SILO FILLING ATTACHMENT FOR AN AIR SEALED SILO HAVING A DOME SHAPED ROOF

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3 Claims

ABSTRACT OF THE DISCLOSURE

The silo filling attachment is intended for use with a silo of air sealed type such as the "Harvestore" silo made by Harvestore Products, Inc. of Arlington Heights, Ill., and having a circular side wall and a dome shaped roof. The attachment includes a fill pipe or material guide member of an inverted channel shape positioned within a radial slot formed in the roof and extending from the outer edge of the roof to a position spaced from the central portion of the roof. The guide way from the lower end of the slot progressively drops within the slot so that the upper end of the guide way is located below the roof and extends inwardly of the silo to a position adjacent the central portion of the silo. The guide way is secured in air sealed engagement with the side walls of the slot and has its lower end connected to the delivery end of a material conveyor pipe that extends vertically along the outside of the silo wall. An air pipe arranged vertically to the outside of the silo wall has its upper end open to the silo and secured to the roof. During silo filling the lower end of the air pipe is open to the atmosphere. After the silo has been filled both the conveyor pipe and the air pipe have their lower ends air sealed by respective removable cover assemblies. A material distributing member within the silo is movably supported on the guide way and is manipulated by a flexible actuating element which is located within the air pipe with one end connected to the distributing member and its other end connectable to the air pipe within the lower end thereof.

Summary of the invention

The silo filling attachment includes a material fill pipe or guide way and an air pipe which remain secured to the silo and provide for filling the silo with rough or fine ensilage material during all weather conditions without any waste of material and without requiring any climbing of the silo by persons in charge of the filling operation. Attachment of a material feed blower to the fill pipe, distribution of the ensilage material within the silo during a filling operation, gauging of the depth of the ensilage within the silo and the air sealing of the lower ends of the air pipe and fill pipe on completion of a silo filling operation are all accomplished from the ground surface. Filling of the silo and the air sealing of the silo after the filling are thus accomplished with maximum safety in a minimum of time.

Detailed description of the invention

Further objects, features and advantages of the invention will become apparent from the following description when taken in connection with the accompanying drawings in which:

FIG. 1 is a perspective view of a silo showing the attachment of this invention in assembly relation therewith;

FIG. 2 is a fragmentary enlarged perspective view of the silo roof showing the assembly of the attachment thereon;

FIG. 3 is an enlarged exploded perspective view of the lower end of an air pipe which forms part of the attachment of this invention showing an air sealing cover means therefor;

FIG. 4 is a perspective view of the silo roof with parts broken away showing the assembly therewith of the fill pipe and material distributing means;

FIG. 5 is illustrated similarly to FIG. 4 showing the material distributing means in a changed position;

FIG. 6 is an enlarged sectional detail view taken along the line 6—6 in FIG. 4;

FIG. 7 shows a modified form of the invention, illustrated similarly to FIG. 5; and

FIG. 8 is a detail sectional view taken along the line 8—8 in FIG. 7.

With reference to the drawings there is illustrated in FIG. 1 a silo, designated generally as 10, having a circular wall 11 to which is secured a dome shaped roof 12. The silo is of a well known air sealed type known as "Harvestore" and manufactured by Harvestore Products, Inc. of Arlington Heights, Ill. The wall 11 is comprised of rectangular shaped longitudinal arcuate panel members 13 secured together by bolt assemblies 14. The roof 12 includes a plurality of generally pie shaped panels 16 having their inner or upper ends secured to a circular crown plate 18 formed with a central opening 19 that is normally closed by a removable cover 21. The lower ends of the roof panels 16 are curved downwardly for securing as by bolt assemblies 22 to the circular side wall 11. One of the roof panels, indicated at 16A, has a circular air opening 23 which in the "Harvestore" silo is normally closed by a cover means (not shown).

In filling the "Harvestore" silo 10 the central roof cover 21 is removed and a center fill pipe (not shown) is extended radially of the roof with its discharge or upper end inserted within the central opening 19. The lower end of this center fill pipe is connectable to the delivery end of a material conveyor tube such as that shown at 24 in FIG. 1. The assembly of the center fill pipe and conveyor tube pipe 24 on the silo 10 requires climbing up the silo wall and working on the roof. Especially in the wintertime such work can be dangerous. Also, since the center fill pipe has an open bottom side exposed to the atmosphere, silo filling under windy conditions usually results in an excessive waste of material due to the ensilage being blown from the fill pipe for accumulation over the roof 12 or for dropping to the ground.

Such disadvantages presently encountered in such a silo fill operation are eliminated by the silo attachment of this invention, shown in FIGS. 1 and 2, and including a fill pipe or guide way 26 and an air pipe 27. The guide way 26 is formed as an integral part of the roof panel, indicated at 16B, and the air pipe 26 has its upper end inserted within the roof opening 19 and secured in an air tight relation with the panel 16a. From the opening 23 the air pipe 27 projects downwardly over the roof and along the outside of the silo wall 11 with its lower end 28 conveniently accessible by standing on the ground surface.

The roof panel 16B is provided with a radial slot 29 (FIGS. 4 and 5) that extends from within the curved lower end of the panel 16B upwardly to a position spaced from the central portion of the roof 12. The guide way 26 (FIG. 6) is of an inverted channel shape and positioned within the slot 29 with its side faces or leg sections 31 adjacent the slot side walls for air tight connection therewith as by weldments. As shown in FIGS. 4 and
5 the leg sections 31 in a direction upwardly of the roof 12 are progressively dropped greater distances within the slot 29 so that the web section or upper face 32 of the fill pipe or guide way 26, at the discharge section 33 of the guide way is located within the silo 10 and below the upper end wall 34 of the slot 29.

The guide way discharge section 33 terminates short of the roof central portion.

The lower end 36 (FIGS. 2 and 5) of the guide way 26 projects outwardly from the lower end of the slot 29 and terminates in a section 37 of a tubular shape that extends downwardly a short distance along the outside of the silo wall 11. The upper or delivery end 38 of the conveyor member 44 is connected by a connector ring 39 to the tubular section 37 of the guide way 26. The inlet end 41 (FIG. 1) of the conveyor tube 24 is connectable to the outlet 42 of a material feeding unit 43 of a fan or blower type. It is to be understood that the conveyor tube 24 remains connected at all times to the guide way member 26, so as to form therewith a continuous fill pipe.

Extended inwardly of the silo 10 from the guide way discharge section 33 is a material distributing member 44 (FIGS. 4, 5 and 6) of an inverted U-shape in transverse cross section. Each leg or side section 45 of the distributing member 44 is of a triangular shape having the hypotenuse edge 47 thereof projected inwardly of the silo from the lower edge 48 of a corresponding leg section 31 of the guide way 26, and the opposite side edge 49 thereof projected inwardly of the silo from the web section 32 of the guide way 26. The leg sections 46 have their apex portions 49 arranged in a straining relation with the discharge section 33 of the guide way 26.

As best appears in FIG. 6, the distributing member 44 at the apex portions 51 of the leg sections 46 is pivotally connected at 52 to the discharge section 33 of the guide way 26 so that the web section 53 of the distributing member 44 forms a continuous surface with the web section 32 of the guide way. The distributing member 44 is thus pivotally supported for up and down movement relative to the guide way 26 to control the distribution within the silo of material ejected from the discharge section 33.

Pivotal movement of the distributing member 44 to vary the angular inclination of its web section 53 relative to the web section 32 of the guide way 26 is manually accomplished by a flexible actuator member 54 having one end 56 (FIG. 5) connected to the web section 53. From its end 56 the flexible member 54 is trained over a pulley 57 supported from the silo roof 12 for extension through the roof opening 23 and the air pipe 27 for connection of its other end 58 (FIG. 3) within the air pipe adjacent the lower end 28 thereof.

The lower end 28 of the air pipe is normally air sealed by a cover assembly 59 (FIG. 3), which includes a cover supporting ring 61 of a right angle shape in transverse section positioned about and secured as by welding to the air pipe 27 so that the vertical leg 62 of the ring 61 projects downwardly from the terminus end 63 of the air pipe 27. A cover member 64 provided with an air sealing gasket 65 has the peripheral portion thereof in seated engagement on the lower face 67 of the leg 62, and is clamped thereagainst in a well-known manner by clamping levers 68 which are pivotally mounted from the underside of the horizontal ring leg 69.

The lower end of the conveyor tube 24, similarly to the air pipe 27, is normally closed by a cover assembly (not shown) which is similar in construction to the cover assembly 59 and assembled in like manner with the lower or inlet end 41 of the conveyor tube 24.

When the silo is to be filled the cover assembly 59 is removed from the lower end 28 of the air pipe 27 and the distributing member 44 is adjusted in accordance with the type of material with which the silo 10 is to be filled. For an ensilage or forage material the distributing member 44 is pivotally moved to its position shown in FIG. 4, wherein the web section 53 thereof is extended in substantial longitudinal alignment with the web section 32 of the guide way 26. A portion of the leg sections 31 is permitted to fall downwardly into the silo from the open under side of the guide way 26 while other portions thereof continue through the guide way 26 and distributing member 44 for distribution about that side of the silo remote from the guide way 26.

If the silo 10 is to be filled with a heavy material, such as grain or the like, the distributing member 44 is inclined downwardly relative to the discharge section 33 of the guide way 26, as shown in FIG. 4, to direct such material downwardly over the central portion of the silo. As is well-known a grain material will tend to pile up in a conical shape so as to automatically distribute itself about the interior of the silo.

With the blower 43 connected to the conveyor tube 24 the filling of the silo takes place. During such filling the silo is open to the atmosphere through the air pipe 27 so as to eliminate any build up of air pressure in the silo. If it should be necessary to gauge the depth of the material to which the silo has been filled there is provided a gauging apparatus which includes a weight 71 (FIGS. 4 and 5) suspended by a measuring cable 72 supported from the silo roof 12 on a pulley 73 and extended therefrom through the air pipe 27 adjacent the actuator member 54 for connection within the lower end 28 of the air pipe as indicated at 74 in FIG. 3.

On completion of the filling operation the lower end of the air pipe 27 is closed by the cover 64 and with a like cover being used to close the lower or inlet end 41 of the conveyor tube 24. The silo is thus completely air sealed to protect the material therein against spoilage. It is to be understood that in order to compensate for internal gas pressure changes within the silo the usual breather bags and air pressure relief valves may be provided in a manner well known. The breather bags are insertable in the silo through the central roof opening 19, which also provides for a visual inspection of the interior of the silo when necessary.

The modified form of the silo attachment shown in FIGS. 7 and 8 is similar to the silo attachment described in connection with FIGS. 1–6, inclusive, except for the guide way or fill pipe 80 having its lower end 81 extended through the silo wall 11 below the silo roof 12. Similar numerals of reference therefor will be used in FIGS. 7 and 8 to designate like parts in FIGS. 1–6.

The fill pipe 80 (FIGS. 7 and 8) is of an inverted channel shape in transverse cross section so as to have a base section 82 and depending leg sections 85. A generally clow shape adaptor 84 of a tubular shape in transverse cross section has an upper or inner end 86 projected into the silo 10 through an opening 87 formed in the silo side wall 11 at a position immediately below the silo roof 12. The outer or lower end 88 of the adaptor 84 extends downwardly adjacent to and outside of the silo wall 11. An outwardly extended lateral flange 89 near the inner end 86 of the adaptor is secured by bolts 91 in an air tight relation with the silo wall 11, while the outer end 88 of the adaptor is connected by the connector ring 93 to the delivery end 38 of the conveyor tube 24.

As best appears in FIG. 7 the inner end 86 of the adaptor 84 is received within the lower end 81 of the guide way 80 so that the leg sections 85 at such lower end straddle the inner end 86 of the adaptor with the base section 82 of the guide way supported on the adaptor. The base section 82 at the upper end 92 of the guide way 80 is provided with oppositely directed lateral flanges 93 which are secured to the underside of a roof panel 16 by bolts 94. It is seen, therefore, that the adaptor 84 constitutes a tubular downward extension of the guide way 80, that is connectible with the delivery end 38 of the material conveyor tube 24.
The distributing member 44 is assembled with the guide way 80 in all respects similar to its assembly with the guide way 26 to distribute material over central portion of the silo, as shown in FIG. 4, or to one side thereof, as shown in FIG. 5.

Although the invention has been described in connection with preferred embodiments thereof it is to be understood that it is not to be so limited since changes can be made therein which are within the full intended scope of this invention as defined by the appended claims.

We claim:

1. A silo filling attachment for a silo of air sealed type having a circular side wall and a dome shaped roof, comprising:
   (a) a material guide way of an inverted channel shape extended radially of said silo roof with the upper end thereof terminating short of the central portion of the silo roof, said guide way having a lower end portion of a tubular shape in transverse section projected outwardly from the silo and extended toward the upper end thereof, and
   (b) a material conveyor tube having a delivery end connected to said lower end portion of the guide way, and a receiving end adjacent the base of the silo,
   (c) an air pipe having an upper end secured in air tight engagement with said roof and open to the inside of the silo, said air pipe arranged to the outside of the silo with the lower end thereof open to the atmosphere adjacent the base of the silo,
   (d) a first cover means for the lower end of said air pipe, and
   (e) a second cover means for the receiving end of said conveyor tube,
   (f) said first and second cover means being open when the silo is being filled and closed after the silo has been filled.

2. The silo filling attachment according to claim 1 including:
   (a) a pivoted material distributor for the upper end of said guide way,
   (b) means pivotally connecting said distributor to said upper end of the guide way for movement from a first position extended longitudinally outwardly from the silo to a second position tilted downwardly from said upper end, and
   (c) means for pivotally moving said distributor including a flexible member secured at one end of said distributor and extended through said air pipe for connection of the other end thereof within the lower end of the said air pipe.

3. A silo filling attachment for a silo of air sealed type having a circular wall and a dome shape roof formed of a plurality of radially extended interlocked panel members comprising:
   (a) a first panel member for said roof formed with a radial slot open to the lower end of the panel and terminating adjacent the upper end thereof,
   (b) a material guide way of an inverted channel shape located within said slot, with the upper end thereof located within the silo and terminating short of the central portion of the silo roof,
   (c) a pivoted material distributor of an inverted channel shape extended inwardly of the silo from the upper end of said guide way,
   (d) means pivotally connecting said distributor on said upper end of the guide way for movement from a first position extended longitudinally outwardly from the guide way to a second position tilted downwardly from the guide way,
   (e) an air pipe having an upper end secured in air tight engagement with a second panel member and open to the inside of the silo, said air pipe arranged to the outside of the silo with the lower end thereof open to the atmosphere adjacent the base of the silo,
   (f) a removable cover means for the lower end of said air pipe,
   (g) means for pivotally moving said distributor including a flexible member extended through said air pipe for attachment at one end to said distributor and attachment of the other end thereof to said air pipe within the lower end thereof, and
   (h) a connection at the lower end of said guide way for the delivery end of a material conveyor tube extended vertically to the outside of the silo,
   (i) said cover means being removed from the lower end of said air pipe when the silo is being filled with material and said conveyor tube having the receiving end thereof closed after the silo has been filled.

4. A silo filling attachment for a silo of air sealed type having a circular side wall and a dome shaped roof comprising:
   (a) a material guide way of an inverted channel shape,
   (b) said roof having a radially extended portion formed with a radial slot for receiving said guide way, said slot extended from the lower end of said roof portion to a position spaced outwardly from the central portion of the roof,
   (c) said guide way positioned within said slot with the lower end thereof located from the lower end of said roof portion and the upper end thereof projected radially inwardly of the silo from the upper end of said slot,
   (d) means securing the guide way in air sealed engagement with the side walls of said slot,
   (e) a connection at the lower end of said guide way for the delivery end of a material conveyor tube,
   (f) an air pipe extended along the outside of the silo having an upper end projected over the roof,
   (g) means connecting said upper end of the air pipe with the roof for opening into the silo,
   (h) a cover means for the lower end of the air pipe, and
   (i) a cover means for the receiving end of the material conveyor tube,
   (j) said two cover means being open in open positions therefor when the silo is being filled.

5. The silo filling attachment according to claim 4 including:
   (a) a pivoted material distributor for the upper end of said guide way,
   (b) means pivotally connecting said distributor on said upper end of the guide way for movement from a first position extended longitudinally outwardly from the silo to a second position tilted downwardly from said upper end, and
   (c) means for pivotally moving said distributor including a flexible member secured at one end of said distributor and extended through said air pipe for connection of the other end thereof within the lower end of the said air pipe.

6. A silo filling attachment for a silo of air sealed type having a circular side wall and a roof comprising:
   (a) a material guide way of an inverted channel shape extended radially of said silo roof with the upper end thereof terminating short of the central portion of the silo roof, said guide way having a lower end portion of a tubular shape in transverse section projected outwardly from the silo and extended downwardly along the outside of said silo wall,
   (b) a material conveyor tube having a delivery end connected to said lower end portion of the guide way, and a receiving end adjacent the base of the silo,
   (c) an air outlet in said roof open to the atmosphere,
   (d) a cover means for said outlet, and
   (e) a cover means for the receiving end of the material conveyor tube,
   (f) said two cover means being in open positions therefor when the silo is being filled.
7. A silo filling attachment for a silo of air sealed type having a circular side wall and a roof comprising:
(a) a material guide way of an inverted channel shape,
(b) a material conveyor tube having a receiving end and a delivery end projected inwardly of said silo through an upper portion thereof,
(c) said material guide way located within and extended radially of said silo, with the inner end thereof spaced outwardly from the central portion of the roof,
(d) means connecting the outer end of said material guide way with the delivery end of said material conveyor tube,
(e) an air outlet in said roof open to the atmosphere,
(f) a cover means for said outlet, and
(g) a cover means for the receiving end of the material conveyor tube,
(h) said two cover means being in open positions therefore when the silo is being filled.

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