

TRANSFER STATION

The invention relates to a station, particularly a station for the transfer of flowable material from one location to another.

Flowable material is usually in the form of powder, dust, grains, pellets, tablets, capsules, pulverulent material or the like particulate material. Such flowable material often has to be transferred from one location to another, for example from an intermediate bulk container (IBC) in which it is stored or transported, to a point of use. Thus the material can be a food product constituent such as a flavouring which has to be transferred to a point of use, where the final food product is made. The IBC is set down on a discharge station, and opened for controlled flow of material through a conduit of the station to another location for use.

The material could be a pharmaceutical powder, a powder used in the nuclear industry, or any other kind of powder. All, when they are used in material handling apparatus of the kind described, can pollute the environment and can also be a health hazard to operatives at the discharge station.

It is accordingly an object of the invention to seek to mitigate this disadvantage.

According to a first aspect of the invention there is provided a station for the transfer of flowable material from one location to another, comprising a conduit for the flowable material, a member adapted for obturating and opening the conduit for controlling flow of material therethrough, and a device for cleaning at least an external surface of the obturating member

whereby to obviate contamination of the surroundings of the station with flowable material.

The cleaning device may comprise a chamber mounted at or adjacent an extremity of the conduit.

This provides a relatively simple construction, particularly where the chamber may comprise a generally toroidal body adapted for mounting at the extremity of the conduit.

There may be means to admit a cleaning medium, which for preference may be air.

The body may define a through passage with a peripheral seal element at one end. This provides a means to isolate the interior of the body from the external atmosphere.

The seal element may comprise an annular flexible lip seal an inner peripheral part of which projects radially of the passage. This is a relatively efficient arrangement, particularly when the body may comprise a peripheral flange on which the lip seal may be mounted.

The body may comprise an extension whereby the cleaning device may be mountable on the conduit. This is a relatively simple construction.

The body of the chamber may comprise a duct adapted to be connected to extraction means whereby to extract contents of the chamber.

The duct may be tangentially arranged with respect to the body, and it may enter the body intermediate the flange and the annular extension. This provides for relatively efficient extraction.

The duct and cleaning medium admittance means may penetrate the body at the same position. This provides for an efficient action, particularly when they both enter tangentially and point in opposite directions.

The device may be removably mountable at an extremity of the conduit.

There may be an annular seal at the extremity of the conduit.

The annular seal at the extremity of the conduit and the seal element of the body may be spaced apart and substantially parallel. This provides an efficient double seal arrangement.

The seal device and seal element may have respective inner peripheries which may extend into the conduit and may be adapted to contact the obturating member.

According to a second aspect of the invention there is provided apparatus for handling flowable material, comprising a station as hereinbefore defined and a container for flowable material adapted to cooperate with the station for transfer of the material.

The container may comprise an IBC.

According to a third aspect of the invention there may be provided a device

for cleaning at least the external surface of an obturating member of a station for transfer of flowable material, comprising a body adapted to be mounted at or adjacent an extremity of a conduit of the station, and means to admit cleaning medium to and extract material from the body.

The cleaning medium admittance means may comprise an inlet orifice arranged to admit air tangentially of the chamber. This provides for an efficient cleaning action.

The means to extract material may comprise an extraction duct arranged tangentially of the body. This provides for efficient extraction action.

The inlet orifice and extraction duct may penetrate the body at substantially the same position. This provides for efficient cleaning as the maximum cleaning effect is achieved, particularly when the inlet and orifice and extraction duct point in opposite directions.

The body may be a substantially bowl shape whereby to provide a tangential vortex of air for cleaning.

The body may have a peripheral flange adapted to mount a seal device.

The seal device may comprise a flexible annular seal element radially inner part of which may be adapted to contact at least the obturating member. This provides a seal whilst allowing for cleaning.

The body may comprise an inner shoulder whereby the device may be mountable at the extremity of a conduit of the transfer station.

A station and device embodying the invention are hereinafter described, by way of example, with reference to the accompanying drawings.

Fig. 1 is a schematic representation, with parts broken away for clarity, of a station, in this embodiment a discharge station, for transfer of flowable material from one location to another, there being parts shown broken away or in section for clarity;

Fig. 2 shows a side elevational view of a cleaning device of the station of Fig. 1, and to a larger scale than that figure;

Figs. 3 to 16 shows a complete cycle of operation, in respective sequential operating stages, of the station of Fig. 1 for the transfer of particulate flowable material from one location to the other, in the Figs. from an IBC to a point of use (not shown), Fig. 3 showing the start of the cycle and Fig. 16 the end thereof.

Referring firstly to Figs. 1 and 2, 2A of the drawings, there is shown a station 1, in the embodiment a discharge station, for the transfer of flowable material, in the embodiment particulate material such as a powder from one location to another, comprising a conduit, or hopper 2, for the flowable material, a member 3 adapted for obturating and opening the conduit 2 for controlling flow of material therethrough, and a device 4 for cleaning at least an external surface of the obturating member 3 whereby to obviate contamination of the surroundings of the station 1 with flowable material.

The obturating member 3 is a conical device which is mounted at the upper (in use in the embodiment and as viewed in the Figs.) end of the conduit 2,

and which projects therefrom. The conical device or probe 3 is raised and lowered by a bellows means 5 and by a mechanism 6 which provides a pre-lift of the probe 3 before operation of the bellows means 5, whereby to provide a variable lift of the probe. The probe 3 has an internal vibrator device 7 which oscillates or vibrates the cone at a specified time during a discharge cycle as hereinafter described. The discharge station 1 has guides or supports 8 for receiving feet of an IBC holding material to be transferred.

At the upper edge of the conduit 1 there is an annular seal 9 in the form of a flexible and resilient member or lower lip seal which is secured to the outer perimeter of the conduit 2 and which has a radially extending part which extends into the conduit 2 to provide a brushing but sealing contact with a part of the obturating device 3 which includes an inflatable ring 10 which acts as a clamp of the probe as described hereinafter.

Mounted on the upper edge or perimeter of the conduit 2 is the cleaning device 4. This comprises (Figs. 2, 2A) a bowl or dish-shaped toroidal body 11 with an upper (as viewed) horizontal (also as viewed) flange 12 to which is secured an annular flexible and resilient lip seal 13 which is secured to the flange 12 by a clamping ring 14 using nuts and bolts 15. The lip seal 13 has a radially inwardly extending part 16 which contacts the external surface of the probe 3 in one position, in which position the lip seal 13 is spaced from and lies substantially parallel to the seal 9.

The body 11 in its curved or dish-shaped part is penetrated by means 17 to admit cleaning medium, in the embodiment air, and means 18 to extract air or air and material from the interior of the device 4. The air admittance means 17 is in the form of a tube which enters the body 11 tangentially.

Likewise, the duct 18 also penetrates the body 11 tangentially, the tube 17 and duct 18 entering the body 11 at substantially the same point, and facing in opposite directions. The duct is connected via an exhaust valve 19 to a flexible pipe 20 which is connected with an extractor fan (not shown). The tube 17 is connected with a source of air under pressure, also not shown.

The body 11 also has a cylindrical extension 21 by which it is mounted on the external surface of the upper end of the conduit 2, trapping the lip seal 9 thereon, there being an internally projecting annular shoulder or flange 22 which sits on the seal 9 and thus on the upper edge of the conduit 2.

There is also a projection 23 which provides for releasable securement by clamp means (not shown) to the conduit. When in position, the cleaning device 4 forms a plenum chamber.

In use, and referring now to Figs. 3 to 16, Fig. 3 shows the discharge station 1 schematically with an IBC 24 containing particulate flowable material 25 being lowered in the direction of the arrow 'A'. An outlet 26 of the IBC is closed by a closure device 27 of conical shape which is complementary to the probe 3. The seals 13, 9 contact the external surface of the probe 3 and the mechanism 6 is actuated to provide a pre-lift of the probe 3. Air is admitted under pressure through the tube 17 to the interior of the body 11, of the device 4, and extracted from the body through the duct 18.

The dish-shaped geometry of the interior of the body 11 and the tangential entry of the air provide a toroidal vortex of cleaning air which sweeps out the entire interior of the device, cleaning it and the external surface of the probe 3 so as to cleanse both of foreign bodies which might contaminate the

particulate material 25 to be transferred. The air and any foreign bodies are extracted from the duct 18 via the flexible pipe 20 by the fan.

As the IBC is lowered, its outlet 26 engages the flexible seal 13 and bends it downwardly as viewed in Fig. 4, the pre-lift of the probe being maintained (arrow 'B'), and the air being admitted still so that the outlet 26 of the IBC is also cleaned as it enters the body 11. Air and foreign bodies are extracted through the duct 20 (arrow 'C'). This contact with the seal 13 lasts for 5 seconds in the embodiment.

Turning to Fig. 5, the IBC is then raised (for 30 seconds arrow 'D') to allow further cleaning of the IBC outlet 26 whilst the pre-lift of the probe 3 is maintained, and the cleaning air is admitted, and extraction takes place as before, through the duct 18.

The IBC 24 is then lowered so that its feet 28 rest in the guides or supports 8, the mechanism 6 providing the pre-lift is de-actuated whilst cleaning air continues to be admitted to the body 11 and extraction continues (arrow 'C'). In this position, as shown in Fig. 6, the outlet 26 of the IBC has not only turned the seal 13 downwardly, but it has also engaged and turned the seal 9 downwardly too, the two seals engaging to provide a sealed interior of the body 11. The cleaning air flow is then ceased, as is extraction (Fig. 7).

The next stage in transfer is shown in Fig. 8. The probe 3 is lifted under low pressure for 15 seconds in the embodiment (arrow 'B'), and then the probe 3 and IBC outlet closure 27 are clamped together by inflation of the toroidal clamp or tyre-like ring 10 (Fig. 1) which engages a depending skirt of the outlet closure device 27. With the toroidal ring 10 still effective as shown by

arrows 'E', the system is ready for discharge of material 25 from the IBC 24 via a low pressure raising of the probe 3, with the outlet closure 27, by the bellows 5 as shown in Figs. 9 and 10, the latter Fig. showing passage of material to the conduit 2 from the IBC 24 through an annular gap opened up by raising of the probe 3 and outlet closure 27 (there is a cover or shroud 29 protecting the mechanism, bellows etc.). The material 25 flows over the seals 13 and 9. To ensure complete discharge, and overcome "bridging" or "rat-holing" of the material the vibrator 7 is actuated (Fig. 11) to vibrate the probe 3 and outlet closure 27, for 20 seconds in the embodiment.

After complete discharge, and cessation of vibration, the bellows 5 is actuated to lower the probe 3 and outlet closure 27, the ring clamp 10 still being actuated as shown by the arrows (Fig. 12).

Then, as shown in Fig. 13 the system is ready for an air clean sequence. The IBC is raised F, for 30 seconds, air being admitted through the tube 17 to the body 11 and thereby cleaning the outlet 26, any particles being extracted as before through the duct 18, the ring clamp 10 still being actuated as shown by the arrows 'E'. This operational step is shown in Fig. 14.

The air cleaning is continued for 15 seconds when the ring clamp 10 is deactivated and the cone lowered by deactivating the mechanism, as shown by the arrows 'G' in Fig. 15, the outlet closure 27 having been released from the probe on deflation of the ring clamp 10.

The IBC 24 is then removed to a neutral position, Fig. 16, the probe being pre-lifted by the mechanism 6 and the seals 9, 13 returning under their inherent resilience to seal against the probe 3, the air being admitted through

the tube 17, and extracted with particulate material from the duct 17, so that no particles can escape to the atmosphere and contaminate the environment surrounding the station 1, which is then ready for an ensuing transfer operation.

CLAIMS

1. A station for the transfer of flowable material from one location to another, comprising a conduit for flowable material, a member adapted for obturating and opening the conduit for controlling flow of material therethrough, and a device for cleaning at least an external surface of the obturating member whereby to obviate contamination of the surroundings of the station with flowable material.
2. A station according to Claim 1, the cleaning device comprising a chamber mounted at or adjacent an extremity of the conduit.
3. A station according to Claim 2, the chamber comprising a generally toroidal body adapted for mounting at the extremity of the conduit.
4. A station according to Claim 2 or Claim 3, comprising means to admit a cleaning medium.
5. A station according to Claim 3, the cleaning medium comprising air.
6. Apparatus according to Claim 5, the body defining a through passage with a peripheral seal element at one end.
7. A station according to Claim 6, the seal element comprising an annular flexible lip seal an inner peripheral part of which projects radially of the passage.
8. A station according to Claim 7, the body comprising a peripheral



flange on which the lip seal is mounted.

9. A station according to Claim 8, the body comprising an extension whereby the cleaning device is mountable on the conduit.

10. A station according to any of Claims 3 to 9, the body of the chamber comprising a duct adapted to be connected to extraction means whereby to extract contents of the chamber.

11. A station according to Claim 10, the duct being tangentially arranged with respect to the body.

12. A station according to Claim 11, the duct entering the body intermediate the flange and the annular extension.

13. A station according to any of Claims 10 to 12, the duct and cleaning medium admittance means penetrating the body at substantially the same position.

14. A station according to Claim 13, the device being removably mountable at an extremity of the conduit.

15. A station according to any of Claims 6 to 14, there being an annular seal at the extremity of the conduit.

16. A station according to Claim 15, the annular seal at the extremity of the conduit and the seal element of the body being spaced apart and substantially parallel.



17. A station according to Claim 16, the seal device and seal element having respective inner peripheries which extend into the conduit and are adapted to contact the obturating member.

18. A station for the transfer of flowable material from one location to another, substantially as hereinbefore described with reference to the accompanying drawings.

19. Apparatus for handling flowable material, comprising a station according to any preceding claim and a container for flowable material adapted to cooperate with the station for transfer of the material.

20. Apparatus according to Claim 19, the container comprising an IBC.

21. Apparatus for handling flowable material, substantially as hereinbefore described with reference to the accompanying drawings.

22. A device for cleaning at least the external surface of an obturating member of a station for transfer of flowable material, comprising a body adapted to be mounted at or adjacent an extremity of a conduit of the station, and means to admit cleaning medium to and extract material from the body.

23. A device according to Claim 22, the cleaning medium admittance means comprising an inlet orifice arranged to admit air tangentially of the chamber.

24. A device according to Claim 23, the means to extract material comprising an extraction duct arranged tangentially of the body.



25. A device according to Claim 24, the inlet orifice and extraction duct penetrating the body at substantially the same position.
26. A device according to Claim 25, the body being a substantially bowl shape whereby to provide a tangential vortex of air flow for cleaning.
27. A device according to any of Claims 22 to 26, the body having a peripheral flange adapted to mount a seal device.
28. A device according to Claim 27, the seal device comprising a flexible annular seal element a radially inner part of which is adapted to contact at least the obturating member.
29. A device according to any of Claims 22 to 28, the body comprising an inner shoulder whereby the device is mountable at the extremity of a conduit of the transfer station.
30. A device for cleaning at least the external surface of an obturating member of a station for transfer of flowable material, substantially as hereinbefore described with reference to the accompanying drawings.