

PATENT SPECIFICATION

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(54) A SILO HAVING A DEVICE FOR FLUIDISING AND DISCHARGING PARTICULATE MATERIAL

(71) We, SOCIÉTÉ SYMAC, a French body Corporate of 18 Avenue du Bois Préau, 925000 Rueil, France, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to performed, to be particularly declared in and by the following statement:—

This invention relates to a silo having a device for fluidising and discharging particulate material therefrom.

For emptying silos with a flat base it is known to use devices which include a rotatably driven chain of which one of its ends is free to extend to the periphery of the silo and to roll up about the axis of rotation.

It has been established by our trials that a chain can not be used successfully for the discharge of divided or pulverulent products. If the chain is disposed at a certain height to avoid it coming into contact with the base, it follows that the chain adopts a curved position under its own weight and the product which lies under the chain is not discharged.

Moreover, if the chain rests on the base during rotation considerable noise and premature wearing out of the chain results, which requires that the chain is frequently replaced and this is very troublesome in causing the silo to be put out of action.

The chain due to its displacement at the moment of stopping has a tendency to roll up on itself to cause knots which it is impossible to untie without emptying the silo.

Moreover it is also known with flat base silos to use a flexible element to replace the chain to avoid the above disadvantages.

One such element allows the formation of a mixture of the product with the ambient air so that fluidisation of the divided product is obtained thereby assuring discharge more easily.

Silos with conical or pyramidal bases enable as compared to silos with flat bases, simultaneous filling up and emptying

without allowing a part of the product first stocked in the silo to remain.

Furthermore it is known that a device with the conical base can comprise a smooth shaft on which is fixed two resilient arms, but one such arrangement can not prevent the fact that the product is run off principally along this shaft thus disturbing the emptying of the silo.

The silo according to the invention has for an object to achieve emptying which is not exclusively central and to enable simultaneous refilling of the silo.

According to the invention a silo having a device for fluidising and discharging particulate material therefrom comprises a rotatable shaft arranged to extend internally of the base of the silo, hub members mounted for rotation on the shaft and extending in successive spaced planes perpendicular to the axis of the shaft, and at least one elongate flexible and deformable element attached at one of its ends to each of the hub members to be extendable outwardly of the hub member, the elements having a length no greater than the radial distance between the outer edge of the associated hub member and the nearest part of the wall of the base of the silo.

Further features of the invention will appear from the following description of an embodiment of the invention given by way of example only and with reference to the drawings in which:

Fig. 1 is a sectional elevation of a silo fitted with a discharge device and having a conical base,

Fig. 2 is an elevation of a detail of the silo of Fig. 1,

Fig. 3 is a sectional elevation of a modification of the silo of Fig. 1, and

Fig. 4 is a sectional view of part of the modification of Fig. 3.

Referring to Fig. 1, the illustrated silo is more particularly concerned to ensure the evacuation of the interior of the silo with a vertical axis filled with material in particulate form, such as granular or

5 pulverulent, for example, flour. A base 23 of the silo is in the form of a truncated cone or an inverted pyramid but it is evident that it can be of a different form, for example part spherical. Although it is not shown it is possible for the base 23 to be symetrical or asymetrical.

10 At the bottom of the base 23 of the silo is disposed a housing or trough 24 which communicates with the silo through an opening 25 and by a transfer member of helical spiral form which is constituted by two elements 26, 26a.

15 One of the helical elements 26 is connected at one of its ends to the output shaft 27 of a motor 28 and at the other end to a shaft 29 of transmission means 30 with bevel gearing fixed to a support 31 attached to the base of the housing 24.

20 At its other end 29a the shaft 29 is connected to the helical element 26a which extends with its free end into a lateral discharge duct 31a integral with the housing 24.

25 This arrangement enables the helical elements 26, 26a of the discharge mechanism to be disposed coaxially with the shaft 29 of the transmission 30 and directly in engagement with the shaft 29 of the transmission and driven by the motor 28 through the intermediary of the element 26. It is also possible to omit any additional transmission for driving the helical extraction means.

35 In the interior of the silo defined by the base 23 a rotary shaft 32 is arranged extending vertically and fixed to the output shaft of the transmission 30, the shaft 32 carrying hub members 33, 33a, 33b, 33c of circular form in vertically spaced planes perpendicular to the axis of the shaft 32 and on each hub member is attached one end of each of two flexible, deformable elongate elements such as 34, 34a, 34b, 34c.

45 The members 33 to 33c can have a conical vertical section as shown in chain lines for the member 33a.

50 The elements 34, 34a, 34b, 34c are extendable outwardly of the associated hub member and have a length no greater than the radial distance separating the outer edge of the associated members 33, 33a, 33b, 33c, and the wall of the base 23. The flexible elements can include, if necessary, weights at their free ends.

55 The members 33, 33a, 33b, 33c have different radial dimensions such that this dimension (or diameter) is at a maximum for the member 33 situated towards the bottom of the silo and progressively decreasing upwardly to reach a minimum for the member 33c situated at the top of the shaft 32. It will also be seen that the radial width of the members is not greater than the length of the associated flexible elements.

Inwardly of the opening 25 of the silo leading into the housing 24 of the extraction means, a member 35 is disposed which is of bell shaped form and is fixed to the bottom of the rotary shaft 32 and on which are fixed flexible elements 36, 36a of similar form to the elements 34 and which are for fluidising the product at the level of the outlet and in the housing 24.

75 Referring now to Fig. 2, a disc 37 is located on at least one of the members, such as 33 and has a diameter at least equal to that of the associated member of such a kind that it is mounted freely rotatable on the member through rollers 38 or by equivalent means such as ball bearings.

This arrangement is for enabling the disc 37 to turn freely while it supports little product and to be fixed while it supports the mass of product located in the silo.

85 The device operates in the following manner:

When the device is at rest and the silo is empty, the elements 34, 34a, 34b, 34c hang freely from the members to which they are attached, by reason of their flexibility.

90 After filling the silo with the product and at the beginning of rotation of the shaft 32 by the motor 28 through the transmission 30, the elements 34, 34a, 34b 34c have a tendency to deploy themselves radially under the action of centrifugal force, however, by virtue of the presence of the product the longer elements mounted on the members of the smaller radial dimension, such as 34c, have a tendency to roll themselves onto the shaft 32 as shown in continuous lines in Fig. 1, to the extent that the member at the upper part, such as 33c, has its effective length reduced so that the free end extends to a width which is no greater than the length of the element.

105 On the contrary the member 33 situated at the bottom of the silo has a relatively greater diameter and carries the shortest flexible elements 34 which are not rolled up around the shaft but are completely curled up under the member, thereby resulting in the elements having a tendency to be deployed radially quicker than the flexible elements 34b, 34c which are rolled up around the shaft 32. In this way the elements 34 at once produce fluidisation of the product at their level in the silo, then the elements 34a carried by the member 33a situated immediately above come into action and open up progressively to reach the position shown by chain lines in Fig. 1, and following in sequence the other elements 34b and 34c do likewise in going up towards the upper part of the silo.

120 The product thus runs off in generally horizontal layers because of the presence of the successive members 33 to 33c which form baffles and brake the descent of the 130

product lengthwise of the shaft 32, the braking action being more efficient if the members 33 are provided with discs 37 capable of lying substantially fixed in relation to the rotating members.

The object of the present invention is to obtain emptying which is not effected exclusively along the shaft 32, for a large part of the extraction of the product, in order to permit a simultaneous filling of the silo.

For large flows an independent drive assembly for the unloading system can be used, the shaft 32 being driven by an assembly shown in Figs 3 and 4. The drive assembly is formed of a tubular member 39 pivotally mounted on a wall of the base 23 of the silo by means of a plate 40, such that the tubular member 39 extends partly internally and partly externally of the silo.

At its external end the tubular member 39 carries a motor 41 having a drive shaft 42 on which is attached a pulley 43 which is connected by a belt 44, preferably notched, to another pulley 45 which is attached to the shaft 32 carrying the flexible elements.

The assembly formed by the pulleys 43, 45 and the belt 44 is disposed internally of the tubular member 39 which is closed by a cover at its internal end.

Bearing blocks 46 and 47 give support to the shaft 32 with respect to the member 39.

The plate 40 is adjustable to enable it to be positioned in several positions relative to the silo wall.

WHAT WE CLAIM IS:—

1. A silo having a device for fluidising and discharging particulate material therefrom comprising a rotatable shaft arranged to extend internally of the base of the silo, hub members mounted for rotation on the shaft and extending in successive spaced planes perpendicular to the axis of the shaft, and at least one elongate flexible and deformable element attached at one of its ends to each of the hub members to be extendable outwardly of the hub member, the elements having a length no greater than the radial distance between the outer edge of the associated hub member and the nearest part of the wall of the base of the silo.

2. A silo according to claim 1 wherein the elements are weighted.

3. A silo according to claim 1 or 2 wherein the hub members have different radial dimensions so that for the member towards the bottom of the silo the radial dimension is at a maximum and for the upper member the dimension is at a

minimum, the dimensions of the members progressively decreasing between the lower and upper members.

4. A silo according to any one of claims 1 to 3 wherein the radial width of the hub members is no greater than the length of the associated flexible element or elements.

5. A silo according to any one of claims 1 to 4 wherein on at least one of the hub members is mounted a freely rotatable disc.

6. A silo according to any one of the preceding claims wherein the shaft supporting the hub members is driven by a motor through a transmission means having bevel gearing.

7. A silo according to claim 6, wherein an input shaft of the transmission means bevel gearing is disposed coaxially of a helical transportation means which is located in a housing at the bottom of the silo, one element of the transport means interconnecting a shaft of the motor and one of the ends of the input shaft of the bevel gearing, and another element of the transport means being fixed to the other end of the input shaft.

8. A silo according to any one of the preceding claims wherein under a discharge opening of the silo is disposed at least one flexible elongate element fixed to a hub member attached to the rotatable shaft.

9. A silo according to any one of claims 1 to 5 wherein the rotatable shaft carrying the flexible elements is driven by a drive assembly comprising a tubular member in which is disposed two pulleys interconnected by a belt and connected respectively to the rotatable shaft and to a motor shaft, the tubular member being fixed to the wall of the base of the silo by an adjustable member.

10. A silo according to claim 9 wherein part of the tubular member extends to the exterior of the silo and a motor is fixed to said part, the shaft of the motor carrying one of the pulleys.

11. A silo having a device for fluidising and discharging particulate material therefrom substantially as described with reference to Fig. 1 of the drawings or as modified according to Fig. 2 or Figs. 3 and 4 of the drawings.

WALFORD & HARDMAN BROWN,
Chartered Patent Agents,
Trinity House,
Hales Street,
Coventry, CV1 1NP.
Agents for the Applicants

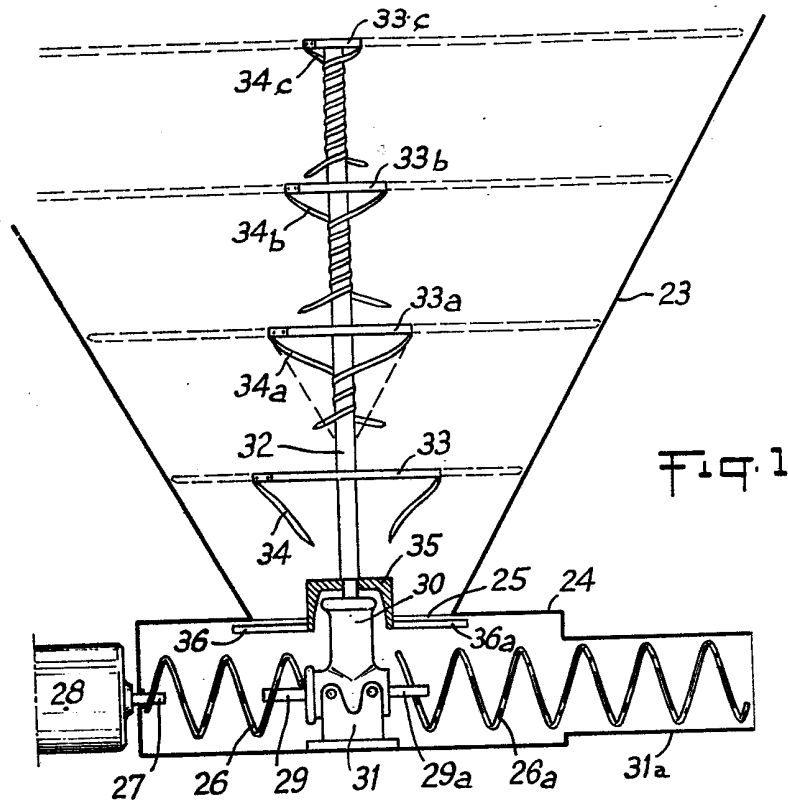


Fig. 1

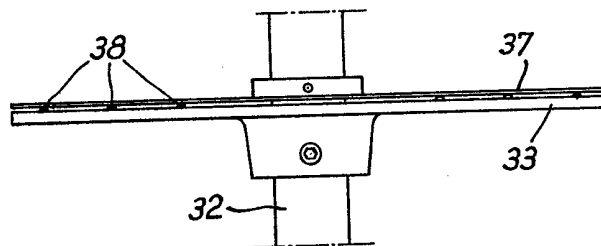


Fig. 2

FIG. 3

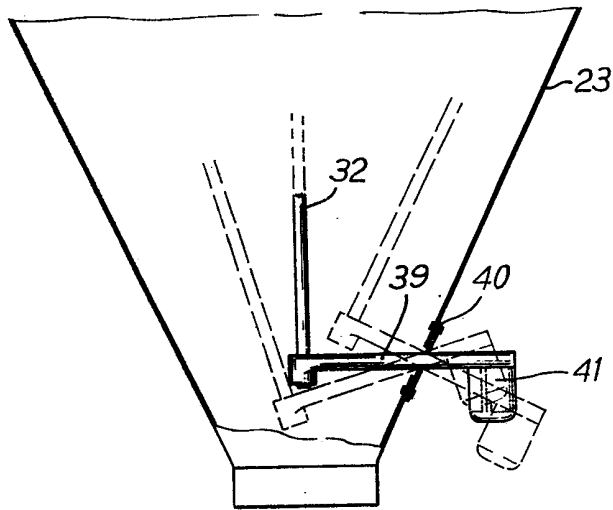


FIG. 4

