I/We, ARBIOS Societe Anonyme
of AVENUE EMILE ROUSSEAU, B-6000 CHARLEROI, BELGIUM

hereby apply for the grant of a standard patent for an invention entitled:

VESSEL FOR ANAEROBIC FERMENTATION

which is described in the accompanying complete specification

Details of basic application(s):

<table>
<thead>
<tr>
<th>Number of basic application</th>
<th>Name of Convention country in which basic application was filed</th>
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<tr>
<td>85870050.3</td>
<td>EP</td>
<td>02 APR 85</td>
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My/our address for service is care of CLEMENT HACK & CO., Pate Attorneys, 601 St. Kilda Road, Melbourne 3004, Victoria, Australia.

DATED this 18th day of March 1986

ARBIOS Societe Anonyme

CLEMENT HACK & CO.

TO: The Commissioner of Patents.

R.G. Duckworth
DOCUMENTS LODGED WITH THIS APPLICATION ARE UNSUITABLE FOR REPRODUCTION AND MAY BE INSPECTED AT THE PATENT OFFICE A.C.T.
It is already known to provide a device for extracting material in the form of a powder or in the form of particles, in a vessel of circular or polygonal cross-section having a bottom consisting of a flat plate. The known extraction device is in the form of a frame sliding on the flat plate and associated with several upwardly open channels, which are parallel to the flat plate of the vessel.

The known extraction device operates in the following manner. The frame sliding on the flat plate sweeps the material until it falls into the upwardly open channels. Then the transport screws displace the material towards openings provided at the side, under the flat plate of the vessel.

It is an object of the invention to modify such a known vessel so that it may be utilised as a reactor vessel for anaerobic fermentation.

According to the invention, the vessel is characterised first of all in that it is closed by a cover having at least one opening communicating with an inlet duct for material to be submitted to anaerobic fermentation and an opening communicating with a discharge duct for gas produced during fermentation, secondly in that the pistons or activating shafts for the sliding frame and the drive shafts for the transport screws are surrounded by sealing glands, and finally in that the channels equipped with transport screws terminate at at least one discharge channel, the...
(11) AU-A-54920/86

...cross-section of which narrows towards the outlet opening, and in which there is disposed a transport screw extending towards the outlet opening, without however reaching this opening, and the transport screw forms, in the region of the discharge channel the cross-section of which narrows, a plug of fermented material of a density sufficient to prevent escape of gas produced during anaerobic fermentation through the outlet opening of the discharge channel.

Claim

1. A flat plate vessel comprising an extraction device having a sliding frame (6) on the flat plate, the frame being associated at least with one upwardly open channel (7), which is parallel to the flat plate and is provided with a transport screw (8), characterised in that the vessel is first of all closed by a cover (3) having at least one opening communicating with an inlet duct (5) for material to be subjected to anaerobic fermentation and an opening communicating with a discharge duct (4) for gas produced during fermentation, secondly that at least one activating shaft (13) for the sliding frame (6) and the drive shafts for the transport screws (8 and 10) are surrounded by sealing gland devices, and finally in that the channels (7) equipped with transport screws (8) terminate at at least one discharge channel (9), the cross-section of which narrows towards the outlet opening, and in which there is disposed a transport screw (10) extending towards the outlet opening, without however reaching this opening, and the transport screw forms, in the region of the discharge channel (9) the cross-section of which narrows, a plug of fermented material of a density sufficient to prevent escape of gas produced during anaerobic fermentation through the outlet opening of the discharge channel.
Short Title: Int. Cl:
Application Number: 54920/86
Lodged: Complete Specification-Lodged:
Accepted: Lapsed:
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Related Art:

TO BE COMPLETED BY APPLICANT

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Complete Specification for the invention entitled:
VESSEL FORanaerobic fermentation

The following statement is a full description of this invention including the best method of performing it known to me:-
It is already known to provide a device for extracting material in the form of a powder or in the form of particles, in a vessel of circular or polygonal cross-section having a bottom consisting of a flat plate. The known extraction device is in the form of a frame sliding on the flat plate and associated with several upwardly open channels, which are parallel to the flat plate of the vessel.

The known extraction device operates in the following manner. The frame sliding on the flat plate sweeps the material until it falls into the upwardly open channels. Then the transport screws displace the material towards openings provided at the side, under the flat plate of the vessel.

It is an object of the invention to modify such a known vessel so that it may be utilised as a reactor vessel for anaerobic fermentation.

According to the invention, the vessel is characterised first of all in that it is closed by a cover having at least one opening communicating with an inlet duct for material to be submitted to anaerobic fermentation and an opening communicating with a discharge duct for gas produced during fermentation, secondly in that the pistons or activating shafts for the sliding frame and the drive shafts for the transport screws are surrounded by sealing glands, and finally in that the channels equipped with transport screws terminate at at least one discharge channel, the cross-section of which narrows towards the outlet opening, and in which there is disposed a transport screw extending towards the outlet opening, without however reaching this opening, and the transport screw forms, in the region of the discharge channel the cross-section of which narrows, a plug of fermented material of a density sufficient to prevent escape of gas produced during anaerobic fermentation through the outlet opening of the discharge channel.

The invention is explained hereinafter with reference to an example of an embodiment shown schematically in the attached drawing. Figures 1 and 2 of the drawing are respectively, a section of a vessel in elevation and a section of a vessel in plan. Figure 3
represents a gland device.

In Figures 1 and 2, a fermentation vessel is formed from a flat plate 1, a side wall 2, and a cover 3. In the cover, a central opening communicates with an outlet duct 4 for gas produced during fermentation, while other openings are connected to inlet ducts 5 for the material to be subjected to anaerobic fermentation. These inlet ducts are fed by one or more pumps, not shown, of the concrete-pump type. Due to its being transported by means of pumps, the material to be subjected to fermentation attains, in the inlet ducts 5, a density sufficient to prevent escape of gas produced through the inlet ducts 5. If several inlet ducts 5 terminate at different locations on the cover 3, it is possible to provide an arrangement, not illustrated, for advancing in turn the material in the different inlet ducts 5 and thus ensuring a good distribution of fresh material, and optionally recycled material, in the upper part of the reactor vessel. In order to withdraw the fermented material on the base of the vessel, a sliding frame 6 moves in a reciprocating manner on the base. In order to ensure a good standard of scraping, the frame 6 is formed from cross-members in the form of a wedge, the members being disposed in such a way that the face of the wedge perpendicular to the base of the vessel defines a side directed towards extraction channels 7. These extraction channels are equipped with transport screws 8 and communicate with a discharge channel 9 located at the side of the vessel.

The cross-section of at least a part of the discharge channel 9 narrows to an increasing extent as it approaches the outlet opening of the channel 9. A transport screw 10 extending towards the outlet opening of the channel 9 is also disposed in the interior of the channel 9. The downstream end of the screw 10 is located in a part of the channel 9 where its cross-section narrows towards the outlet opening, but the screw does not reach to this outlet opening. In this way, a plug of fermented material is formed upstream of the outlet opening.

It is clearly possible to use a transport screw 10, the pitch of which varies along its axis, and in particular it is possible to use a screw, the pitch of which shortens at the downstream end, that is to say, at the location where the channel narrows, or where there is formed a plug of a density sufficient
to avoid escape of fermentation gas through the outlet opening of channel 9. The space above the screw 10, on the upstream side, that is to say, on the side away from the outlet opening of channel 9, may be connected by means of a suitable duct 11 to the gas outlet duct 4 leading from the cover. In addition, the discharge channel 9 is preferably inclined so that the material is entrained in it towards the top and the liquid squeezed out during the compression of the material forming the plug runs towards the bottom, or a purging device 12 may be provided, either acting intermittently or continuously. The outlet end of channel 9 may also be closed by a closure valve, not shown, during the periods when transport screw 10 is stationary.

The frame 6 is secured to one or more displaceable shafts 13 activated by one or more motor means, for example, hydraulic actuators 14.

At the locations where these displaceable shafts 13 pass through the vessel, sealing glands 15 are provided in order to prevent gas formed in the vessel from escaping along these shafts 13. Glands of this kind are also provided at the locations where the drive shafts of screws 8 and 10 pass out.

At each location where one of the displaceable drive shafts 13 passes out of the vessel, a gland device 15 in accordance with Figure 3 may be provided, this consisting of a chamber 16 between two glands 17 and 18. A supplementary gland 19 may also be provided, this being inactive during movement of the shafts 13 and provided with a locking device 20. A gland 19 of this kind is applied to shaft 13 by device 20 at the instant the shaft stops, to replace glands 17 and 18. The same arrangement of gland may be used at the locations where the drive shafts of transport screws 8 and 10 leave the boundary enclosing the reaction gas, that is to say the vessel and the channels 7 and 9. However, since the rotating glands around the drive shafts of screws 8 and 10 are subjected to only a relatively low degree of wear, it is possible to dispense with gland 19 and its locking device 20.

The chambers 16 of the various gland devices 15 are connected to the gas outlet duct 4 by means of duct 21. Similarly, the space in discharge channel 9 upstream of the plug located near
the outlet opening is connected to the duct 4 by means of a duct 11. In this way, excessive local pressures causing escape of fermentation gas towards the exterior are avoided.

Like channel 9, each chamber 16 is also provided with purging means 22, either continuous or intermittent.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A flat plate vessel comprising an extraction device having a sliding frame (6) on the flat plate, the frame being associated at least with one upwardly open channel (7), which is parallel to the flat plate and is provided with a transport screw (8), characterised in that the vessel is first of all closed by a cover (3) having at least one opening communicating with an inlet duct (5) for material to be subjected to anaerobic fermentation and an opening communicating with a discharge duct (4) for gas produced during fermentation, secondly that at least one activating shaft (13) for the sliding frame (6) and the drive shafts for the transport screws (8 and 10) are surrounded by sealing gland devices, and finally in that the channels (7) equipped with transport screws (8) terminate at at least one discharge channel (9), the cross-section of which narrows towards the outlet opening, and in which there is disposed a transport screw (10) extending towards the outlet opening, without however reaching this opening, and the transport screw forms, in the region of the discharge channel (9) the cross-section of which narrows, a plug of fermented material of a density sufficient to prevent escape of gas produced during anaerobic fermentation through the outlet opening of the discharge channel.

2. A vessel according to claim 1, characterised in that the sealing gland devices include a chamber (16) between two glands and in that the chamber (16) is connected to the discharge duct (4) by means of a duct (21).

3. A vessel according to claim 2, characterised in that the gland devices also include a gland (19), which is located where an activating shaft (13) passes out of the vessel and is provided with a locking device (20).

4. A vessel according to any of claims 1, 2, or 3, characterised in that the space within the discharge channel (9) upstream of the plug closing off its outlet opening is connected to the discharge duct (4) by means of a duct (11).

5. A vessel according to any of the preceding claims, characterised in that the discharge channel (9) includes a purging device (12).
6. A vessel according to either of claims 2 or 3, characterised in that each chamber (16) is provided with purging means (22).

DATED THIS 18TH DAY OF MARCH, 1986.

ARBGOS
By Its Patent Attorneys:

CLEMENT HACK & CO.