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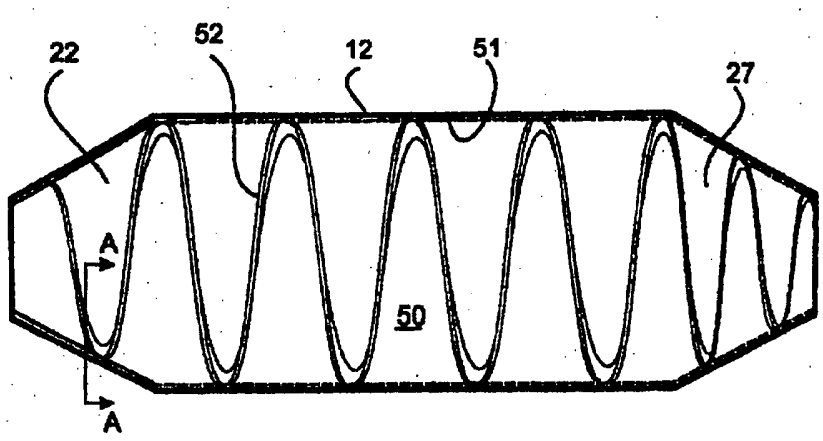
(54) Title: METHOD AND APPARATUS FOR COLLECTION AND TREATMENT OF ENCAPSULATED WASTE



(57) Abstract: An autoclave reactor (12) for treating municipal solid waste (MSW) including agricultural waste and medical waste wherein the MSW may be encapsulated in plastic bags. The reactor is equipped with a loading internal guiding means (52) for treating the waste in such a manner as to decompose the organic fraction into a pulp which acts as a fluid whereby rigid, material such as metal and glass may be removed by known means. The reactor may also be equipped with: (a) piercing and cutting devices for rupturing the encapsulating material thereby expelling air and releasing the contents, (b) means for collecting vapours and emissions for treatment before they are released into the environment, (c) a vacuum means for removing vapours and drying the resulting products, (d) a sensing means which determines the viscosity of the reactor contents and this information is fed into a computer which determines when the desirable decomposition has been reached.

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Method and Apparatus for Collection and Treatment of Encapsulated Waste

Field of Invention.

The present invention relates generally to the art of collection and disposal of waste products. It has particular application to the collection, treatment, and recycling of encapsulated waste, such as muncipal solid waste (MSW) including medical waste and agricultuiral waste.

Background Art

For the purpose of this specification, waste products refer to household waste 'garbage'. which is encapsulated in garbage bags, usually plastic bags, and medical waste encapsulated in bags and rigid containers, MSW.

It is common in certain fields to enclose waste in sealed containers such as plastic bags, to facilitate removal for disposal. One particular instance of such packaging is in the case of medical waste wherein the waste is packaged, not only for convenience of handling but also to ensure that pathogens are not spread inadvertently.

Alternative means of treatment of MSW have previously been disclosed by the present applicant in a series of patents, amongst which are issued in the USA. Pat. no. 4,342,830 dated 3 Aug. 1982. 4,540,495 dated 10 June 1985. no. 4,844,351 dated 4 July 1989. no. 4,190,226 dated 2 March 1993. no. 5,361, 994, dated 8 Nov. 1994. no. 5,427,650 dated 27 June 1995. Each of these have been primarily concerned with providing apparatus and method to improve the amount of waste that may be recycled. However each patent discloses a treatment of the waste by steam and pressure in a manner which sterilizes the waste. In addition the methods include a means of thorough agitation and mixing which ensures that all of the waste is effected by the steam, heat and pressure. While the process defined in the applicant's patents mentioned above have been found to effectively sterilize the waste, even medical waste, they have nonetheless been found to be inefficient in treating waste encapsulated in multiple bags and rigid containers. The treatment process requires substantial processing time and energy to break down the bags and other containers sufficiently to ensure thorough agitation and sterilization of the contents. This requires a considerable energy input beyond what would normally be required to treat the waste, therefore the process is inefficient. The waste included in the bag is small compared to the volume of the sealed bag, because of the volume of air in the bag. If a pressure vessel, as disclosed in the applicants patents mentioned above is filled with bagged waste, the quantity of waste held is quite small compared with the volume of the pressure vessel. The treatment process requires a substantial processing time to break down the plastic of the waste bags to sufficiently ensure thorough agitation and sterilization of the contents. This requires a considerable energy input just to remove the waste from its encapsulation so that it may be exposed to treatment.

The proceeding discussion of the background to the invention is intended only to facilitate an understanding of the present invention. It should be appreciated that the

discussion is not an acknowledgment or admission that any of the material referred to was common knowledge in Australia at the priority date of this application..

Disclosure of the Invention

According y, the invention resides in a waste collection and processing unit adapted to process encapsulated waste. The process unit comprising an autoclave ratable about an axis, drive means adapted to cause rotation the autoclave, defining a chamber with an inlet, a first closure adapted to sealing close the inlet , guide means within the chamber adapted to coax the waste away from the inlet during the rotation of the autoclave, piercing means adapted to pierce the capsules on contact and a port adapted to be connected to a source of sterilizing medium.

According to a preferred feature of the invention, the chamber is further provided with an outlet and and a second closure adapted to sealingly close the outlet, the guide means being adapted to coax the waste to move from the inlet to the outlet during the rotation of the pressure vessel.

According to a preferred embodiment, the sterilizing medium is steam.

According to a preferred feature of the invention, the piercing means is provided in a portion of the autoclave proximate to the inlet.

According to a preferred embodiment, the autoclave is substantially cylindrical, the chamber thereby defined having an inner surface, and the guide means comprises a helical rigid strip extending substantially perpendicularly inwardly from the inner surface into the chamber. (flighting)

According to a preferred embodiment, the axis about which the autoclave rotates is inclined to the horizontal, the inlet being positioned at a level above the outlet.

According to a preferred embodiment the guide means is configured helical to extend substantially along the length of the inner surface of the cylindrical pressure vessel.

According to a preferred embodiment the guide means may be of variable dept. into the cylinder in order to control the flow of the material.

According to a preferred embodiment, the pitch of the helical guide means reduces proximate to the outlet.

According to a preferred feature of the invention, the piercing means is associated with the guide.

According to a preferred embodiment, the piercing means comprises knife members releasably supported by the guide means.

According to a preferred embodiment, the knife members extend from the inner edge of the guide means inwardly into the chamber.

According to a preferred embodiment , the piercing means comprises serrations formed on the guide means.

According to a preferred feature of the invention, the process unit further comprises loading means associated with the inlet.

According to a preferred feature of the invention, an air inlet is provided proximate to the inlet, the air inlet being adapted to be connected to a source of pressurized air, which may be heated.

According to a preferred feature of the invention the autoclave is provided with a vacuum inlet, the vacuum inlet being adapted to be connected to an evacuating means.

According to a preferred feature of the invention, a water inlet is provided proximent to the inlet, the water inlet adapted to be connected to a source of pressurized water or other fluids

According to a preferred feature of the invention, the pressure vessel is associated with a barrier which extends around the ~~around the~~ exterior of the pressure vessel and isolates the inlet from the outlet.

According to a preferred feature of the invention, the inlet is located in an enclosure accommodating the loading means, the enclosure isolating the inlet from the ambient surroundings.

According to a preferred embodiment, the barrier comprises a wall of the enclosure.

According to a preferred feature of the invention, the process unit further comprises a collecting zone associated with the outlet which is isolated from the ambient surroundings

According to a preferred feature of the invention, the process unit further comprises a sensing means adapted to sense the viscosity of the fluidised waste, the sensing means being adapted to provide a signal when a predetermined level of viscosity of the fluidised waste has been attained.

According to a preferred feature of the invention, the process unit is microprocessor controlled.

According to a preferred feature of the invention, the process unit may be mounted on a truck or other mobile means.

According to a preferred feature of the invention, the mobile process unit may be used as a collection compactor (garbage compactor truck}.

The invention will be more fully understood in light of the following description of several specific embodiments.

Brief Description of the Drawings

The description is made with reference to the accompanying drawings of which:

Figure 1 is a diagrammatic side elevation of a waste process autoclave unit according to a first embodiment;

Figure 2 is a another diagrammatic side elevation of a first embodiment;

Figure 3 is a further diagrammatic side elevation of the first embodiment;

Figure 4 is a side elevation of the cylindrical vessel of the first embodiment having the near wall cut-away;

Figure 5 is a partial sectional view of the cylindrical vessel of the first embodiment through section A-A shown in Figure 4;

Figure 6 is a side view of flighting as show in Figure 5;

Figure 7 is a partial sectional view of the cylindrical vessel through line A-A shown in Figure 4 according to a second embodiment;

Figure 8 is a side view of flighting as shown in Figure 7;

Figure 9 is side view of flighting as arranged in Figure 7 according t0 a third embodiment :

Figure 10 is a view of the autoclave unit mounted on a truck;

Figure 11 is a longitudnal diagramatic section showing alternative positioning of the helical guide allowing for a kneding action and mastification of the organics (chicken craw)

Best Model(s) for carrying Out the Invention

The first embodiment of the invention as shown at Figure 1,2 and 3 comprises a process unit 10 adapted to process waste (including medical waste) encapsulated in plastic and other containers. The process unit comprises a substantially cylindrical autoclave 12 which is supported by support members 31 and 32 which may be mounted on a mobile vehicle or may be stationary. Support members provide for rotationabout its longitudinal axis. The cylindrical vessel 12 is adapted to be caused to rotateby means of a motor 33 having an output gear 34 adapted to engage a gear 36 secured around the periphery of vessel 12. The cylindercal vessel 12 is inclined at a predetermined angle to facilate the movement waste through the cylindrical vessel 12.

The cyndrical vessel 12 defines an internal chamber 50 having an inlet 23 at one end 21 of the cylindrical vessel 12 and an outlet 28 at the other end 26. The process unit 10 is further provided with a first closure adapted to close the inlet 23 and a second closure 29 adapted to close the outlet 28. Each of the closures are supported from above the cyndrical vessel 12 by support means adapted to move the closure from a position

wherein it is engaged with the respective end to a position upwardly clear of the respective end when disengaged from the respective end.

The inlet closure is provided with a first aperture (not shown) which is connected to a source of steam through a steam line 36. The inlet closure is further provided with a second aperture (not shown) which is connected to a source of compressed air through an air line 37. The inlet closure is further provided with a third aperture (not shown) which is connected to a vacuum pump through a vacuum line 44.

A first enclosure 42 is associated with the inlet to substantially contain the inlet and to collect any air expelled from the chamber when waste is delivered to it. Air from within the first enclosure 42 is exhausted through an air treatment means adapted to destroying any pathogens which may be present in the air prior to the air being exhausted into the atmosphere.

The process unit 10 further comprises an inlet conveyor 38 and a sub-conveyor 39 (see Figure 2) adapted to deliver bagged waste to the inlet. The sub-conveyor is adapted to be movable away from the inlet to enable the inlet to be closed by the first closure 24. The conveyor 38 and sub-conveyor 39 penetrate the first enclosure to transport bagged waste to the cylindrical vessel 12.

As shown in Figure 3, the process unit may be connected to a waste collection and sorting means 45 adapted to receive processed waste from the outlet after completion of the process cycle. In addition the collecting and sorting means comprises means to classify the treated waste into predetermined classes. In general, suitable collection and sorting means have been described in the the applicant's previous US patents mentioned in the description of the background to this invention, above.

In addition, the collection and sorting means is provided with a filtration means to collect airborne waste expelled from the cylindrical vessel by compressed air. The filtration means comprises a mesh filter exhausting to the environment at the end of a duct directing the airborne waste away from the path of the more dense waste.

As shown in figure 4, the cylindrical vessel has an internal surface 51 to which is attached flighting 52. The flighting 52 comprises a rigid strip extending substantially perpendicularly inwordly into the chamber 50 from the inner surface 51. The flighting 52 is configured helically too extend substantually along the full length of the inner surface 51 of the cylindrical vessel. A sparging steam line may be incorpated into the flighting as described in US patents above.This steam line may be connected to piercing members 61 Figure 5, so that steam is injected into the bags as they are being pierced

The pitch of the helix of the flighting is reduced in the outlet portion 27, producing compression on the waste. For ease of maintenance, the flighting 52 may be constructed from a series of segments configured end to end arrangement and reasonably secured to the inner surface 51.

In the region of the chamber adjacent to inlet 23 and as shown in more detail in Figures 5 and6 The flighting 52 is provided with piercing means in the form of a searies of

knife menbers 61 projecting from the flighting 52. each knife member 61 comprises a rigid blade having a substantially diamond cross-section to provide stiffness and further
comprises a relatively broad end engaging the flighting, or sparging line and a substantially pointed opposed end projecting into the chamber 50. The broad end and the pointed end are connected by edges of the blade whish are sharpened. The knife members are sharpened. the knife members are releasably attached to the flighting or sparging line (not shown) to enable replacement in the event of damage or brakage to the knife members 61.

In use, bagged waste 41 is loaded into the cylindrical vessel 12 through inlet 23 by the conveyor 38 while the cylindrical vessel 12 is rotating, the outlet 28 being closed by second closure 29. After entry into chamber 50, the container (bag) 41 is moved about within the chamber 50 because of the rotation of the cylindrical vessel 12. When a bag 41 contacts the pointed end of a knife member 61 in the inlet portion of chamber 50, the bag 41 is pierced . The rotational movement of the cylindrical vessel 12 ensured that the bag (container) 41 is torn open after it is pierced and injected by steam, thereby releasing and spreading the contents within chamber 50. Further as a result of the rotational motion the flighting urges the waste away from the inlet, toward the outlet portion. As a result the waste is pre-compacted during the loading process, increasing the vessel capacity by 50% or more. Loading continues until sufficent waste has been inserted. Thereafter the inlet is closed by the first closure 24 and steam under pressure is introduced into chamber 50. The cyndrical vessel 12 is rotated and pressurized steam is directed into the chamber 50 through the steam line 54, expelling air through a relief valve (not shown) and filling the cylindrical vessel 12 with steam under pressure. The helical configuration of the flighting 52 tramsports the waste materials to the closed end of the vessel. Since the exit closure member 16 is closed and there is no exit, the waste material is squeezed back (extruded) through that portion of the chamber between the flighting in a manner previously described in the applicant's patent no. US 5,190,446. This process causes any paper (cellulose) to be torn apart by the compression and sheer action of this indirect extrusion.

After a predetermined viscosticy or period of time which depends on the nature of the waste being being processed, the pressure within the vessel is released. The steam remaining in the autoclave is evacuated through the vacuum line 44. A predetermed vacuum depending on the nature of the waste being treated, causes the the moisture content of the waste to be reduced. As a result of the heat and vacuum the cellulose material present takes on a finely shredded, fluffy appearance as a result of being exposed to the vacuum and this material is easily able to be displaced by a blast of air. Upon completion of the evaucation phase, air is admitted into the autoclave to bring the priddure to atmospheric pressure. The second closure member 29 is opened. The cellulose material is expelled by directing a draft of pressurized air from the air line 37 into the chamber 50. This airborne waste is collected by the filtration means to collect airborne waste within the waste collection and sorting means 45. The remainder of the processed waste which is solid or paste like is forced out of the chamber 50 by the rotary of the flighting 52.

In a preferred adaption of the first embodiment, the inlet closure is provided wirh a third aperture (not shown) which is connected to a source of water by a water line. a

spray nozzle is mounted to the inner side of the third aperture. In use, after the cylindrical vessel is emptied of the waste, water from the water line is sprayed into the chamber to clean the chamber of remaining refuse.

In a second embodiment, as shown in Figure 7 and 8, the knife members are mounted to the inner edge of the flighting 52 and extend radially inwardly from the inner edge into the chamber 50.

In a third embodiment as shown in Figure 9, the knife members may be directed at obliquely to the radial direction.

In a fourth embodiment, not shown, the piercing means comprises saw tooth-like serriation's, not shown, associated with the inner edge 52 of the flighting. The internal edge of flighting has saw-tooth like edging to the flighting.

In a fifth embodiment, the serrations are provided by a metal strip with the serrations preformed on one edge, the strip being adapted to be secured to the flighting proximate the edge of the edge of the flighting.

In a sixth embodiment, the pressure unit comprises a pressure vessel rotatable about an axis and having a motor adapted to cause rotation of the pressure vessel in a manner similar tooth described with respect to the first embodiment. The pressure vessel defines a chamber with an inlet and a first closure adapted to sealingly close the inlet. Guide means and piercing means are provided within the chamber, in a manner similar to that of the first or subsequent embodiments. However, in this embodiment, no separate outlet is provided

In a further adaption of any of the previous embodiments, a second enclosed space in the form of a roon encloses the inlet end of the cylindrical vessel, the cylindrical vessel penetrating an opening in a wall of the room intermediate the ends of the cylindrical vessel. The conveyor, 38, the sub-conveyor 39 and first enclosure are contained within the second enclosure, A sealing means is associated with the opening of the wall, the sealing means being adapted to sealingly engage the cylindrical vessel without impeding rotation. In this manner, the outlet of the cylindrical vessel is isolated from the inlet. The room containing the inlet may then be treated as a hazardous area where in it is recognized that there is a risk of contact with pathogens and in which appropriate safety precautions should be taken. By operation of the process unit as described above, the outlet of the cylindrical vessel need never be opened while the inlet is open, other than for maintenance of the process unit. When the second closure is opened, the inlet is closed by the first closure and processing of the waste has been completed rendering the chamber of the cylindrical vessel and its contents are completely sterilized. In this way, the area adjacent to the outlet may be treated as a safe area with regards to the spread of pathogens wherein no special precautions are required.

In this embodiment the loading means and the waste collection and sorting means are adapted so that they may be alternately positioned adjacent to the opening and otherwise moved clear of the opening, in other respect the ampetures for steam etc. are

best located in the closed end. This embodiment may be adapted for mobile operation for waste collection, (waste compactor truck). See Figure 10.

In use, when processing is complete, the fluffy cellulose waste is removed by directing a stream of air from the airline into the chamber. the cellulose waste is expelled through the opening as a result and the waste filtered in the manner of the first embodiment The remaining waste is removed from the chamber by reversing the rotation of the pressure vessel, whereby it is coaxed by the flighting. In other respects, this embodiment may be be adapted as previously described in respect of the other embodiments.

In a further adaption of any of the previous embodiments, the process unit further comprises a sensor adapted to detect the viscosity of the processing waste. The sensor is adapted to signal when ~~when~~ the processed waste has reached a predetermined level of fluidisation. This level of fluidisation more accurately identifies when the waste has been processed sufficiently. The signaling by the sensor may then be used as a means to identify when the processing should cease, rather than operating the process unit for specific time period.

In an adaptatioin of the previous embodiments, the pitch spacing of the flighting (see fig 11) may be varied to produce a kneading effect on the materal being processed. The spacing shown on fig 11 may be varied from x-2 to x+2 to produce this kneading.This compression-relaxation action, along with the broken glass and other abrasives inherent in MSW produces a mastification effect (chicken gizzard) resulting in particle size reduction for further fermentation or gasification.

In another adaptation of any of the previous embodiments, the process unit is microprocessor controlled. A microprocessor is connected to actuate the motor, 33, the closures 24 and 29, the vent fan the conveyor 38 and sub-conveyor 39, steam air and water valves and waste collection and sorting means 45. Automatic operation of the process unit is established in a pre-determined manner, with appropriate safety interlocks in place to ensure that the operation occurs only after appropriate precautions have been taken.

The process unit according to the above embodiments provides a means for processing of bagged waste in which a substantial quantity of bagged waste may be processed in an efficient and economic manner in a way in which the environmental impact is considerably reduced from previous methods. by use of this process unit, a process for processing bagged waste may be implemented which incorporate procedures for safe handling of bagged waste containing pathogens. The process is further adapted to the use of techniques previously identified for for the processing municipal solid waste, which substantially enhances the proportion of waste recovered for recycling. In addition, when used to process medical waste, the process is effective in separating a needle or other "sharps" from their plastic hypodermic syringe. Such needles arethen able to be separated for re-cycling. As a result of this separation of the sharps, the need for hammer-mill is removed. This reduces operating costs considerably.

It should appreciated that the scope of the present invention need not be limited to the particular scope of the embodiments described above.

Throughout the specification, unless unless the contact requires otherwise, the word ' comprise' or 'comprising' will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or integers. The terms of autoclave, pressure vessel, and cylindrical vessel are used substantially interchangeably.

Clifford Carlton Holloway
Applicant

Claims

The claims defining the invention are as follows;

1. An autoclave reactor for treating municipal solid waste (MSW) including agricultural waste and medical waste. Most MSW is encapsulated in plastic bags and the like, however waste having no encapsulation is included in this invention. This reactor is equipped with loading device and internal guiding means (flighting) for directing, mixing and treating waste in such a manner as to decompose the organic fraction into a pulp. This pulp acts as a fluid whereby rigid material such as metal and glass may be removed by known means, permitting the recovery of valuables such as metals, glass, plastics, fabric, cellulose and the like for recycling.

2. An autoclave reactor for treating MSW including agricultural waste and medical waste, equipped with piercing and cutting devices for rupturing the encapsulating material and releasing the contents. Entrapped air is expelled, thereby increasing the capacity of the reactor by increasing the density of the waste, and exposing the contents to heat, steam and pressure resulting in reduced residency time.

3. An autoclave reactor device for treating MSW including agricultural waste and medical waste equipped with means for collecting vapors (emissions) for treatment before they are released into the environment. This treatment prevents harmful emissions, carbon dioxide, methane, ammonia, nitrogen oxides, volatile organic and the like from escaping into the atmosphere.

4.An autoclave reactor device for treating MSW including agricultural waste and medical waste, equipped with a vacuum means for removing vapors and drying the resulting products.

5.An autoclave reactor device for treating MSW including agricultural waste and medical waste, equipped with a sensing means which determines the viscosity of the reactor contents. The microcomputer determines when the desirable decomposition has been reached and stops the operation. This is more efficient than time and temperature settings.

6.An autoclave reactor means in claim 2. for relieving the encapsulation restraints on waste, expelling unwanted air, thereby increasing density, thereby increasing the capacity of the autoclave reactor.

7. An autoclave reactor means in claim 2. for relieving the encapsulation restraints on the waste thereby exposing the waste to steam, heat, and pressure treatment thereby reducing the residence reaction time.

8. An autoclave reactor means in claim 1. where organic matter, including paper is exposed to heat, steam and pressure, increasing the decomposition of paper and the like, resulting in partial hydrolization of the cellulose for fermentation.

9. An autoclave reactor device in claim 1. where agricultural waste such as phosphogypsum (by product of fertilizer production) may be added to the MSW where the acid, inherent in phosphogypsum, helps decompose cellulostic material for further fermentation or gasification. The mineral content of phosphogypsum increases the value of a resulting organic fraction as a soil conditioner (compost). This increases desirable compost content and disposes of a by product of agricultural fertilizer production.

10An autoclave reactor device in claim 1. where agricultural waste such as bagasse (by product of sugar production) may be added to MSW where the broken glass inherent in MSW combined with the compression, relaxation action of the autoclave reactor produces a mastication effect on the bagasse reducing particle size and exposing cellulose to reaction forces. This increases a desirable lignocellulose content and disposes of a by product of sugar production.

11. An autoclave reactor device in claim 1 where steam heat and pressure plus the kneading effect of flighting (guide) configuration decomposes organic matter. This decomposed organic matter, subjected to steam, heat and pressure in the reactor, begins to act as a fluid. Crystalline material is aligned and subjected to compression, relaxing activity resulting in a piezoelectric effect, further decomposing organic material.

12. An autoclave reactor means in claim 1 where steam, heat and pressure plus mechanical forces acting on the fluidized material produces cavitation activity which may be increased by adding ultrasonic devices. Cavitation activity enhances organic decomposition.

13. An autoclave reactor device in claim 2 equipped with a vacuum means for drying the autoclave contents. A portion of this dried cellulose produces a cotton like fluff as a result of vacuum drying. This fluff is suitable for paper production.

14. An autoclave reactor means in claim 2 to supply water and other fluids containing surfactants, acids, alkali and other chemicals to inhance the biological decomposition of the contents of the reactor.

15. An autoclave reactor device in claim 2 whereby the reactor is mounted on a vehicle and used for collecting MSW and other waste. The vehicle collection autoclave provides compaction of MSW superior to conventional MSW compactor vehicles due to its internal configuration.

16. An autoclave reactor device in claim 15 to supply compressed air including heated air such as the exhaust air from the vehicles engine to provide heat to the contents of the collection vehicle producing steam from the moisture content inherent in MSW.

17. An autoclave reactor means in claim 16 whereby the engine exhausts from the collection vehicle contains carbon monoxide and other compounds and molecules which are deadly to pathogens and all living organisms.

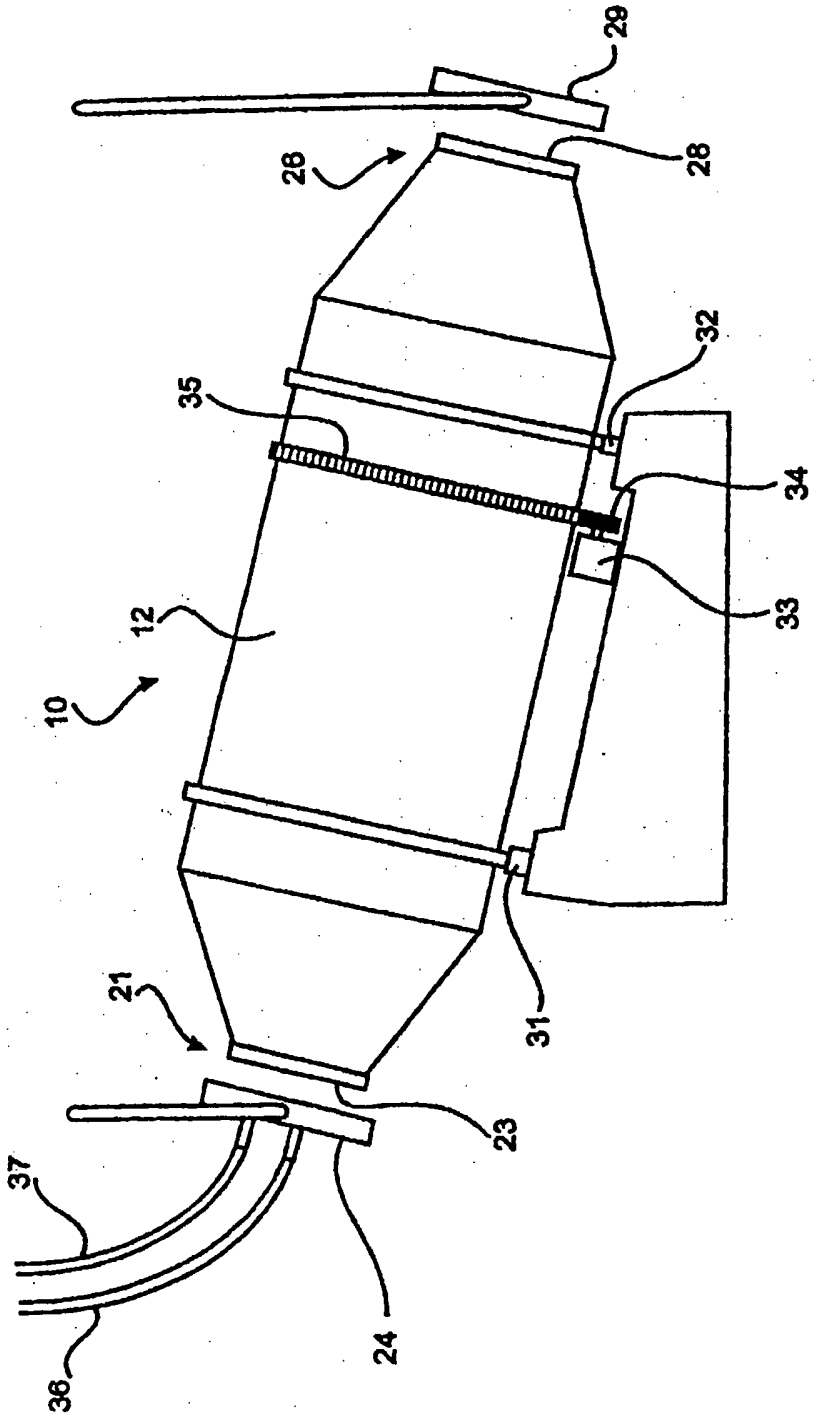


Fig. 1

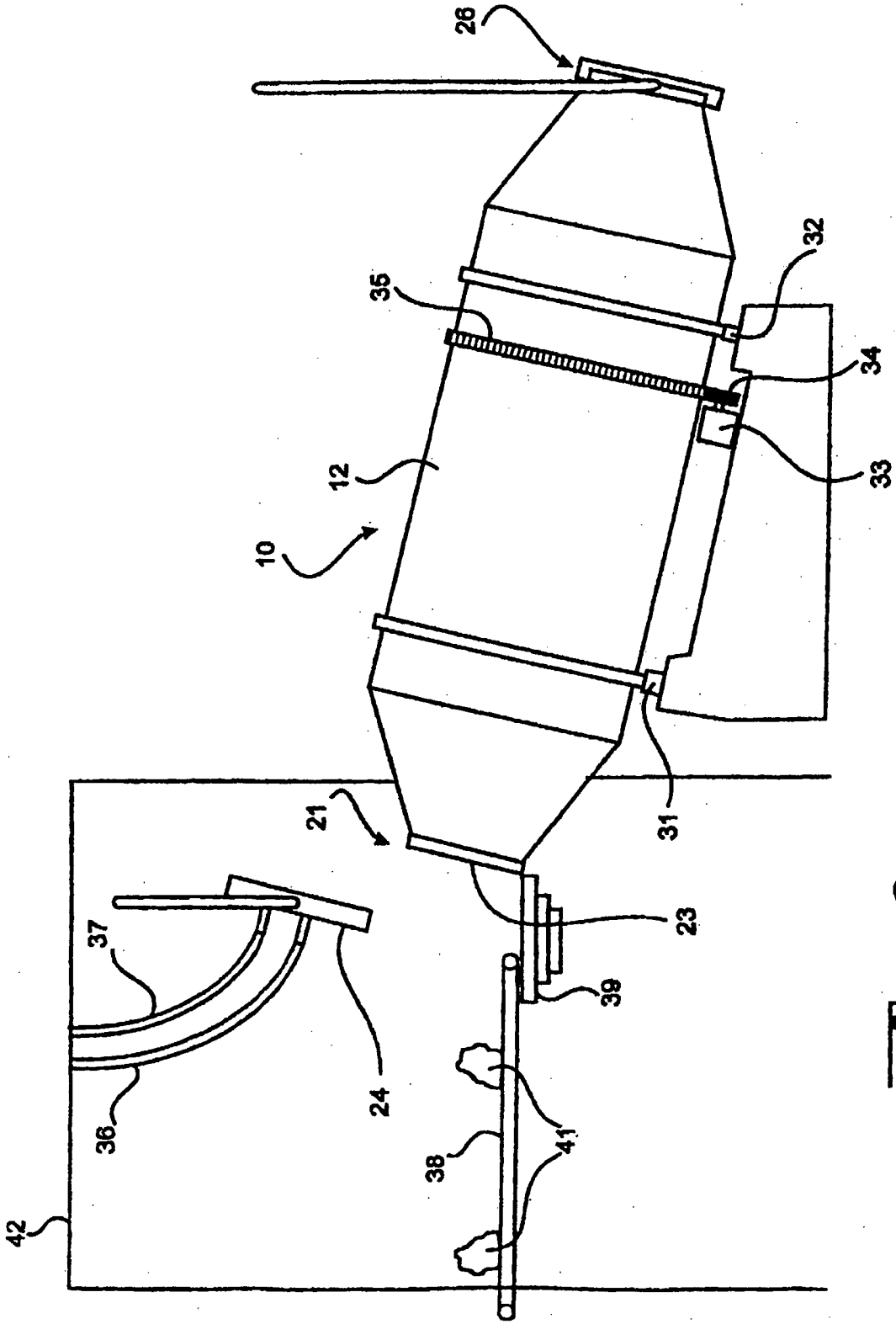


Fig. 2

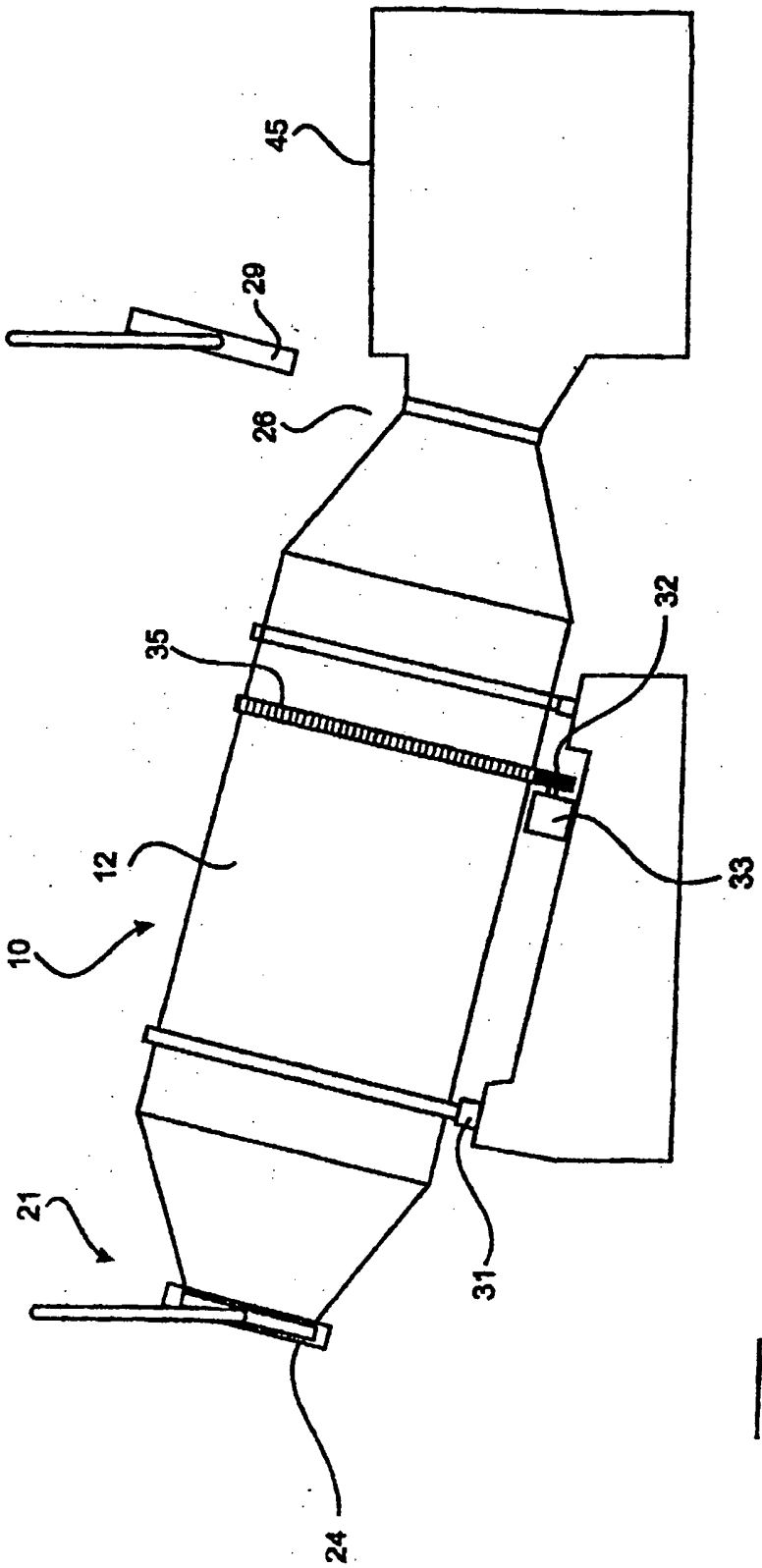


Fig. 3.

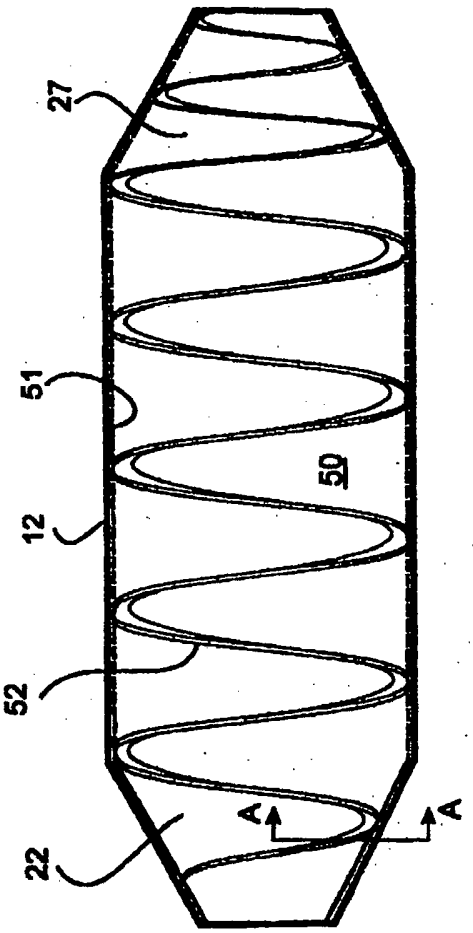


Fig. 4

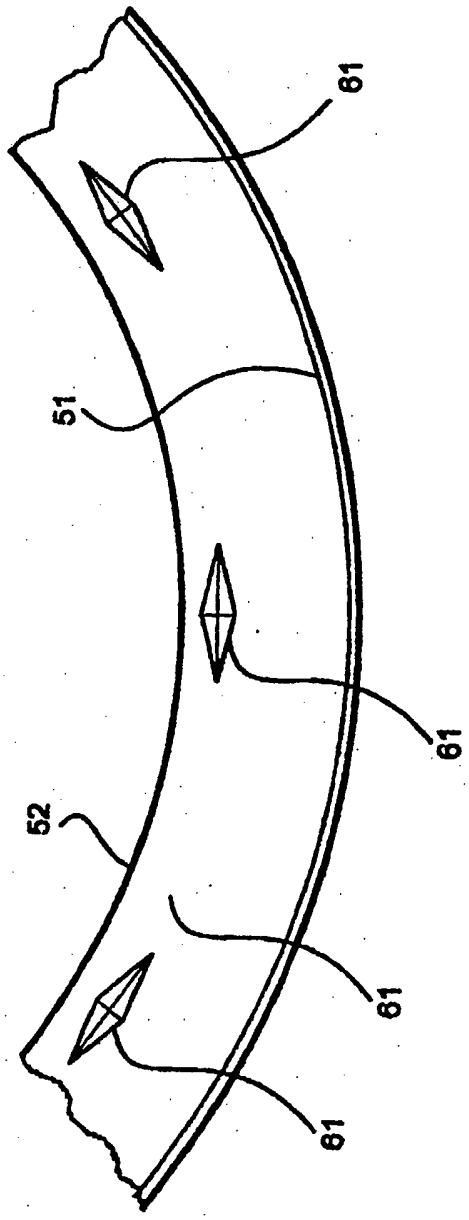


Fig. 5

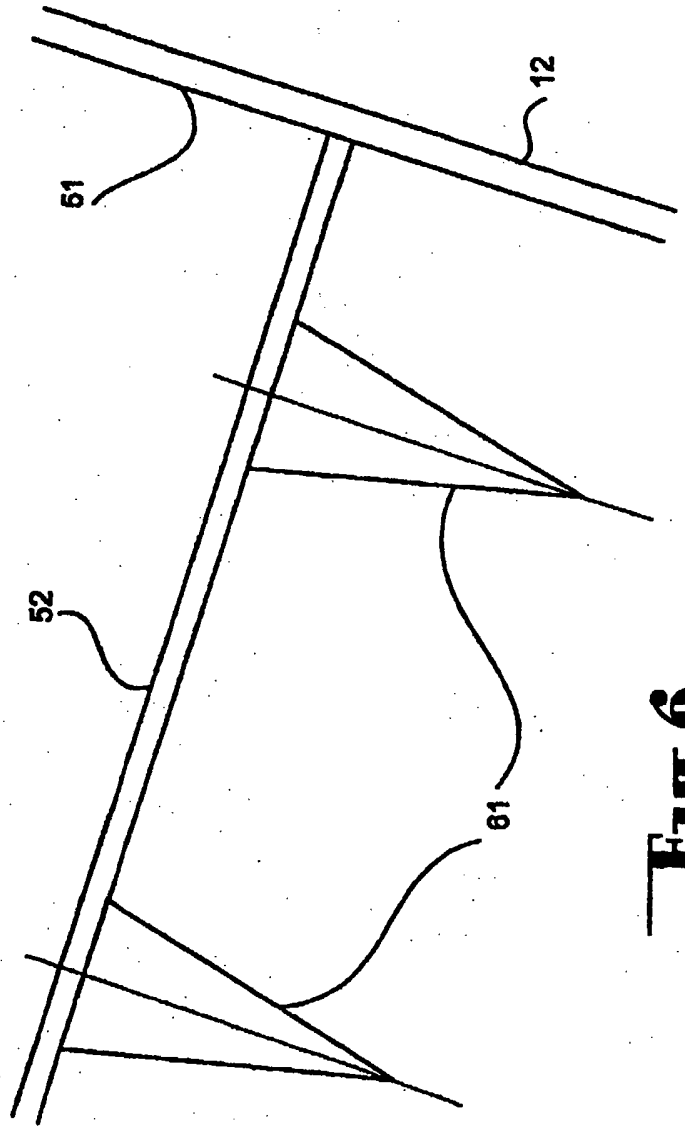


Fig. 6

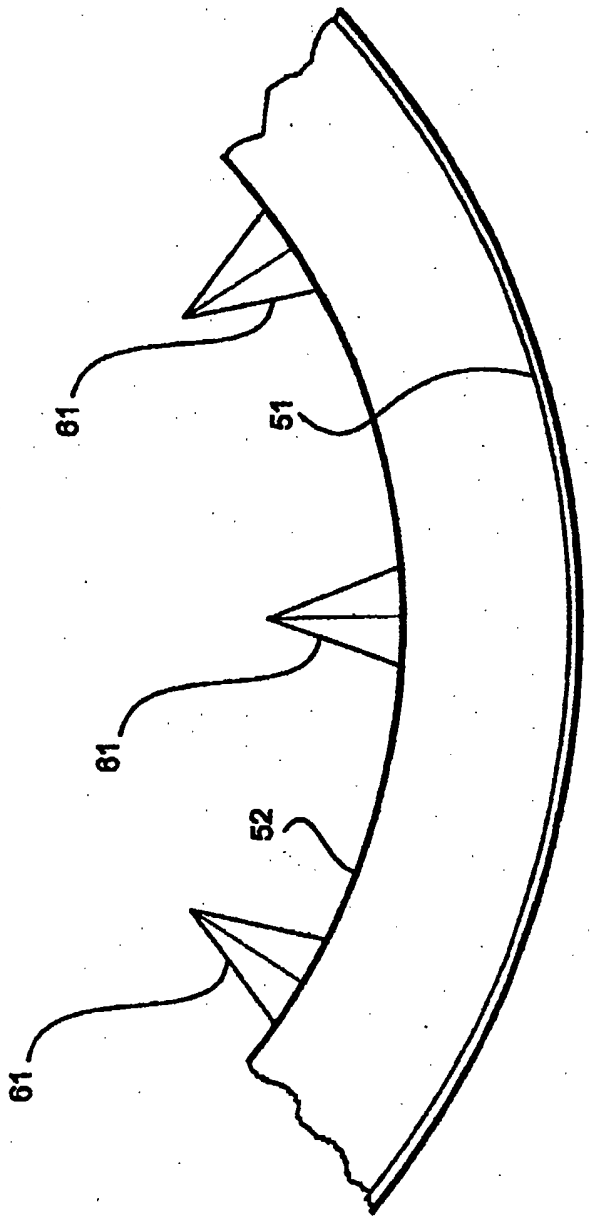


Fig. 7

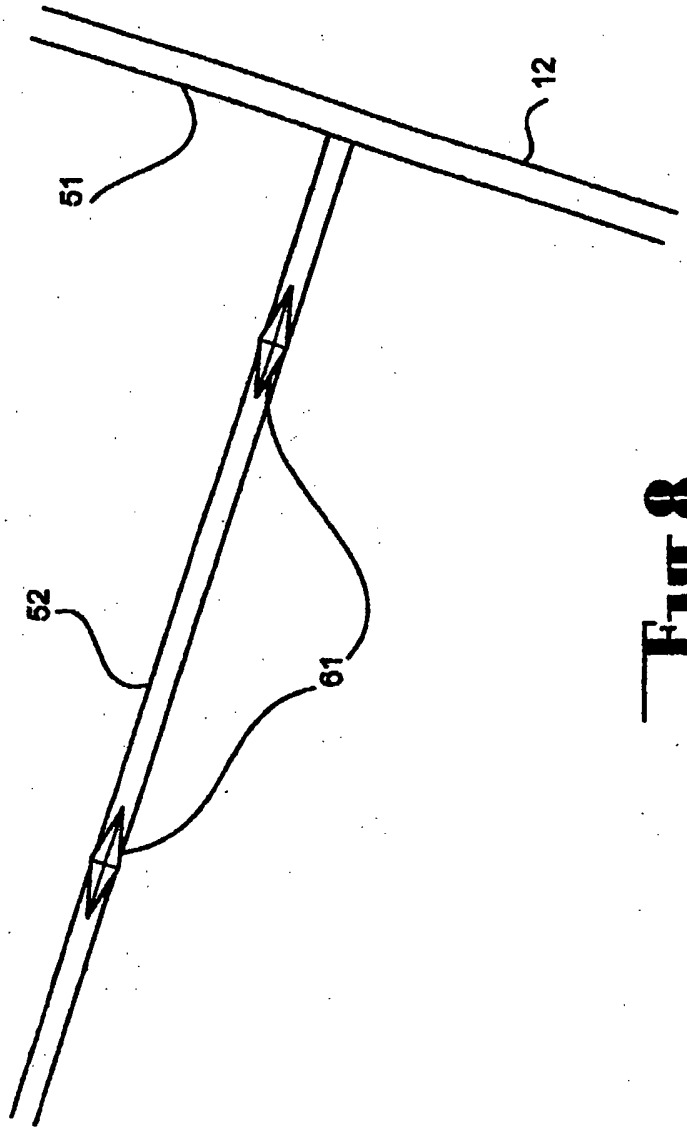


Fig. 8

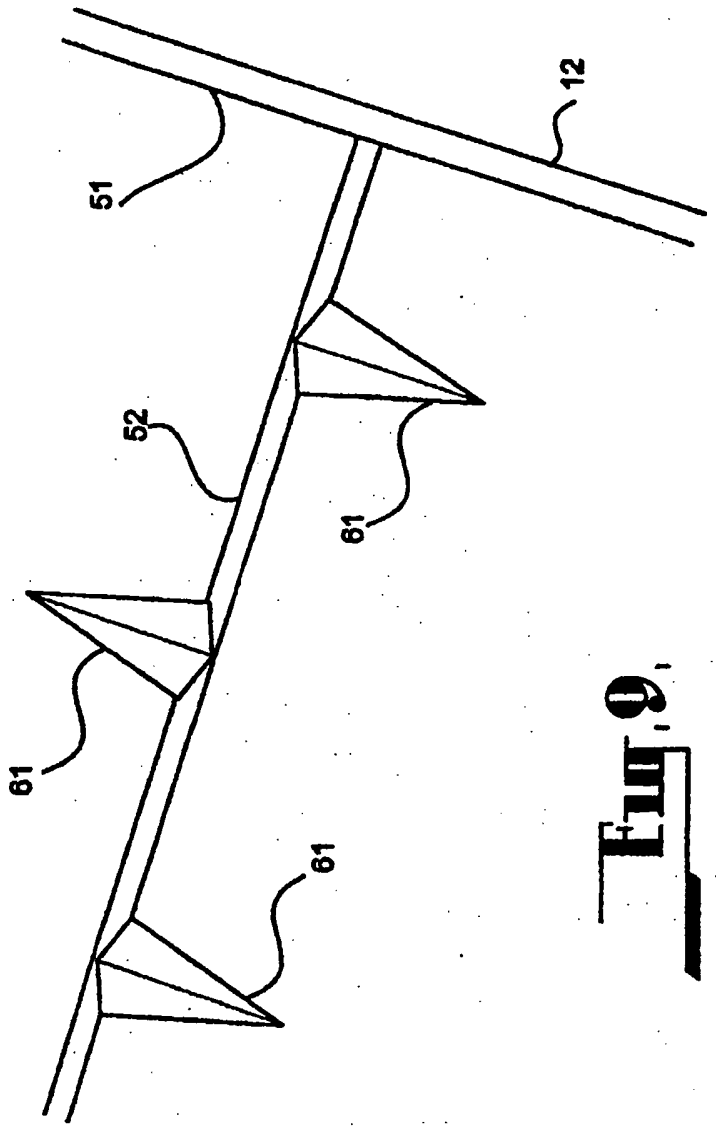


Fig. 9

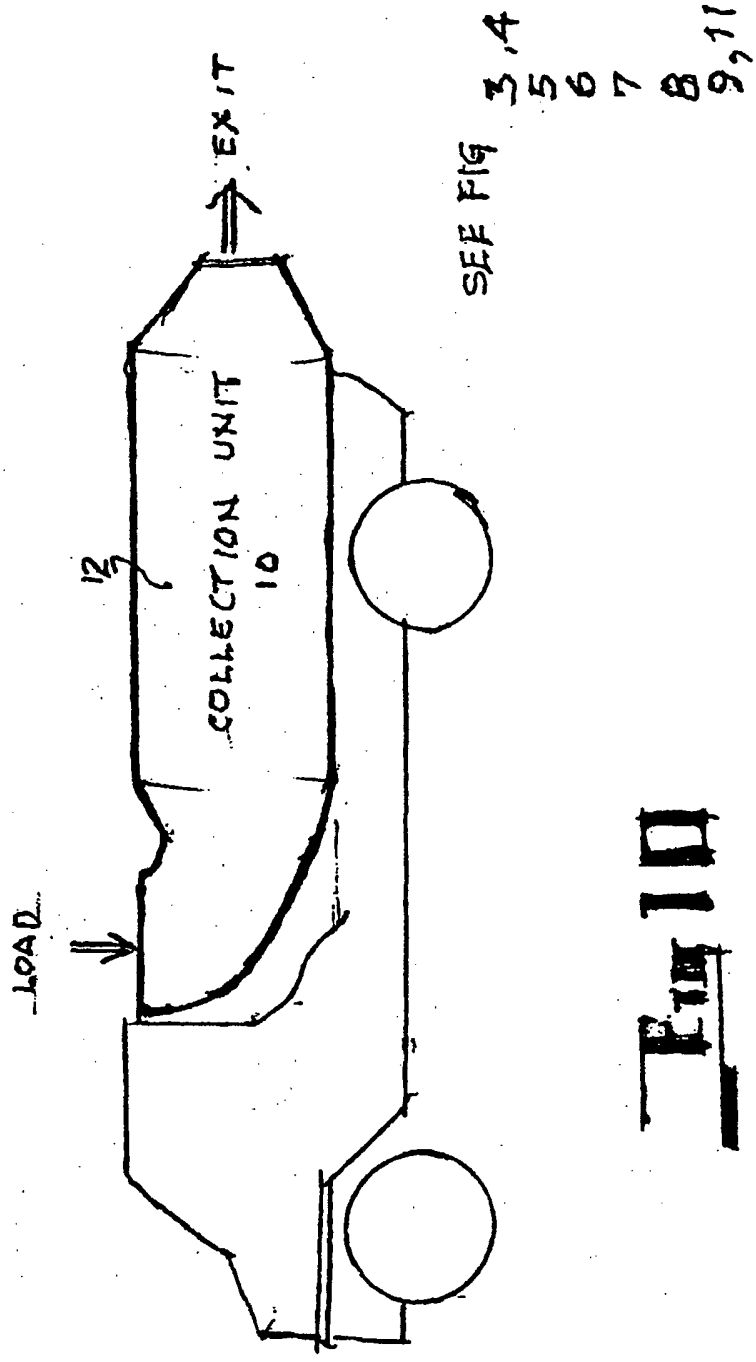
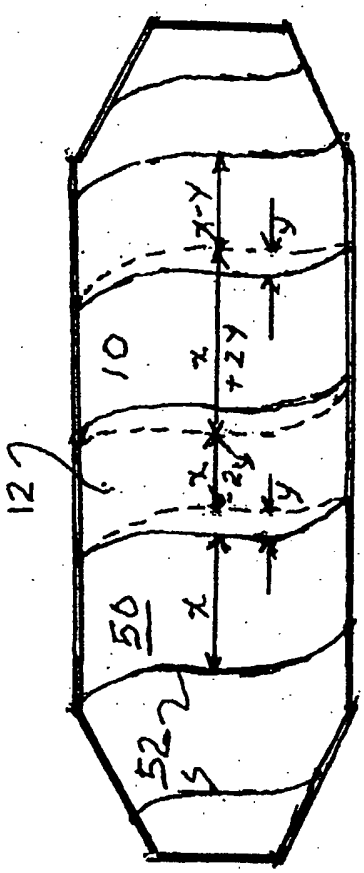


Fig 10



LONGITUDNAL SECTION

FIG 11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2005/001185

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. [7]: B09B 3/00, A61L 11/00, B02C 18/40

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
DWPI: B09B 3/-, A61L 11/-, B02C 18/-, 19/-, B01J 3/04, and keywords autoclave, waste, shred, viscosity and similar terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2003/035970 A (UNIVERSITY OF ALABAMA) 1 May 2003 Pages 14-20	1-4, 6-8, 11, 13, 14
X	WO 2000/072987 A (MSW PATENTS INC) 7 December 2000 Abstract, page 3, page 7 line 22-page 8 line15	1-3, 6-8
X	WO 1994/026320 A (TEB HOLDING SA) 24 November 1994 Whole Document	1-4, 6-8
X	EP 277507 B (ROLAND, ROLF EMIL) 13 January 1993 Claims 1 and 9	1-4, 6, 7, 15-17

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 September 2005	28 SEP 2005
Name and mailing address of the ISA/AU	Authorized officer
AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	**M. BREMERS** Telephone No : (02) 6283 2052

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2005/001185

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5427650 A (HOLLOWAY) 27 June 1995 Columns 4-6	1, 4, 8
X	US 5217688 A (VON LERSNER) 8 June 1993 Claim 1	1-4, 6, 7
X	WO 2002/024354 A (ENVIRONMENTAL WASTE INTERNATIONAL) 28 March 2002 Abstract, claims 1, 7, 8	2, 3, 6, 7
X	US 4844351 A (HOLLOWAY) 4 July 1989 Claim 1, Figures 1 and 2	2, 6, 7
X	US 5480610 A (BIRKHOLZ et al) 2 January 1996 Abstract	3, 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2005/001185

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See Extra Sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

Supplemental Box
(To be used when the space in any of Boxes I to VIII is not sufficient)

Continuation of Box No: III

The international application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept. In coming to this conclusion the International Searching Authority has found that there are different inventions as follows:

1. Claim 1 and dependent claims. It is considered that the internal flighting to mix the waste comprises a first "special technical feature".

2. Claim 2 and dependent claims. It is considered that the rupturing of the encapsulating material comprises a second "special technical feature".

3. Claim 3. It is considered that the collection and treatment of vapours comprises a third "special technical feature".

4. Claim 4. It is considered that the vacuum for removing vapours and drying the products comprises a fourth "special technical feature".

5. Claim 5. It is considered that the viscosity sensor comprises a fifth "special technical feature".

These groups are not so linked as to form a single general inventive concept, that is, they do not have any common inventive features, which define a contribution over the prior art. The common concept linking together these groups of claims is an autoclave for treating waste. However this concept is not novel in the light of the documents cited in Box V of this report. Therefore these claims lack unity a posteriori.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/AU2005/001185

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
WO	03035970	CA	2464090	CN	1541291	EP	1438459
		GB	2392677	NZ	533075		
WO	0072987	AU	51586/00	EP	1196255	US	6397492
WO	9426320	BR	9406624	CA	2162293	EP	0697895
		US	5424033				
EP	0277507	DE	3800821				
US	5427650						
US	5217688	CA	2079003	EP	0522145	MX	9300109
		WO	9212738				
WO	0224354	AU	93565/01	BR	0114224	CA	2320455
		CA	2422928	CN	1476357	EP	1318875
		US	2004054240				
US	4844351						
US	5480610	EP	0555724	JP	5337169		

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX