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Construction material silo for storing dry construction material ✓

- 5 The invention relates to a construction material silo for storing dry construction material, especially dry cement or dry mortar.

Conventional construction material silos usually comprise a closed storage container, a material intake line which can be closed and opened by means of a valve and a material outlet line which can be opened and closed by means of another valve. Taking material into the storage container through the intake line, or taking out material through the outlet line results in a variation of the stock level of the storage container and of the free space within the storage container. A variation of the free space can result in a pressure in the storage container which is different from the ambient pressure. Such a pressure shift can cause problems during the material intake and the material discharge process. To avoid that a pressure shift can appear, conventional construction material silos are provided with a compensation line connecting the storage container with the ambience. In this way taking material into the storage container through the intake line results in blowing air out of the storage container through the compensation line. Taking material out of the storage container through the outlet line results in air being sucked into the storage container through the compensation line.

Normally, especially in tropical areas, the ambient air is not dry. Therefore, moist air can be sucked into the silo. If the moist air comes into contact with construction materials, such as cement or mortar stored in the silo, it is commonly found that the cement absorbs the moisture of the air and hardens and, e.g. cakes at the side walls of the silo. This results in a waste of cement. Further, a reduction of the silo space is caused. It is another disadvantageous effect that hardened pieces of cement can be conveyed into a pipe system connected





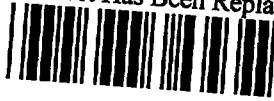
to the silo and cause damages, e.g. in a pump for driving the cement.

On the other hand, the taking in and taking out of construction
5 material causes a substantial material movement within the
storage container. The movement results in a whirling up of
dust or construction material particles. Therefore, the air
blown out of the storage container can be charged with a
substantial quantity of particles, resulting in environmental
10 pollution.

It is an object of the invention to create a silo for storing
dry construction material, in which silo the silo pressure
remains stable during the material intake process and the
15 material discharge process and, simultaneously, an undesired
exchange of airborne materials, such as solid particles and/or
moisture between the silo and the ambience is eliminated.

According to the invention, the object is achieved by a
20 construction material silo according to claim 1.

The construction material silo according to the invention has a
closed storage container to which a material intake line is
connected. The material intake line can be opened and closed by
25 means of a material intake valve. Further, a material outlet
line is connected to the storage container. The material outlet
line can be opened and closed by means of a material outlet
valve. Further, the silo is provided with a dry air intake
device and an air outlet device, each connecting the storage
30 container with the ambience. The air intake device comprises an
air intake line connecting the storage container with the
ambience, a nonreturn air intake valve, by means of which the
air intake line is opened when the pressure inside the storage
container is lower than the ambient pressure, and an air drying
35 filter cartridge arranged in the air intake line. The air
outlet device comprises an air outlet line connecting the
storage container with the ambience and a nonreturn air outlet
valve by means of which the air outlet line can be opened when



the pressure inside the storage container is higher than the ambient pressure.

5 In the sense of the present application as silo is not only regarded a storage container of a cylindrical shape or the like, but can be regarded a storage container system of any shape.

10 By providing the air outlet device, it is achieved that, when material is taken into the storage container through the material intake line and thus the free space within the storage container is reduced, air is blown out of the storage container. Thereby a pressure increase in the storage container is avoided. By providing the dry air intake device, it is
15 achieved that, when material is taken out from the storage container through the outlet line and thus the free space within the storage container increases, air is sucked into the storage container. Thereby a pressure decrease in the storage container is avoided. By providing a nonreturn valve each, for
20 both the dry air intake device and the air outlet device, the object is achieved that no air can be blown out through the air intake line and no air can be sucked through the air outlet line. Therefore, all air introduced into the storage container is introduced through the air intake line. By providing the air
25 intake device with the air drying filter cartridge, it is achieved that all air sucked into the storage container through the air intake line is dried. The air blown out of the storage container, in the case of taking in material, is the storage air present in the free space of the storage container. If the
30 storage air receives moisture from the cement or from a leakage in the storage container or likewise, it can become less dry than the dry air introduced into the storage container. Therefore, the dry air sucked into the storage container cannot only serve to maintain a stable low content of moisture in the
35 storage air, but even lower the content of moisture in the storage air. Thereby a moisturizing and hardening of the construction material stored in the storage container can be avoided .



Preferably, the nonreturn air intake valve and the nonreturn air outlet valve each are designed as a self-operating valve which is operated by the pressure acting on both ends of the valve. Thereby it is achieved that no valve control device is required and the valves operate automatically.

According to the invention it is possible that no filter is arranged in the the air outlet line. However, preferably, an air dedusting filter cartridge is arranged in the air outlet line.

By providing the air dedusting filter cartridge in the air outlet line, the object is achieved that the quantity of dust or construction material blown out of the storage container through the air outlet line is substantially reduced, or even reduced to zero.

According to the invention it is possible that the dry air intake device and the air outlet device are formed in any appropriate design, e.g. mainly inside or mainly outside the storage container, e.g. as a cast construction, a welding construction, a construction using semifinished products or the like. Preferably, however, one or both, the dry air intake device and the air outlet device, comprise a cylindrical pipe portion forming the air intake line or the air outlet line, respectively. The cylindrical pipe portion has a flange at one end, by means of which the cylindrical pipe portion is bolted to the storage container such that the cylindrical pipe portion is aligned with an opening provided in the wall of the storage container. The filter, namely the air drying filter cartridge or the air dedusting filter cartridge, is formed as an insert part which has a cross section corresponding to the cross section of the cylindrical pipe portion, and is inserted into the cylindrical pipe portion. The nonreturn valve, namely the air intake valve or the air outlet valve, respectively, is also formed as an insert part and is inserted into the cylindrical pipe portion.



By forming the air drying filter cartridge and/or the air dedusting filter cartridge as an insert part insertable into a corresponding cylindrical pipe portion, it is achieved that an exchange of the filter cartridge can be carried out easily by drawing out the old cartridge and inserting the new cartridge. By forming the air intake line and/or the air outlet line as a cylindrical pipe portion, it is achieved that a filter cartridge and the air inlet valve and/or the air outlet valve can be formed as insert parts, which can easily drawn out of the device. It is a further effect, that the air intake line and/or the air outlet line can be manufactured at low costs, e.g. on the basis of a semifinished product. By providing the flange at the end of the cylindrical pipe portion, the object is achieved that the air intake line and/or the air outlet line can be easily disconnectably mounted to the storage container by means of bolts.

According to the invention, the cylindrical pipe section can be open at the end opposite to the flange. In this case, it is even easier to remove the filter cartridge from the cylindrical pipe portion and hence to exchange it. Preferably, however, the cylindrical pipe section can be covered, at the end opposite to the flange, with a cover cap. The cover cap has an opening through which the air can be sucked or blown, respectively. Thereby it is secured that the filter cartridges are protected against outside influences, and that bigger particles, dust particles and rain water or the like can be prevented from entering the cylindrical pipe section.

Embodiments of the invention are described with reference to the drawing. In the drawing:

Figure 1 shows a side view of an embodiment of the silo according to the invention.

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Figure 2 shows a sectional view of the dry air intake device according to a preferred embodiment of the silo according to the invention.



Figure 3 shows an explosive view of the dry air intake device according to the preferred embodiment shown in figure 2.

From figure 1 a schematic view of an embodiment of the silo
5 according to the invention can be seen. A storage container 1
has essentially the shape of a cylinder, the cylinder axis of
which is aligned in the direction predetermined by gravity,
wherein the cylinder is provided with a cone-shaped end portion
11 at its bottom side. The cylinder is supported by support
10 bars 6 such that the bottom end is arranged at a distance from
the ground. The storage container 1 is closed, apart from
passages to a material intake line 2, a material outlet line 3,
an air intake line 41 and an air outlet line 51.

15 The material intake line 2 is arranged excentrically at the
cone-shaped end portion 11. A first portion 22 of the material
intake line 2 extends from the inner surface of the storage
container 1 into the inner space of the storage container 1. A
second portion 23 of the material intake line 2 including a
20 material intake valve 21 extends outwardly from the outer
surface of the storage container 1.

The material outlet line 3 including a material outlet valve 31
is arranged at the lower cone end of the cone-shaped end
25 portion 11 and extends towards the ground.

A dry air intake device 4 comprises the air intake line 41, an
air drying filter cartridge 43 and a nonreturn air intake valve
42. The air intake line 41 is formed as a pipe portion having a
30 flange at one end. The air intake line 41 is connected to the
storage container 1 with the flange being fixed to the top side
of the storage container 1. The pipe portion extends from the
top side of the storage container 1 along the back side of the
storage container 1 and ends under and laterally of the cone-
35 shaped end portion 11 of the storage container 1. Thereby it is
achieved that an exchange of the air drying filter cartridge 43
can be carried out conveniently. The air drying filter
cartridge 43 is inserted into the air intake line. The



nonreturn air intake valve 42, in this embodiment, is not formed as a separate element, but is formed by the filter material. It is used a filter material which only permits a one way air flow (not shown in detail) in that direction towards the storage container 1.

An air outlet device 5 comprises the air outlet line 51 and a nonreturn air outlet valve 52. The air outlet line 51 is formed as a pipe portion having a flange at one end. The air outlet line 51 is connected to the storage container 1 with the flange being fixed to the top side of the storage container 1. The pipe portion extends from the top side of the storage container 1 along the back side of the storage container 1 and ends under and laterally of the cone-shaped end portion 11 of the storage container 1. The nonreturn air outlet valve 52 is arranged at the end portion of the air outlet line 51.

The air outlet line 51 has an essentially larger diameter than the air intake line 41.

From figures 2 and 3 the detailed construction of a dry air intake device 4 of the silo can be seen. The air intake line 41 is formed as a cylindrical pipe portion having a flange at one end thereof. As can be seen from figure 2, the flange is fixed to the storage container 1 by means of bolts 7 in such a manner that the cylindrical pipe portion is aligned with an opening provided in the wall of the storage container 1. A seal element 8 is inserted between the flange and the wall. A cover cap 48 having an opening 481 is fixed at the end of the cylindrical pipe portion opposite to the flange.

The air intake valve 42 has a cylindrical shape having a lower diameter than the inner diameter of the cylindrical pipe portion. The air intake valve 42 is inserted into a ring-shaped valve holder 49 having an outer diameter corresponding to the inner diameter of the cylindrical pipe portion and an inner diameter corresponding to the outer diameter of the air intake valve 42. The unit formed by the air intake valve 42 and the

ring-shaped valve holder 49 is inserted into the cylindrical pipe portion such that it is arranged adjacent to the wall of the storage container 1.

- 5 The air drying filter cartridge 43 which has a cylindrical shape and has a diameter corresponding to the outer diameter of the cylindrical pipe portion is inserted into the cylindrical pipe portion such that it is arranged adjacent to the unit formed by the nonreturn air intake valve 42 and the ring-shaped
- 10 valve holder 49. Between the air drying filter cartridge 43 and the cover cap 48 a free space is provided in the cylindrical pipe portion.

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Claims

1. Construction material silo for storing dry construction material, the silo having

- 5 a) a closed storage container (1),
- b) an intake valve (21) by means of which a material intake line (2) connected to the storage container (1) can be opened and closed,
- c) a material outlet valve (31) by means of which a
- 10 material outlet line (3) connected to the storage container (1) can be opened and closed,
- d) a dry air intake device (4) comprising an air intake line (41) connecting the storage container (1) with the
- 15 ambience, a nonreturn air intake valve (42), by means of which the air intake line (41) is opened when the pressure inside the storage container (1) is lower than the ambient pressure, and an air drying filter cartridge (43) arranged in the air intake line (41), and
- e) an air outlet device (5) comprising an air outlet line
- 20 (51) connecting the storage container (1) with the ambience and a nonreturn air outlet valve (52) by means of which the air outlet line (51) is opened when the pressure inside the storage container (1) is higher than the ambient pressure.

25 2. Construction material silo according to claim 1, wherein the air outlet device (5) comprises an air dedusting filter cartridge (53) arranged in the air outlet line (51).

30 3. Construction material silo according to claim 1 or 2, wherein

- a) the dry air intake device (4) comprises a cylindrical pipe portion forming the air intake line (41) and having a flange at one end, by means of which flange the cylindrical pipe portion is bolted to the storage container (1) such that
- 35 the cylindrical pipe portion is aligned with an opening provided in the wall of the storage container (1),
- b) the air drying filter cartridge (43) is formed as an insert part having a cross section corresponding to the cross



section of the cylindrical pipe portion, and is inserted into the cylindrical pipe portion, and

c) the nonreturn air intake valve (42) is formed as an insert part and is inserted into the cylindrical pipe portion.

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4. Construction material silo according to any one of claims 1 to 3, wherein

10 a) the air outlet device (5) comprises a cylindrical pipe portion forming the air outlet line (51) and having a flange at one end, by means of which flange the cylindrical pipe portion is bolted to the storage container (1) such that the cylindrical pipe portion is aligned with an opening provided in the wall of the storage container (1),

15 b) the air dedusting filter cartridge (53) is formed as an insert part having a cross section corresponding to the cross section of the cylindrical pipe portion, and is inserted into the cylindrical pipe portion, and

c) the nonreturn air outlet valve (52) is formed as an insert part and is inserted into the cylindrical pipe portion.

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