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(54) INLET HOPPER CONSTRUCTION FOR A TWIN-SCREW PUMP

EINLASSTRICHTERKONSTRUKTION FÜR EINE DOPPELSCHNECKENPUMPE

STRUCTURE DE TREMIE D'ENTREE POUR POMPE A DOUBLE VIS

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EP 1 671 036 B1

Description

TECHNICAL FIELD

[0001] The present invention relates to an inlet hopper construction for a twin-screw pump of the kind set forth in the preamble of claim 1.

BACKGROUND ART

[0002] In inlet hopper constructions for twin-screw pumps of this kind it is known to provide the feed screws in the bottom part of the hopper with a close fitting between the screws and the bottom of the inlet hopper by having a cylindrical bottom formation with approximately same radius of curvature as the radius of the feed screws and having this cylindrical formation extending to approximately half way up along the sides of the feed screws, where a mainly planar extension is forming the rest of the hopper construction. A hopper construction of this kind is e.g. known from US-4,566,640 and US-4,685,628.

DISCLOSURE OF THE INVENTION

[0003] It is the object of the present invention to provide an inlet hopper construction of the kind referred to above, with which it is possible to improve the filling of the feed screws and consequently the filling of the pump screws, and this object is achieved with an inlet hopper construction for a twin-screw pump of said kind, which according to the present invention also comprises the features set forth in the characterising clause of claim 1. With this arrangement, the material from the hopper is able to fill the feed screw grooves from the sides as well as from the top of said feed screws, whereby the filling of the feed screws and consequently the pump screws is increased compared to the constructions in accordance with the prior art.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] In the following detailed part of the present description, the invention will be explained in more detail with reference to the exemplary embodiment of an inlet hopper construction for a twin-screw pump according to the invention shown in the drawings, in which

Figure 1 schematically shows a cross section of an inlet hopper construction in accordance with a preferred embodiment of the present invention with feed screws mounted therein,

Figure 2 schematically shows the construction in Figure 1 for indicating the different radii of the feed screws and the cylindrical formation of the bottom of the hopper construction,

Figure 3 shows the construction of Figures 1 and 2 in a longitudinal cross section, and

Figures 4a and 4b schematically shows combined feed screws and pump screws for use in the hopper construction in accordance with the preferred embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0005] The inlet hopper construction shown in Figures 1-3 for a twin-screw pump comprises two mutually engaging feed screws 1,1' positioned at the bottom of the inlet hopper 3 for feeding the material from the hopper 3 toward the twin-screw pump. The twin-screw pump comprises two mutually engaging pump screws 2,2', preferably with constant pitch, as shown in Figures 4a and 4b, which in the embodiment shown are positioned on a shaft common with the shaft of the feed screws 1,1', and thus aligned co-axially with the feed screws. Furthermore, the twin-screw pump comprises a pump casing 4 (not shown in detail) and the pump screws 2,2' are positioned in the casing 4 with close clearances between the casing 4 and between the mutually engaging flights and grooves of the pump screws 2,2'. The function of the twin-screw pump is as known from the prior art and it should not be necessary here to explain this function in detail. In the embodiment shown in the drawings, the twin-screw pump has its pumping screws 2,2' extending out of the casing 4 in order to prevent the twin-screw pump from being "over-filled".

[0006] In certain applications, in which the twin-screw pump is used for dosing material, e.g. for filling sausages, it is of major importance that the pump screws 2,2' are completely filled with material from the hopper 3. In traditional constructions, e.g. as known from the above-mentioned US-4,566,640, the filling of the pumping screws 2,2' will normally only reach 80%-85%, especially in connection with certain high viscosity or lumpy material. The result of such insufficient filling is a reduced precision of the dosing of material out of the twin-screw pump. In order to increase the above filling percentage, the present invention prescribes the provision of a widening out 5 along the outer sides of the feed screws 1,1', which allows the material in the hopper 3 to enter into the grooves of the feed screws 1,1' from the sides as well as from the top. In the embodiment shown in the figures, the widening out 5 along the outer sides of the feed screws 1,1' are formed as a cylindrical formation of the bottom with a radius R+X, which is larger than the outer radius R of the feed screws 1,1', and the inlet hopper 3 is formed with a close fitting with the bottom part of the feed screws 1,1' by having the centre for the cylindrical formation of the bottom part positioned at a distance Y above the centre for the feed screws 1,1', where $Y \leq X$.

[0007] As an alternative, the position of the centre for the cylindrical formation of the bottom part can be positioned at a distance Y in a direction deviating from vertical by an angle α and with the same restrictions between X and Y as mentioned above. The angle α is preferably between 0° (as shown in Figure 2) and 30°. In a preferred embodiment, the value of X is between 10 and 50% of

R and the value of Y is X - δ, where δ is between 0 and 5% of R.

[0008] It will be evident for a man skilled in the art that other formations than the cylindrical formation of the bottom part can provide a similar widening out 5 along the outer sides of the feed screws 1,1' and that the dimensioning of the widening out naturally will depend on the material to be fed towards the twin-screw pump, i.e. the viscosity, granularity, and other parameters for the pumped material.

[0009] As shown in Figure 3, the hopper construction 3 is provided with a conically narrowing transition part 6 between the widening out bottom part 5 and the pump casing 4. This conical narrowing transition part 6 provides a further increased filling of the feed screws 1,1', when the material in the hopper 3 is transported towards the pump screws 2,2' and the pump casing 4. Preferably, the conical narrowing transition part 6 is formed as a combination of two truncated cones, thus providing a smooth transition from the two cylindrical hopper bottom parts with radius R+X to the two cylindrical pump casings 4 with radius R. In the embodiment shown, the cone angle, i.e. the top angle of the cone is approximately 30°. Other angles are naturally possible, but this angle should preferably be kept below 50°.

[0010] As shown in Figures 1-3, the bottom part of the hopper construction 3 is provided with axially extending rails 7 in order to guide the material axially along the feed screws 1,1' during the rotational movement of said feed screws 1,1'.

[0011] Preferably, the screws 1,2 and 1',2', respectively, are rotating in opposite directions and in such directions that the movement direction of the feed screws 1,1' along the outer sides of the hopper 3 is in the direction of the bottom of the inlet hopper 3. Such a rotational direction will improve the function of the widening out 5 along the outer sides of the feed screws 1,1' for improved filling of the feed screws 1,1' and accordingly, the pump screws 2,2'.

[0012] In the embodiment shown, the radius R for the feed screws 1,1' and the pump screws 2,2' is constant and identical, but for a man skilled in the art it will be evident that other formations of the feed screws and the pump screws can be envisaged.

[0013] In the embodiment shown in the drawings, the feed screws 1,1' are formed with relatively narrow flights and relatively broad grooves, which is especially suitable in connection with high viscosity and/or lumpy material. However, the feed screws 1,1' can be formed in other ways, e.g. identical to the pump screws 2,2', said last possibility being an advantage in connection with materials of low viscosity.

[0014] Experiments have shown that with a construction corresponding to the above described preferred embodiment, the filling of the pump screws 2,2' can be increased from 85%, as measured on a traditional construction, to approximately 98-99%, as measured with the preferred embodiment.

[0015] Above, the invention has been described in connection with a preferred embodiment and it will be evident for a man skilled in the art that many modifications can be made without departing from the scope of the appended claims.

Claims

1. Inlet hopper construction for a twin-screw pump comprising two mutually engaging feed screws (1,1'), said feed screws (1,1') being positioned at the bottom of the inlet hopper (3) for feeding the material towards the twin-screw pump,
   two mutually engaging pump screws (2,2') aligned co-axially with the feed screws (1,1') and positioned in a pump casing with close clearances with said casing (4) and between the mutually engaging flights and grooves, said inlet hopper (3) being formed with a close fitting with the bottom part of the feed screws (1,1') and a widening out (5) along the outer sides of the feed screws (1,1') in order to allow the material in the hopper (3) to enter into the grooves of the feed screws (1,1') from the sides as well as from the top, **characterised by** the widening out (5) along the outer sides of the feed screws (1,1') being formed as a cylindrical formation of the bottom with a radius (R + X) which is larger than the outer radius (R) of the feed screws (1,1').

2. Inlet hopper construction in accordance with claim 1, **characterised by** the distance Y ($Y \leq X$) between the centre of the feed screws (1,1') and the centre for the cylindrical formation of the bottom part, whereby there is provided a close fitting between the bottom part of the feed screws (1,1') and the inlet hopper (3) bottom section.

3. Inlet hopper construction in accordance with claim 2, **characterised by** comprising an angle α between the vertical direction and the line between the centres for the feed screws (1,1') and the centres for the cylindrical parts of the bottom of the hopper (3), where $0° \leq \alpha \leq 30°$.

4. Inlet hopper construction in accordance with any of the preceding claims, **characterised by** choosing X = 10-50% of R and choosing Y = X - 6, where $0 < \delta \leq 5\%$ of R.

5. Inlet hopper construction in accordance with any of the preceding claims, **characterised by** further comprising a conically narrowing transition part (6) between the widening out bottom part and the pump casing.

6. Inlet hopper construction in accordance with claim 5, **characterised by** the conical narrowing transition

part (6) being formed as a combination of two truncated cones.

7. Inlet hopper construction in accordance with claim 6, **characterised by** the cone angle γ of the conically narrowing transition part (6) being 10-50°, preferably 25-35°, and more preferred equal to 30°.

8. Inlet hopper construction in accordance with any of the preceding claims, **characterised by** the rotational direction of the two mutually engaging feed screws (1,1') being such that the movement direction of said feed screws (1,1') along the outer sides is in the direction of the bottom of the inlet hopper (3).

9. Inlet hopper construction in accordance with any of the preceding claims, **characterised by** the feed screws (1,1') and the pump screws (2,2') having the same diameter (2R).

10. Inlet hopper construction in accordance with any of the preceding claims, **characterised by** comprising axially extending rails (7) in the bottom of the hopper construction for guiding the material axially along the feed screws (1, 1').

Patentansprüche

1. Beschickungstrichterkonstruktion für einen Doppelschneckenpumpe, umfassend zwei ineinander greifende Vorschubschnecken (1, 1'), wobei die Vorschubschnecken (1, 1') für die Zufuhr des Förderguts zur Doppelschneckenpumpe am Boden des Beschickungstrichters angeordnet sind (3), zwei ineinander greifende Pumpenschnecken (2, 2'), die koaxial mit den Vorschubschnekken (1, 1') ausgerichtet und in einem Pumpengehäuse mit geringem Abstand zur Wand des Gehäuses (4) und zwischen den ineinander greifenden Gängen und Nuten angeordnet sind, wobei der Beschickungstrichter (3) dicht passend mit dem unteren Teil der Vorschubschnekken (1, 1') ausgebildet ist, sowie eine entlang der Außenseiten der Vorschubschnecken (1, 1') vorgesehene seitliche Verbreiterung (5), durch welche dem Fördergut im Trichter (3) das Eindringen in die Nuten der Vorschubschnecken (1,1') von der Seite und von oben ermöglicht wird, **dadurch gekennzeichnet, dass** die seitliche Verbreiterung (5) entlang der Außenseiten der Vorschubschnecken (1, 1') als teilzylindrische Ausbildung der Bodenteils mit einem Radius (R + X) gestaltet ist, welcher größer ist als der Außenadius (R) der Vorschubschnekken (1, 1').

2. Beschickungstrichterkonstruktion nach Anspruch 1, **gekennzeichnet durch** den Abstand Y ($Y \leq X$) zwischen der Mittelachse der Vorschubschnecken (1, 1') und der Mittelachse der teilzylindrischen Ausbildung des Bodenteils, wodurch eine dichte Passung zwischen dem Bodenteil der Vorschubschnecken (1, 1') und dem Bodenteil des Beschickungstrichters (3) hergestellt wird.

3. Beschickungstrichterkonstruktion nach Anspruch 2, **gekennzeichnet durch** einen Winkel α zwischen der Vertikalen und der Verbindungslinie zwischen den Mittelachsen der Vorschubschnecken (1, 1') und den Mittelachsen der teilzylindrischen Abschnitte des Bodenteils des Trichters (3) mit $0° \leq \alpha \leq 30$ °.

4. Beschickungstrichterkonstruktion nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Werte X = 10 bis 50 % von R und $Y = X - \delta$ mit $0 < \delta < 5$ % von R gewählt wurden.

5. Beschickungstrichterkonstruktion nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** sie weiterhin einen konisch zulaufenden Übergangsabschnitt (6) zwischen der seitlichen Verbreiterung des Bodenteils und dem Pumpengehäuse aufweist.

6. Beschickungstrichterkonstruktion nach Anspruch 5, **dadurch gekennzeichnet, dass** der konisch zulaufende Übergangsabschnitt (6) als Kombination zweier Kegelstumpfe ausgeführt ist.

7. Beschickungstrichterkonstruktion nach Anspruch 6, **dadurch gekennzeichnet, dass** der Kegelwinkel Y des konisch zulaufenden Übergangsabschnitts (6) 10 bis 50°, bevorzugt 25 bis 35°, besonders bevorzugt 30 ° beträgt.

8. Beschickungstrichterkonstruktion nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Rotationsrichtung der beiden ineinander greifenden Vorschubschnecken (1, 1') so gewählt ist, dass die Bewegungsrichtung der Vorschubschnecken (1, 1') entlang der Außenseiten mit der Richtung des Bodenteils des Beschickungstrichters (3) übereinstimmt.

9. Beschickungstrichterkonstruktion nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Vorschubschnecken (1,1') und die Pumpenschnecken (2, 2') denselben Durchmesser (2R) aufweisen.

10. Beschickungstrichterkonstruktion nach einem der vorhergehenden Ansprüche, **gekennzeichnet durch** am Boden des Beschickungstrichters angeordnete, axial verlaufende Schienen (7) zur axialen Führung des Förderguts entlang der Vorschubschnecken (1, 1').

Revendications

1. Structure de trémie d'entrée pour pompe à double vis comportant
deux vis (1, 1') d'alimentation en prise l'une avec l'autre, lesdites vis (1, 1') d'alimentation étant positionnées au fond de la trémie (3) d'entrée en vue d'acheminer la matière vers la pompe à double vis, deux vis (2, 2') de pompage en prise l'une avec l'autre alignées coaxialement avec les vis (1, 1') d'alimentation et positionnées dans un carter de pompe avec de faibles jeux vis-à-vis dudit carter (4) et entre les filets et les rainures en prise les uns avec les-autres, ladite trémie (3) d'entrée étant formée de façon à donner un ajustement serré avec la partie inférieure des vis (1, 1') d'alimentation et un élargissement (5) le long des côtés extérieurs des vis (1, 1') d'alimentation afin de permettre à la matière située dans la trémie (3) de pénétrer dans les rainures des vis (1, 1') d'alimentation par les côtés ainsi que par le haut, **caractérisée en ce que** l'élargissement (5) le long des côtés extérieurs des vis (1, 1') d'alimentation est formé comme une conformation cylindrique du fond présentant un rayon (R + X) supérieur au rayon extérieur (R) des vis (1, 1') d'alimentation.

2. Structure de trémie d'entrée selon la revendication 1, **caractérisée par** la distance Y ($Y \leq X$) entre le centre des vis (1, 1') d'alimentation et le centre de la conformation cylindrique de la partie de fond, un ajustement serré étant ainsi assuré entre la partie inférieure des vis (1, 1') d'alimentation et la section de fond de la trémie (3) d'entrée.

3. Structure de trémie d'entrée selon la revendication 2, **caractérisée en ce qu'**elle comporte un angle α entre la direction verticale et la ligne joignant les centres des vis (1, 1') d'alimentation aux centres des parties cylindriques du fond de la trémie (3), où $0° \leq \alpha \leq 30°$.

4. Structure de trémie d'entrée selon l'une quelconque des revendications précédentes, **caractérisée par** le choix de X = 10-50 % de R et par le choix de Y = X - δ, où $0 < \delta \leq 5$ % de R.

5. Structure de trémie d'entrée selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'**elle comprend en outre une pièce (6) de transition se rétrécissant par conicité entre la partie de fond s'élargissant et le carter de pompe.

6. Structure de trémie d'entrée selon la revendication 5, **caractérisée en ce que** la pièce (6) de transition se rétrécissant par conicité est formée de la combinaison de deux cônes tronqués.

7. Structure de trémie d'entrée selon la revendication 6, **caractérisée en ce que** l'angle de conicité γ de la pièce (6) de transition se rétrécissant par conicité vaut 10 à 50°, de préférence 25 à 35° et est plus préférablement égal à 30°.

8. Structure de trémie d'entrée selon l'une quelconque des revendications précédentes, **caractérisée en ce que** la direction de rotation des deux vis (1, 1') d'alimentation en prise l'une avec l'autre est telle que la direction de mouvement desdites vis (1, 1') d'alimentation le long des côtés extérieurs est dans la direction du fond de la trémie (3) d'entrée.

9. Structure de trémie d'entrée selon l'une quelconque des revendications précédentes, **caractérisée en ce que** les vis (1, 1') d'alimentation et les vis (2, 2') de pompage présentent le même diamètre (2R).

10. Structure de trémie d'entrée selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'**elle comporte des rails (7) s'étendant axialement dans le fond de la structure de trémie en vue de guider axialement la matière le long des vis (1, 1') d'alimentation.

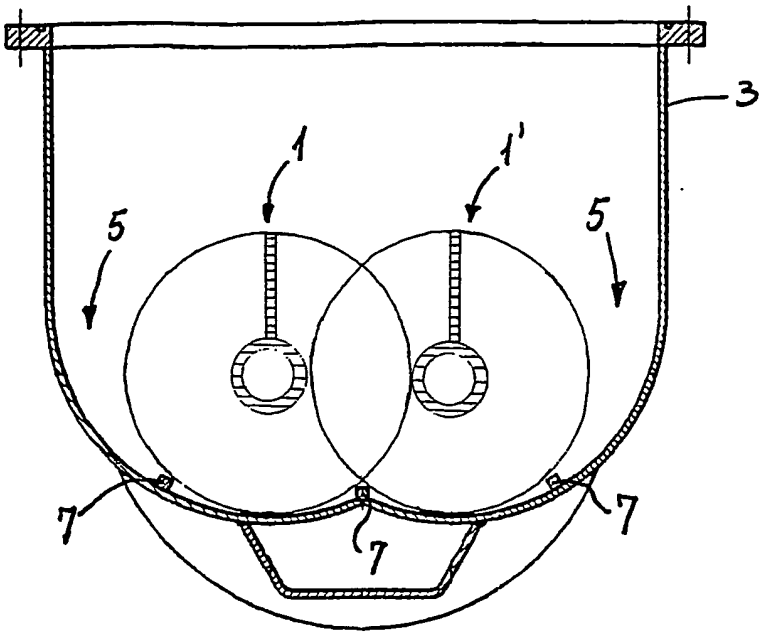

Fig.1.

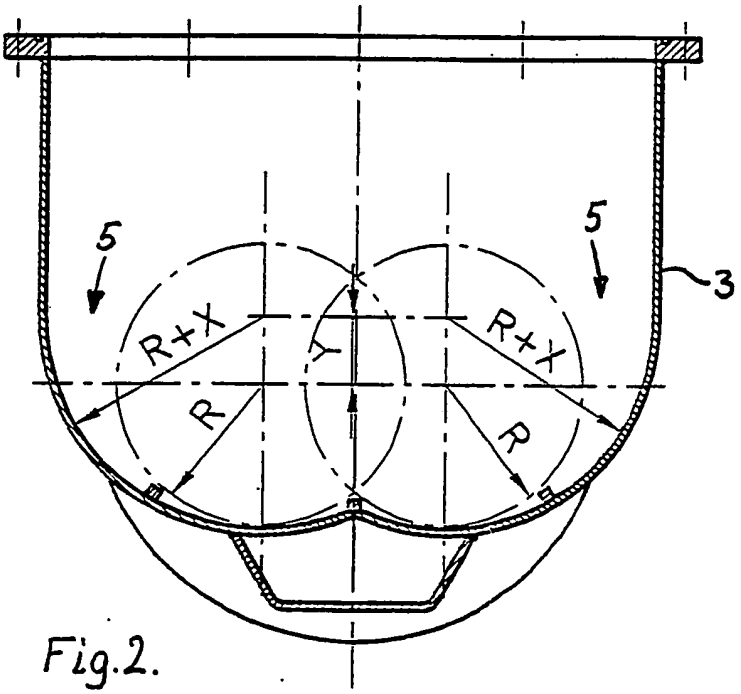

Fig.2.

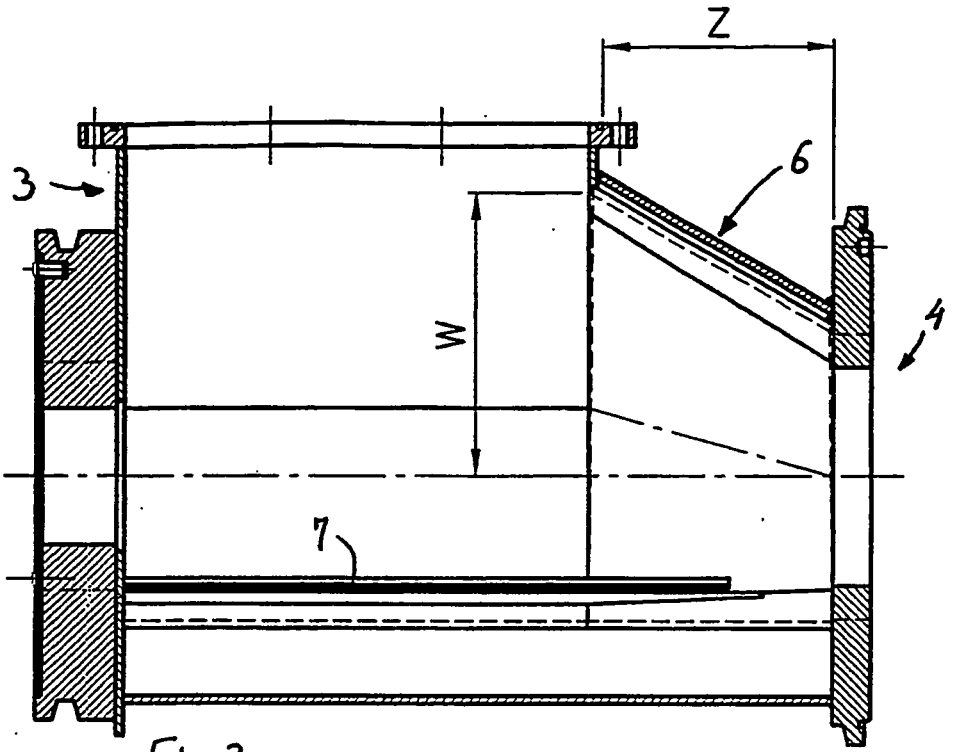

Fig.3.

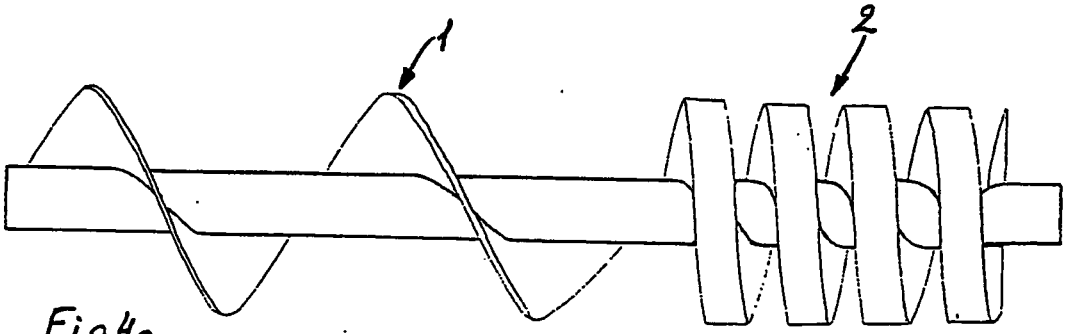

Fig.4a.

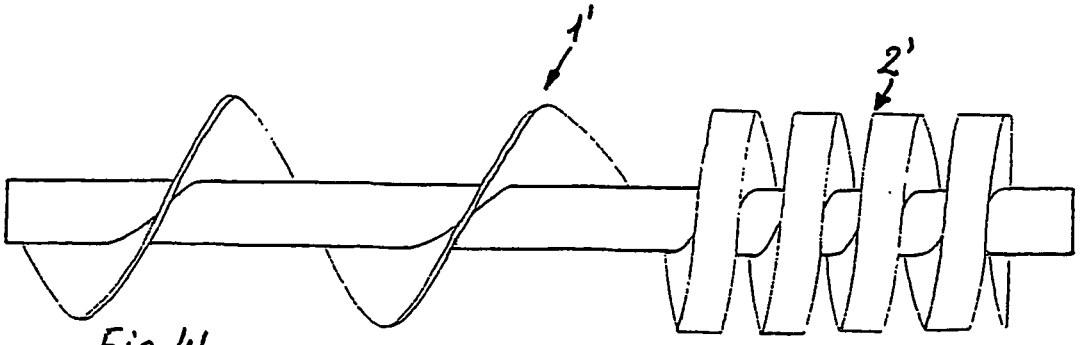

Fig.4b.

REFERENCES CITED IN THE DESCRIPTION

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