Title: CUTTING-MIXING-FEEDING WAGON FOR FIBROUS MATERIALS WITH SILAGE TILLER

Abstract: A wagon (1) for cutting, mixing and feeding ensiled fibrous materials comprising: a container (2) provided with at least one opening for the inlet of the desiled material to be treated and at least one opening (4) for discharging the treated material; at least one rotary auger (3) arranged inside said container and provided with at least a couple of opposed spirals provided with peripheral blades for cutting and mixing said fibrous materials; a silage tiller (6) having a cylindrical drum provided on its lateral surface with a plurality of operative members (61) adapted to convey said desiled fibrous material inside said container (2), said drum being rotated by actuating means (62). The silage tiller (6) is arranged near the top of a rear door (5) of said wagon, said rear door being adapted to rotate around a horizontal axis (7) transversal to the longitudinal axis of the wagon through actuating means.
CUTTING-MIXING-FEEDING WAGON FOR FIBROUS MATERIALS WITH SILAGE TILLER
The present invention relates to an improved cutting-mixing-feeding wagon for fibrous materials, provided with a silage tiller adapted to transfer said ensiled fibrous materials inside the wagon.

It is well known that the desiling operation of fibrous materials such as forage, grass, straw and the like, is carried out by using cutting and mixing wagons provided with two articulated arms supporting a rotary cutter which descends vertically along the front of the ensiled material and conveys it inside the wagon pushing it in a direction tangentially to its rotation direction. A covering case fixed to the articulated arm of the cutter and partially covering said cutter, enhances the delivery of the material inside the wagon.

This kind of construction known and used since several years has a rather high cost and for this reason the penetration of the markets by the wagons provided with silage tillers is difficult. The higher cost of applying a silage tiller to a cutting and mixing wagon mainly consists of the articulated arms moving the cutter up and down.

These articulated arms, as shown in Fig. 1 illustrating the prior art, must be moved by actuating cylinders, one cylinder for each side and each arm.

Moreover during the working motion of the cutter, the rear door of the wagon must be opened even in gradual and different ways so as to allow inlet of the desiled material into the wagon.

This occurs mainly when the cutter is operating in the lowest part of its motion, namely close to the ground, where the ensiled material must be projected upwards and therefore must overcome a height difference.

The manoeuvre of the rear door involves also the specific construction of manoeuvre means contributing to increase the cost of the wagon provided with silage tiller.

The main object of the present invention is to provide a cutting-mixing-feeding wagon for fibrous material provided with a silage tiller, having a simplified construction so as to reduce substantially the costs and consequently may be intended for a broader market.

In the frame of this purpose, an object is to simplify at best the movements of the silage tiller and combine them with the movements of the rear door for the inlet of the desiled material.
Another object is to avoid that the material desired by the cutter is spread out from the wagon where it should be contained.

All the above mentioned and other objects that will be better understood hereinafter are attained by a cutting-mixing-feeding wagon for ensiled fibrous materials comprising:

- a container provided with at least an opening for inlet of the desired material to be treated;
- at least one door for discharging the treated material;
- at least one rotary auger arranged inside said container and provided with at least a couple of opposed spirals, having peripheral blades for cutting and mixing said fibrous materials;
- a silage tiller having a cylindrical drum provided on its surface with a plurality of operative members adapted to cut and convey said desired fibrous material inside the wagon, said drum being rotated by actuator means,

wherein according to the wording of the main claim, said wagon is characterized in that said silage tiller is arranged near the top of a rear door of the wagon, said door being adapted to rotate around a horizontal axis transversal to the longitudinal axis of the wagon through actuator means.

Advantageously according to the invention the movement of the rear door involves also the movement of the cutter so that additional different driving means for the door and the cutter are not required.

Clearly this involves savings in the wagon construction, also in view of using a reduced number of actuator means and removing the need of articulated arms for the cutter.

Moreover such a construction of the wagon according to the invention allows to obtain compact dimensions and therefore a greater facility of use.

Further features and characteristics of the invention will be better understood from the following description of a preferred embodiment given as an illustrative but non-limiting example and shown in the accompanying sheets of drawings in which:

- Fig. 1 shows a cutting, mixing and feeding wagon of the prior art;
- Fig. 2 shows the cutting-mixing-feeding wagon for fibrous material with the silage tiller of the invention with the rear door partially opened and
closed;

- Fig. 3 is another view of the wagon of the invention with the silage tiller; and

- Fig. 4 is a sectional view of the details of the connection of the silage tiller with the rear door.

With reference now to Fig. 3, the cutting, mixing and feeding wagon of the invention is partially shown and indicated generally with reference numeral 1, mounted on wheels and comprises a container 2 with open top and provided on the bottom with rotary augers 3 that cut and mix the desired material conveying it to an opening 4 arranged on one side in a central position of the container and adapted to discharge the desired treated material.

On the rear side the container 2 is provided with a rear door 5 having a concave shape 51 as shown in Fig. 3 and Fig. 2, so as to allow its rest substantially on the ground. The rear door 5 is also provided with lateral shoulders 52 and 53 allowing to restrain the desired material in the event that said material under the action of the cutter 6, does not succeed to reach the inner room of the container 2.

The rear door 5 is hinged at 7 around a horizontal axis transversal to the longitudinal axis of the wagon.

The operation of the rear door 5 is effected by actuating a couple of hydraulic cylinders 54 arranged near the edges of the rear door.

Each of said hydraulic cylinders is hinged at 541, namely at a metal gusset plate 56 protruding from the wagon 2. The end portion of the piston indicated with numeral 543, is hinged on another metal gusset plate 544 belonging to the rear door 5.

As shown in Fig. 2, the couple of hydraulic cylinders 54 allow the rotation downwards of the rear door 5 so as to arrange the cutter 6 in the working position against the heap of ensiled material 9.

The cutter 6, as better shown in Fig. 3, is provided with operative members 61 desiling the fibrous material and catapulting it inside the container 2 during the cutter rotation.

Such a rotation is obtained through a hydraulic motor 62 mounted together with the cutter on supports 55 which are fixedly connected to the lateral shoulders 52, 53 of the rear door 5 as shown in Fig. 4.

The cutter 6 is protected by a conveying case 8 of a suitable shape and of the
same length of the cutting cylinder 6. Such a case 8 is supported by two lateral
aprons 81 connected to the lateral shoulders 52, 53 of the rear door 5. The
action of this conveying case is to address the flow of desiled material inside
the room defined by the container 2.

The excess material that does not succeed to enter the container 2, is
collected in the cavity of the rear door 5 and when the rear door gradually rises
following the working operation of the cutter, as shown in Fig. 2, such a
material collected by the rear door slides inside the wagon.

In operation, to carry out the desiling step with the wagon of the invention, the
rear door 5 must be moved to the position shown with solid lines in Fig. 2.
Then the wagon is put in reverse motion so that the cutter contacts a portion of
the heap and enters the heap at least for a length equal to the radius of the
cutter.

Of course during the reverse motion the rotation of the cutter must be already
started so as to make easier penetration of the cutter into the heap of ensiled
material.

Once the position of the wagon is effected, the hydraulic cylinders 54 are
actuated so that the rotating cutter runs along a circle arc with the centre on
the transversal horizontal axis 7. Once the cutter reaches the upper part of the
heap of ensiled material, the operation may proceed as described, namely
starting again from the bottom or the top, always causing the cutter to enter the
heap for a depth equal to its radius and then actuating the hydraulic cylinders
54.

As hereinabove described, the cutting-mixing-feeding wagon for fibrous
material with silage tiller of the invention is a very cheap and substantially
simple machine, because the long prior art arms supporting the cutter were
removed and also all the opening and closing mechanisms for the rear door
where eliminated since the up and down movement of the cutter is now
coincident with the movement of the rear door.

Even if the operative range of the silage tiller is limited by the distance between
the cutter rotation centre and the hinge of the rear door, this limitation is
anyway largely offset by the simplicity of movement and consequently low cost
of the rear door.
CLAIMS

1) A wagon (1) for cutting, mixing and feeding ensiled fibrous materials comprising:
   - a container (2) provided with at least one opening for inlet of the desiled material to be treated and at least one door (4) for discharging the treated material;
   - at least one rotary auger (3) arranged in said container and provided with at least a couple of opposed spirals provided with peripheral blades for cutting and mixing said fibrous materials;
   - a silage tiller (6) having a cylindrical drum provided on its lateral surface with a plurality of operative members (61) adapted to convey said desiled fibrous material inside said container (2), said drum being rotated by actuating means (62);

   characterized in that said silage tiller (6) is arranged near the top of a rear door (5) of said wagon, said rear door being adapted to rotate around a horizontal axis (7) transversal to the longitudinal axis of the wagon through actuating means.

2) The wagon according to claim 1) characterized in that said rear door (5) has lateral shoulders (52, 53) for restraining the desiled material.

3) The wagon according to claim 2) characterized in that support brackets (55) for said cutter (6) are fixed in said lateral restraining shoulders (52, 53).

4) The wagon according to claim 2) characterized in that said restraining shoulders (52, 53) support at least a covering case (8) conveying the desiled material.

5) The wagon according to claim 1) characterized in that the actuating means for said rear door (5) consist of two hydraulic cylinders (54) arranged at the lateral ends of said door.

6) The wagon according to claim 5) characterized in that each lateral shoulder (52, 53) of said rear door is provided with a support bracket (55) for the cylindrical drum of said cutter, one of said brackets supporting also the actuating means (61) for the rotation of said cutter.

7) The wagon according to any of the preceding claims, characterized in that the actuating means for rotation of the silage tiller (6) is a hydraulic motor (62).
8) The wagon according to any of the preceding claims, characterized in that the rear door (5) has a concave shape.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC 7 A01F25/20

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)

IPC 7 A01F

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 practical, search terms used)

EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
<thead>
<tr>
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<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tbody>
<tr>
<td>X</td>
<td>EP 0 846 411 A (VON DER HEIDE MASCHINENBAU GMB) 10 June 1998 (1998-06-10)</td>
<td>1-3,7</td>
</tr>
<tr>
<td>Y</td>
<td>A column 6, line 26 -column 9, line 58 figures 1-4</td>
<td>5,7</td>
</tr>
<tr>
<td>A</td>
<td>Y DE 298 06 219 U (STRAUTMANN) 29 July 1999 (1999-07-29)</td>
<td>6</td>
</tr>
<tr>
<td>A</td>
<td>Y A page 3 -page 4 figures 1,2</td>
<td>1,4</td>
</tr>
<tr>
<td>Y</td>
<td>A EP 0 861 585 A (VON DER HEIDE MASCHINENBAU GMB) 2 September 1998 (1998-09-02)</td>
<td>7</td>
</tr>
<tr>
<td>A</td>
<td>Y A column 4, line 46 -column 6, line 25 figure 1</td>
<td>1-3,6</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

**Date of the actual completion of the international search**

22 May 2001

**Date of mailing of the international search report**

30/05/2001

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**Authorized officer**

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<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
</table>
| A        | FR 2,596,945 A (DEBOFFLES REGIS)  
16 October 1987 (1987-10-16)  
page 5, line 3 - page 9, line 3  
figures 1, 7A-7D | 1-3,5 |
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
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</thead>
<tbody>
<tr>
<td>DE 29806219 U</td>
<td>29-07-1999</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td>FR 2596945 A</td>
<td>16-10-1987</td>
<td>NONE</td>
<td></td>
</tr>
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</table>