydraulic pressure system which can be continuously adjusted by said central control unit (5).

6. A sieving apparatus for separating a collected material into three fractions, according to one or more of the preceding claims, **characterized in that** said sieving plane comprises said sieving section (6) and said sieving section (7), and further includes a plurality of appearing sieving ports, the size of which depends, in addition to the rotary speed of said disc elements (9) also on the inclination of said sieving plane, controlled by said supporting frame (3).

7. A sieving apparatus for separating a collected material into three fractions, according to one or more of the preceding claims, **characterized in that** said sieving section (7) comprises appearing sieving ports, having a size greater than that of said sieving section (6), and that the separation in this section is facilitated by using air, supplied at a small amount, metered by said unit (19) but distributed with a specific distribution pattern through said shafts (8) toward the inside of said ports.

8. A sieving apparatus for separating a collected material into three fractions, according to one or more of the preceding claims, **characterized in that** said air is conveyed inside each shaft (8) through a lance (14) having a distributing sector (15) upward directed with a distributing section (16), to provide an upward directed air stream.

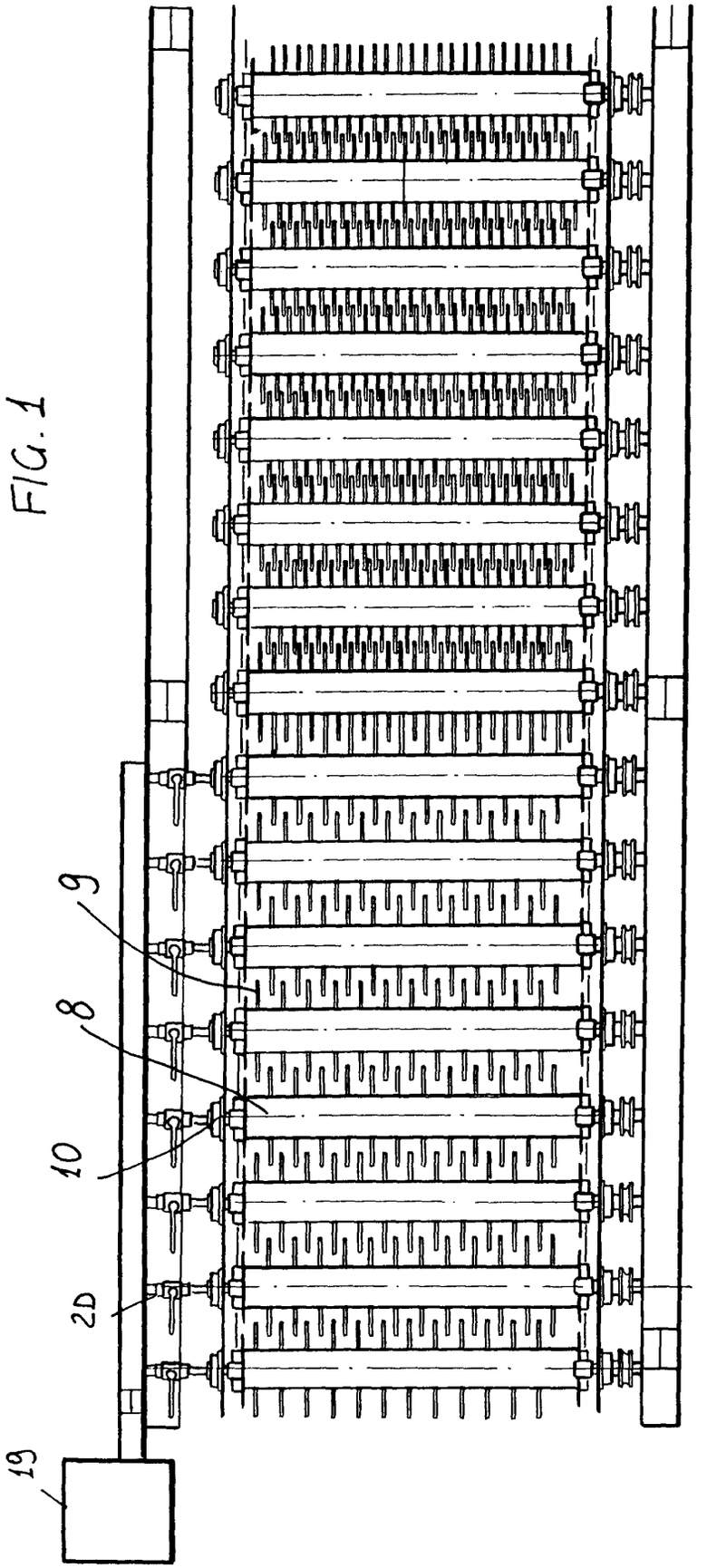
9. A sieving apparatus for separating a collected material into three fractions, according to one or more of the preceding claims, **characterized in that** said collecting and conveying belts (11) and (12) are arranged under the sieving plane and respectively the sections (6) and (7) which are arranged in a series

relationship, and are provided with differentiated passage ports, each section being driven by a dedicated motor and driving means (17) and (18).

10. A sieving apparatus for separating a collected material into three fractions, according to one or more of the preceding claims, **characterized in that** said driving means (17) and (18) are actuated by an electric motor and comprise a RPM changer device (20) which can be controlled through an electric control panel (19) including a programmable logic controller of a PLC type.

11. A sieving apparatus for separating a collected material into three fractions, according to one or more of the preceding claims, and substantially a broadly disclosed and illustrated in the preceding disclosure and figures of the accompanying drawings, which constitute an integrating part of the present Patent Application.

FIG. 1



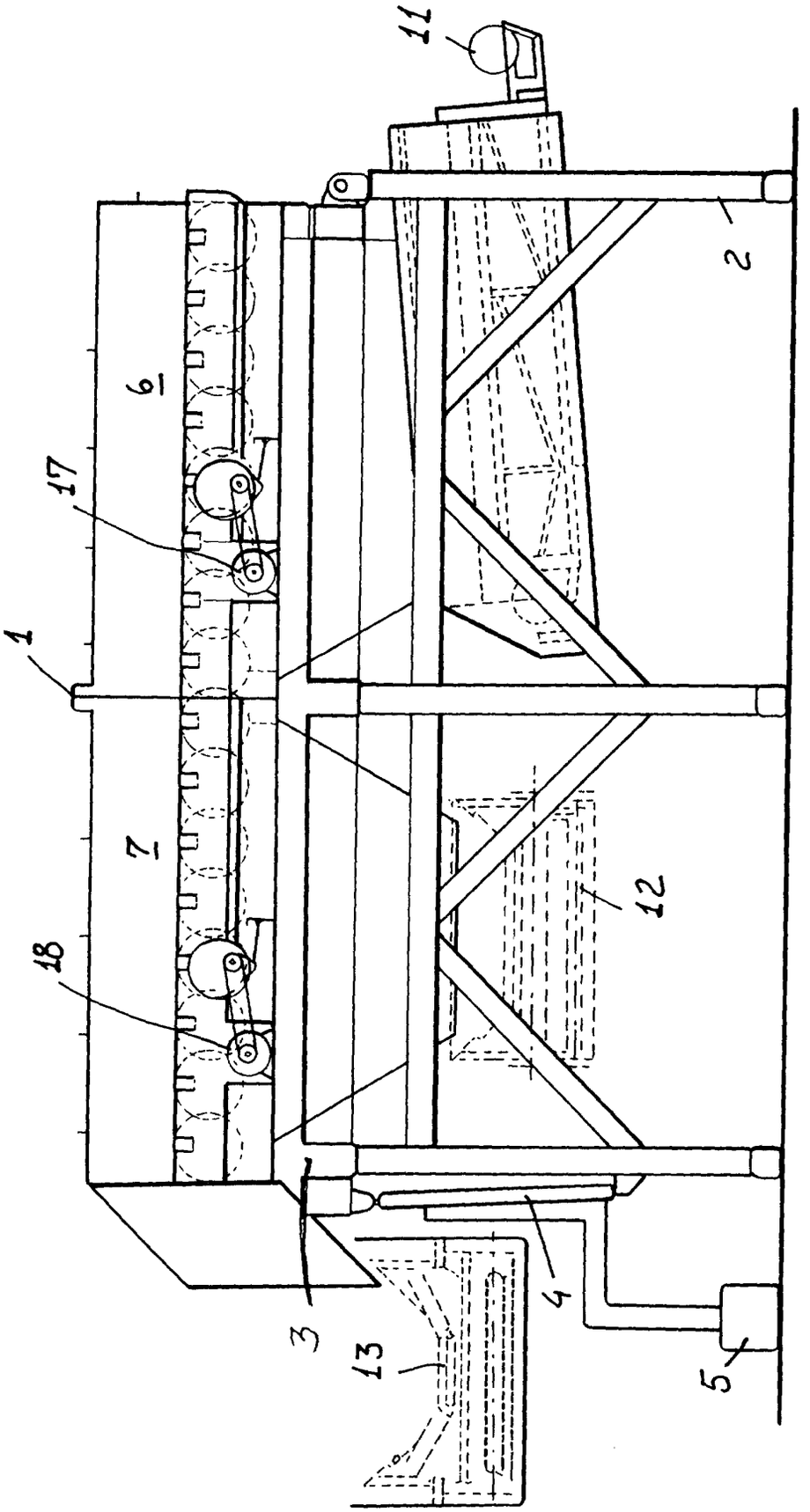


FIG. 2

FIG. 3