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Installation for distribution of granular or powder material via pneumatic transport comprising a device for pressurizing and depressurizing a dispensing hopper for storage of said material.

57 Abstract: An installation (10) for distribution of granular or powder material via pneumatic transport comprising at least one dispensing hopper (12) for temporary storage of the granular or powder material, the dispensing hopper (12) being suited for being, alternately, pressurized for emptying the dispensing hopper (12) and depressurized to permit filling thereof. The installation (10) comprises a device for pressurizing and depressurizing the dispensing hopper (12) with a pressurizing duct (14) associated with the dispensing hopper (12) for feeding pressurizing gas into the dispensing hopper (12) through at least one pressurizing nozzle (40), the pressurizing duct (14) being fluidly connected to a feed line (16) for receiving pressurizing gas from a gas source. The device further comprises a depressurizing duct (18) associated with the dispensing hopper (12) for evacuating pressurizing gas from the dispensing hopper (12). The depressurizing duct (18) is fluidly connected to the at least one pressurizing nozzle (40), wherein the at least one pressurizing nozzle (40) comprises a filter element. (Fig. 1) 92978

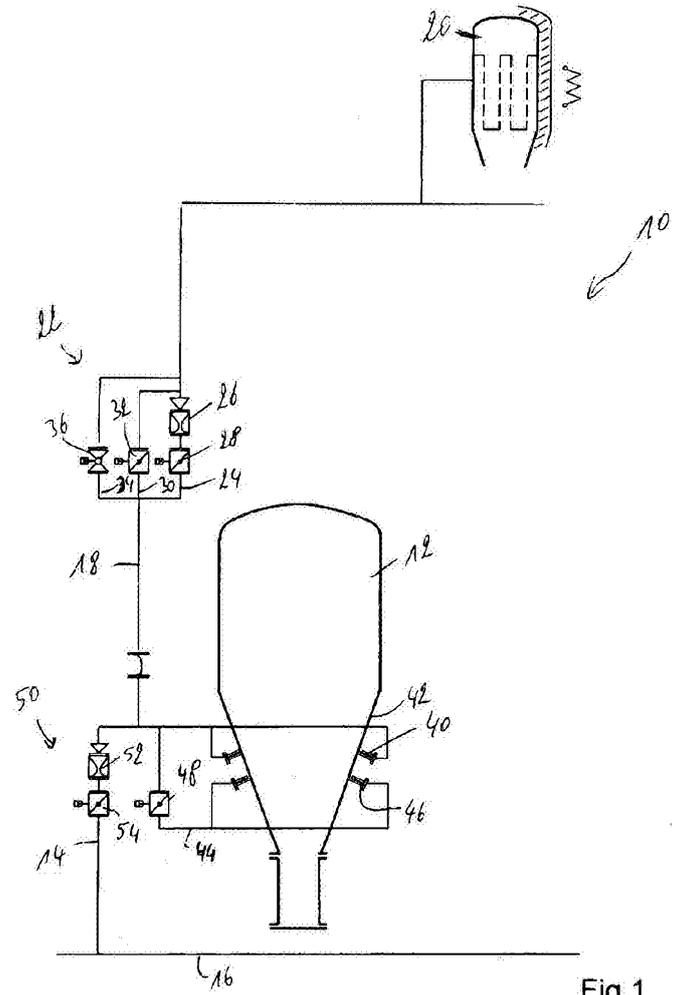


Fig.1

Installation for distribution of granular or powder material via pneumatic transport comprising a device for pressurizing and depressurizing a dispensing hopper for storage of said material

Technical Field

[0001] The present invention relates to an installation for distribution of granular or powder material via pneumatic transport, such as for example an installation for injecting coal into a blast furnace, comprising at least one dispensing hopper for temporary storage of the granular or powder material. The dispensing hopper is pressurized for emptying and must be depressurized to permit filling thereof. The present invention more particularly relates to the depressurizing of such a dispensing hopper. The present invention also relates to a method for operating such an installation.

Background Art

[0002] It is well-known, for example from EP 0 079 444 or EP 0 212 296 to inject granular or powder materials, in particular powdered coal, into a blast furnace. These materials are conventionally transported pneumatically. Typically, in a blast furnace, powdered coal may be injected at the level of each tuyere or at least into a plurality of tuyeres. The coal is supplied from a main storage hopper, which is maintained at atmospheric pressure, and distributed towards each injection point via a pneumatic dispensing line which, in the vicinity of the blast furnace, divides into a plurality of injection lines, each connected to an injection point. The coal may also be transported via the dispensing line towards another vessel maintained under constant pressure, then known as injection hopper, located in the vicinity of the blast furnace. The injection lines are then connected to the injection hopper. Transport and injection installations conventionally comprise pressurized temporary storage vessels, or dispensing hoppers, which are suited to containing the material and are pressurized by a transport gas, for example nitrogen. This gas makes it possible to fluidize the powder material and to transport it to its point of use, conventionally located in the tuyere.

[0003] Transport and injection installations are intended, on the one hand, to enable control of the flow rate of injected material and, on the other hand, a continuous supply of powder material. To this end a set of at least two dispensing hoppers are often located in parallel in the transport line and provided with closing valves enabling control of filling and emptying of each hopper is conventionally used for each transport line. The dispensing hoppers are used alternately, with one being emptied for supplying coal to the blast

furnace tuyeres, while the other one is being filled from the main storage hopper. Furthermore, each dispensing hopper is provided with a weighing means which makes it possible to determine the quantity of powdered coal introduced on each filling, so enabling control of the quantity of coal injected.

[0004] When filling a dispensing hopper from the main hopper, in order to avoid excess pressure which could prevent the coal from flowing well, the gas present in the dispensing hopper is discharged towards the upper part of the main hopper by a pressure-equalizing duct equipped with an isolation valve which is open during the filling. Since the duct is closed by the valve once filling of the dispensing hopper is complete, it therefore remains filled with moist gas containing powdered coal. In order to avoid the risks of condensation and clogging of the coal, or even blockage of the line, which may arise, these ducts are insulated and heated.

[0005] In order to empty each dispensing hopper via pneumatic transport of the powdered coal, these hoppers are supplied with pressurized gas via a duct equipped with a valve, which makes it possible to maintain the pressure required for transport during the entire duration of emptying. These dispensing hoppers, which are maintained under pressure when in use, must therefore periodically be depressurized each time before being refilled from the main storage hopper. The gas escaping from the hopper during depressurization inevitably entrains some powder product still present in the hopper. Bag filters are conventionally used in order to avoid discharging significant quantities of powdered coal into the atmosphere together with the pressurized gas during depressurization. Typically, each dispensing hopper is connected via a depressurizing duct equipped with a valve to a bag filter located on the main storage hopper, which makes it possible to recover the powdered coal retained by the bag filter directly into the main hopper, the gas being discharged into the atmosphere or recovered elsewhere. Since the main hopper is at atmospheric pressure, the filter too is therefore also under atmospheric pressure, the drop in pressure arising from the loss of load between the dispensing hopper and the bag filter and being controllable by the depressurizing valve located on the duct connecting the hopper and filter.

[0006] During depressurization, the pressure in the dispensing hopper declines gradually. Furthermore, the bag filters permit a maximum volumetric flow rate which is determined by the area of the filter's filtration surface. In order to optimize depressurization, it is therefore desired to maintain a maximally constant volumetric flow rate through the filter throughout depressurization, which makes it possible to minimize the necessary filtration surface and hence the overall size of the filters and the cost

thereof. The flow rate control provided by the valve located on the duct between the dispensing hopper and the bag filter makes it possible to ensure the desired constancy of flow rate.

[0007] One drawback of these systems resides in the fact that the control valve therefore necessarily acts on gas streams laden with powder material. Another drawback arises from the fact that, in a typical blast furnace installation, two, or even three, dispensing hoppers are connected to a single low pressure bag filter and, consequently, variations in pressure in a duct connecting a dispensing hopper to the filter during depressurization may have a disruptive effect on the weighing equipment of the other dispensing hoppers, and in particular on the dispensing hopper currently carrying out injection.

[0008] Another drawback arises from the fact that, during depressurization, a certain quantity of powdered coal is returned with the depressurization gas stream towards the bag filter and then onwards towards the main storage hopper. It is not possible to determine this quantity with precision. As a result, not only is the true quantity of coal injected into the tuyeres less than the quantity detected by the dispensing hopper weighing operations, but the quantity is also not known with precision.

[0009] Still another drawback originates from the fact that the duct between the depressurizing valves and the bag filter are relatively long and of large diameter, so resulting in elevated equipment costs.

[0010] It is suggested in WO 2014/006073 to provide a pressurized bag filter for each dispensing hopper and to place the pressurized bag filter in direct fluid communication with the associated dispensing hopper. Any valves or control means regulating the flow of pressurizing gas evacuated from the dispensing hopper is placed downstream of the pressurized bag filter.

Technical Problem

[0011] It is an object of the present invention to provide an improved installation for distribution of granular or powder material, wherein pressurizing and depressurizing of the dispensing hopper is enhanced. This object is achieved by an installation as claimed in claim 1. In particular, the present invention seeks to avoid having to install a pressurized bag filter on each dispensing hopper. It is a further object of the present invention to provide an improved method for distribution of granular or powder material. This object is achieved by a method as claimed in claim 12.

General Description of the Invention

[0012] In the light of these aims, the invention provides an installation for distribution of granular or powder material via pneumatic transport comprising at least one dispensing hopper for temporary storage of the granular or powder material, the dispensing hoppers being suited for being, alternately, pressurized for emptying the dispensing hopper and depressurized to permit filling thereof.

[0013] The installation further comprises a device for pressurizing and depressurizing the dispensing hopper with a pressurizing duct associated with the dispensing hopper for feeding pressurizing gas into the dispensing hopper through at least one pressurizing nozzle, the pressurizing duct being fluidly connected to a feed line for receiving pressurizing gas from a gas source. The device further comprises a depressurizing duct associated with the dispensing hopper for evacuating pressurizing gas from the dispensing hopper.

[0014] According to an aspect of the invention, the depressurizing duct is fluidly connected to the at least one pressurizing nozzle, wherein the at least one pressurizing nozzle comprises a filter element, preferably a sintered metal filter. Thus, the pressurizing nozzles serve for the pressurizing of the dispensing hopper as well as for the depressurizing thereof. No dedicated depressurizing nozzles need be provided. The filter element arranged in the pressurizing nozzle retains a large quantity of the granular or powder material and prevents the latter from flowing through the depressurizing duct. As the pressurizing gas exiting the dispensing hopper is at least partially "dedusted", the wear on any downstream valves is limited. There is no need to provide a bag filter between the dispensing hopper and the valves. Also, in case of a multi-hopper arrangement, there is no need to provide a bag filter associated with each of the dispensing hopper. A single, common bag filter may be arranged downstream of the valves in the depressurizing duct, i.e. shortly before the pressurizing gas exits the installation, either into the atmosphere or for use elsewhere.

[0015] The filter element preferably has a pore size distribution adapted to the bulk material used in the dispensing hopper. The pore size is indeed chosen such that the filter element retains a large portion of the granular or powder material without however creating too high a pressure loss of pressurizing gas passing therethrough, in either direction.

[0016] The depressurizing duct comprises a first de Laval nozzle for controlling the flow of pressurizing gas out of the dispensing hopper, a first shut-off valve being

preferably arranged upstream of the first de Laval nozzle. Such a de Laval nozzle is used to produce a roughly constant gas volume flow rate.

[0017] A first bypass branch bypassing the first de Laval nozzle may be provided for shortening a final depressurizing time when the pressure level in the dispensing hopper is close to the downstream pressure level. The first bypass branch comprises a second shut-off valve to open or close the first bypass branch.

[0018] A second bypass branch bypassing the first de Laval nozzle may be provided for emergency depressurizing of the dispensing hopper at reduced flow rate. Such a second bypass branch would comprise an orifice plate and a third shut-off valve to open or close the second bypass branch.

[0019] By means of the first, second and third shut-off valves, the flow of pressurizing gas out of the dispensing hopper through the depressurizing duct can be controlled depending on the requirements of different circumstances.

[0020] It should be noted that other valve arrangements may also be envisaged such as e.g. described in LU 92 534 or LU 92 813, both herewith incorporated by reference.

[0021] The pressurizing duct may comprise an auxiliary pressurizing branch for feeding pressurizing gas into the dispensing hopper through at least one auxiliary pressurizing gas nozzle, the at least one auxiliary pressurizing gas nozzle being arranged at a level below the at least one pressurizing gas nozzle. Such an auxiliary pressurizing branch preferably comprises a fourth shut-off valve in order to isolate the auxiliary pressurizing branch from the pressurizing duct. The auxiliary pressurizing branch allows feeding pressurizing gas into the dispensing hopper on two separate levels. However, during the depressurizing of the dispensing hopper, it may not be desired to extract pressurizing gas through the lower level. This is in particular the case in installations with parallel hopper arrangement, wherein the dispensing hoppers are generally not fully emptied and the auxiliary pressurizing gas nozzles may still be covered with material. It is then more advantageous to close off the auxiliary pressurizing branch.

[0022] The pressurizing duct may comprise a second de Laval nozzle for controlling the flow of pressurizing gas into the dispensing hopper, a fifth shut-off valve being preferably arranged upstream of the second de Laval nozzle.

[0023] The installation may comprise two or more dispensing hoppers, each dispensing hopper having a depressurizing duct with a first de Laval nozzle for controlling

the flow of pressurizing gas out of the dispensing hopper, each depressurizing duct feeding pressurizing gas to a common bag filter.

[0024] The present invention also relates to a method for operating an installation according to any of claims 1 to 11. The method comprises:

feeding granular or powder material into the dispensing hopper;

operating the device for pressurizing and depressurizing the dispensing hopper in a pressurizing mode;

evacuating the granular or powder material from the dispensing hopper;

operating the device for pressurizing and depressurizing the dispensing hopper in a depressurizing mode.

[0025] In the pressurizing mode, all shut-off valves in the depressurizing duct are closed, while the fifth shut-off valve in the pressurizing duct is open. Pressurizing gas is fed from the feed line through the pressurizing duct into the dispensing hopper. The auxiliary pressurizing branch may also be opened to feed pressurizing gas into the dispensing hopper on two separate levels if so desired.

[0026] In the depressurizing mode, the fifth shut-off valve in the pressurizing duct is closed, while one of the first, second or third shut-off valves is open. Generally, at the beginning of the depressurizing, the first shut-off valve is open and the gas flow through the depressurizing duct is controlled by the first de Laval nozzle. As the pressure level in the dispensing hopper approaches the downstream pressure level, the second shut-off valve is in addition opened to allow further gas evacuation.

[0027] While depressurizing, the fourth shut-off valve may also be closed. This is of particular interest if the associated auxiliary pressurizing nozzles are below the level of material still left in the dispensing hopper.

[0028] The above installation is preferably used for injecting powdered coal into a blast furnace.

Brief Description of the Drawings

[0029] A preferred embodiment of the invention will now be described, by way of example, with reference to Fig. 1, which is a simplified schematic view of an installation according to an embodiment of the invention.

Description of Preferred Embodiments

[0030] Figure 1 shows an installation 10 for distribution of granular or powder material via pneumatic transport comprising at least one dispensing hopper 12 (generally, two or more dispensing hoppers are used) for temporary storage of the granular or powder material, the dispensing hopper being suited for being, alternately, pressurized for emptying the dispensing hopper and depressurized to permit filling thereof, and a device for pressurizing and depressurizing the dispensing hopper. The device for pressurizing and depressurizing comprises a pressurizing duct 14 associated with the dispensing hopper 12 for feeding pressurizing gas into the dispensing hopper, the pressurizing duct 14 being fluidly connected to a feed line 16 for receiving pressurizing gas from a gas source.

[0031] A depressurizing duct 18 is also associated with the dispensing hopper 12 for evacuating pressurizing gas from the dispensing hopper. The depressurizing duct 18 feeds pressurizing gas from the dispensing hopper 12 to a bag filter 20. In the bag filter 20, granular or powder material is removed from the pressurizing gas before the latter is fed to the atmosphere or used elsewhere.

[0032] The depressurizing duct 18 shown in Figure 1 is provided with a first valve arrangement 22 for controlling the flow of pressurizing gas out of the dispensing hopper 12. The depicted first valve arrangement 22 comprises main branch 24 with a first de Laval nozzle 26 and a first shut-off valve 28. A first bypass branch 30, in arranged parallel to the main branch 24, comprises a second shut-off valve 32. A second bypass branch 30, in arranged parallel to the main branch 24, comprises a third shut-off valve 36 upstream an orifice plate.

[0033] Generally, during the depressurizing of the dispensing hopper only one of the shut-off valves 28, 32, 36 is open. A combination of open valves may however also be envisaged.

[0034] Typically, the flow is controlled by the first de Laval nozzle 26 after opening the first shut-off valve 28. In order to shorten the final depressurizing time, i.e. when the pressure level in the dispensing hopper is close to the downstream pressure and the depressurizing flow rate through the de Laval nozzle 26 is strongly decreasing, the second shut-off valve 32 is opened. The third automatic valve 36, upstream the orifice plate, may be opened for the purpose of emergency depressurizing of the *dispensing hopper*, at reduced flow rate.

[0035] In order to avoid compacting of pulverized coal in the dispensing hopper 12, pressurizing gas is generally not injected into the upper part of the dispensing hopper. Instead, pressurizing gas nozzles 40 are usually located in the lower part, i.e. the lower conical part 42, of the dispensing hopper 12.

[0036] The pressurizing duct 14 feeding pressurizing gas to the pressurizing gas nozzles 40 may comprise, as shown in the embodiment of Fig1, an auxiliary pressurizing branch 44 for feeding pressurizing gas into the dispensing hopper 12 at a separate, lower level through auxiliary pressurizing gas nozzles 46. The auxiliary pressurizing branch 44 comprises a fourth shut-off valve 48 for isolating the auxiliary pressurizing branch 44 from the pressurizing duct 14.

[0037] The pressurizing duct 14 comprises a second valve arrangement 50 comprising a second de Laval nozzle 52 and a fifth shut-off valve 54 associated therewith.

[0038] In order to shorten the pressurizing time duration and thus increase the time duration for depressurizing at a reduced flow rate, an alternative second valve arrangement may be used, switching from a pressurizing gas flow rate control by means of a de Laval nozzle, as shown in Figure 1, producing roughly a constant gas mass flow rate, to a control by means of a pressurizing gas flow rate control valve, producing roughly a constant volume flow rate, as described in LU 92 534 or LU 92 813, both herewith incorporated by reference. The constant volume flow rate pressurizing has the advantage of minimizing the required pressurizing time duration, while limiting as well the pressure loss in the sintered metal filters, resulting from the fact that the gas flow in the filter is primarily laminar.

[0039] Similarly, the depressurizing time duration may be shortened by replacing the first de Laval nozzle 26 of the first valve arrangement 22 with an arrangement as described in LU 92 534 or LU 92 813.

[0040] According to the present invention, the depressurizing duct 18 is fluidly connected to the pressurizing gas nozzles 40. In other words, the nozzles used to feed pressurized gas into the dispensing hopper 12 during the pressurizing cycle are also used to evacuate pressurized gas from the dispensing hopper 12 during the depressurizing cycle. To this effect, the depressurizing duct 18 is connected to the pressurizing duct 14 somewhere between the second valve arrangement 50 and the pressurizing gas nozzles 40.

[0041] The pressurizing gas nozzles 40 are each fitted with a filter element, preferably a sintered metal filter adapted to the grain size distribution of the bulk material fed into the dispensing hopper 12. The pore size distribution of the sintered metal filter conditions the gas pressure losses caused in the filters, during pressurizing as well as during depressurizing. For a common pulverized coal grain size distribution, a commercially available sintered metal filter having an indicated 98 % separation efficiency at 9 μm would retain about 93 % of that pulverized coal, when assuming that the grain size distribution of the entrained material is the same as the grain size distribution of whole of that pulverized coal, while the pressure losses in the pressurizing gas would remain acceptable, during both the pressurizing and depressurizing cycles.

[0042] During depressurizing of the dispensing hopper 12, pulverized material is trapped in the sintered metal filters inside the pressurizing gas nozzles, thus preventing a substantial amount of pulverized material from escaping the dispensing hopper 12 and being fed through the depressurizing duct 18 towards the bag filter 20. Reducing the amount of pulverized material in the pressurizing gas in the depressurizing duct 18 prevents excessive wear to the various components in the first valve arrangement 22. The reduced amount of pulverized material in the evacuated pressurizing gas also reduces the amount of pulverized material that would have to be caught in the bag filter 20. Due to the reduced solid material concentration in the evacuated pressurizing gas, the load of the filter bags can be increased and thus the filtering surface area decreased. In case the evacuated pressurizing gas is to be recovered, the bag filter is preferably a pressurized bag filter, as described in patent application WO 2014/006073 or LU 92 944, both herewith incorporated by reference.

[0043] During the subsequent pressurizing cycle, pressurizing gas is again fed into the dispensing hopper through the same pressurizing gas nozzles 40. Generally, the pressurizing gas flow rate is larger than the depressurizing gas flow rate. Thus, the particles trapped in the filters of the pressurizing gas nozzles 40 are blown back into the dispensing hopper 12. This does not only return the trapped particles to the dispensing hopper, but also clears the filter ready for the next depressurizing cycle.

[0044] With respect to the auxiliary pressurizing branch 44, it may be noted that this branch is generally used during the pressurizing cycle, not however during the depressurizing cycle. The use of the auxiliary pressurizing branch 44 is controlled by means of the fourth shut-off valve 48. Indeed, in particular in the case of a parallel hopper arrangement, i.e. of dispensing hoppers feeding pulverized coal into a conveying line, dispensing hoppers are not completely emptied when bulk material is fed into the

conveying line, but a minimum filling level is maintained at the end of the emptying. This may result in that the auxiliary pressurizing gas nozzles 46 remain covered with bulk material contained in the hopper when the depressurizing of the lock hopper is to be performed. It is preferred not to involve the auxiliary pressurizing gas nozzles 46 covered with bulk material into the depressurizing process and isolate them by means of the fourth shut-off valve 48.

[0045] It should be noted that the bag filter 20, as shown in Fig.1, is preferably an atmospheric bag filter. Alternatively, a bag filter suited to operating under pressure may be provided. In an installation with such a pressurized bag filter, the shut-off valves 28, 32, 36 should be installed downstream the bag filter. In this case, an additional shut-off valve should be provided between the dispensing hopper and the bag filter.

[0046] The invention is not restricted to the above embodiments and to the specific application relating to injecting coal into a blast furnace. It may also be applied to other installations comprising pressurized hoppers containing granular or powder materials and requiring periodic pressurization and depressurization of the hoppers through bag filters.

Legend of Reference Numbers:

10	installation for distribution	32	second shut-off valve
12	dispensing hopper	36	third shut-off valve
14	pressurizing duct	40	pressurizing gas nozzle
16	feed line	42	lower conical part
18	depressurizing duct	44	auxiliary pressurizing branch
20	bag filter	46	auxiliary pressurizing gas nozzle
22	first valve arrangement	48	fourth shut-off valve
24	main branch	50	second valve arrangement
26	first de Laval nozzle	52	second de Laval nozzle
28	first shut-off valve	54	fifth shut-off valve
30	first bypass branch		

P-PWU-740/LU

Revendications

1. Installation pour distribution de matière granulaire ou pulvérulente par l'intermédiaire d'un transport pneumatique comprenant au moins une trémie de distribution pour stockage temporaire de ladite matière granulaire ou pulvérulente, la trémie de distribution étant appropriée pour être, de façon alternée, pressurisée pour vider la trémie de distribution et dépressurisée pour permettre le remplissage de celle-ci, et un dispositif pour pressuriser et dépressuriser ladite trémie de distribution, ledit dispositif pour pressuriser et dépressuriser comprenant
- 5
- 10
- une conduite de pressurisation associée avec ladite trémie de distribution pour alimenter un gaz de pressurisation dans ladite trémie de distribution par l'intermédiaire d'au moins une tuyère de gaz de pressurisation, ladite conduite de pressurisation étant fluidiquement connectée à une ligne d'alimentation pour recevoir un gaz de pressurisation d'une source de gaz ;
 - une conduite de dépressurisation associée avec ladite trémie de distribution pour évacuer un gaz de pressurisation de ladite trémie de distribution ;
- caractérisée en ce que**
- ladite conduite de dépressurisation est fluidiquement connectée à ladite au moins une tuyère de pressurisation, dans laquelle ladite au moins une tuyère de pressurisation comprend un élément de filtre.
- 15
- 20
2. Installation selon la revendication 1, dans laquelle ledit élément de filtre comprend un filtre métallique fritté.
- 25
3. Installation selon la revendication 1 ou 2, dans laquelle ledit élément de filtre a une distribution de tailles de pores adaptée à la matière en vrac utilisée dans la trémie de distribution.
- 30
4. Installation selon l'une quelconque des revendications précédentes, dans laquelle ladite conduite de dépressurisation comprend une première tuyère de

Laval pour commander le débit de gaz de pressurisation sortant de la trémie de distribution, une première vanne d'arrêt étant préférablement agencée en amont de ladite première tuyère de Laval.

- 5 5. Installation selon la revendication 4, dans laquelle ladite conduite de dépressurisation comprend une première branche de contournement contournant ladite première tuyère de Laval, ladite première branche de contournement comprenant une deuxième vanne d'arrêt.
- 10 6. Installation selon la revendication 4 ou 5, dans laquelle ladite conduite de dépressurisation comprend une deuxième branche de contournement contournant ladite première tuyère de Laval, ladite deuxième branche de contournement comprenant une plaque à orifice et une troisième vanne d'arrêt agencée en amont de ladite plaque à orifice.
- 15 7. Installation selon l'une quelconque des revendications précédentes, dans laquelle ladite conduite de dépressurisation comprend un filtre à sac.
- 20 8. Installation selon l'une quelconque des revendications précédentes, dans laquelle ladite conduite de pressurisation comprend une branche de pressurisation auxiliaire pour alimenter un gaz de pressurisation dans ladite trémie de distribution par l'intermédiaire d'au moins une tuyère de gaz de pressurisation auxiliaire, ladite au moins une tuyère de gaz de pressurisation auxiliaire étant agencée à un niveau inférieur à ladite tuyère de gaz de
- 25 pressurisation.
9. Installation selon la revendication 8, dans laquelle ladite branche de pressurisation auxiliaire comprend une quatrième vanne d'arrêt.
- 30 10. Installation selon l'une quelconque des revendications précédentes, dans laquelle ladite conduite de pressurisation comprend une deuxième tuyère de Laval pour commander le débit de gaz de pressurisation dans la trémie de

distribution, une cinquième vanne d'arrêt étant préférablement agencée en amont de ladite deuxième tuyère de Laval.

11. Installation selon l'une quelconque des revendications précédentes, comprenant deux trémies de distribution ou plus, chaque trémie de distribution comprenant une conduite de dépressurisation avec une première tuyère de Laval pour commander le débit de gaz de pressurisation sortant de la trémie de distribution, chaque conduite de dépressurisation alimentant un gaz de pressurisation jusqu'à un filtre à sac commun, préférablement un filtre à sac pressurisé.

12. Procédé d'utilisation d'une installation selon l'une quelconque des revendications 1 à 11, ledit procédé comprenant :

- l'alimentation d'une matière granulaire ou pulvérulente dans ladite trémie de distribution ;
- l'utilisation dudit dispositif pour pressuriser et dépressuriser ladite trémie de distribution dans un mode de pressurisation ;
- l'évacuation de ladite matière granulaire ou pulvérulente de ladite trémie de distribution ;
- l'utilisation dudit dispositif pour pressuriser et dépressuriser ladite trémie de distribution dans un mode de dépressurisation.

13. Procédé selon la revendication 12, dans lequel :

- dans ledit mode de pressurisation, de quelconques vannes d'arrêt dans ladite conduite de dépressurisation sont fermées, tandis que ladite cinquième vanne d'arrêt dans ladite conduite de pressurisation est ouverte, alimentant ainsi un gaz de pressurisation de ladite ligne d'alimentation, par l'intermédiaire de ladite deuxième tuyère de Laval, jusque dans ladite trémie de distribution par l'intermédiaire de ladite au moins une tuyère de gaz de pressurisation.

30

14. Procédé selon la revendication 12, dans lequel :

- dans ledit mode de dépressurisation, ladite cinquième vanne d'arrêt dans ladite conduite de pressurisation est fermée, tandis qu'au moins une vanne d'arrêt dans ladite conduite de dépressurisation est ouverte, alimentant ainsi un gaz de pressurisation de ladite trémie de distribution par l'intermédiaire de ladite
5 au moins une tuyère de gaz de pressurisation par l'intermédiaire de ladite conduite de dépressurisation vers ledit filtre à sac.

15. Procédé selon la revendication 13 ou 14, dans lequel :

- dans ledit mode de pressurisation, ladite quatrième vanne d'arrêt dans ladite
10 branche de pressurisation auxiliaire est ouverte ; et
- dans ledit mode de dépressurisation, ladite quatrième vanne d'arrêt dans ladite branche de pressurisation auxiliaire est fermée.

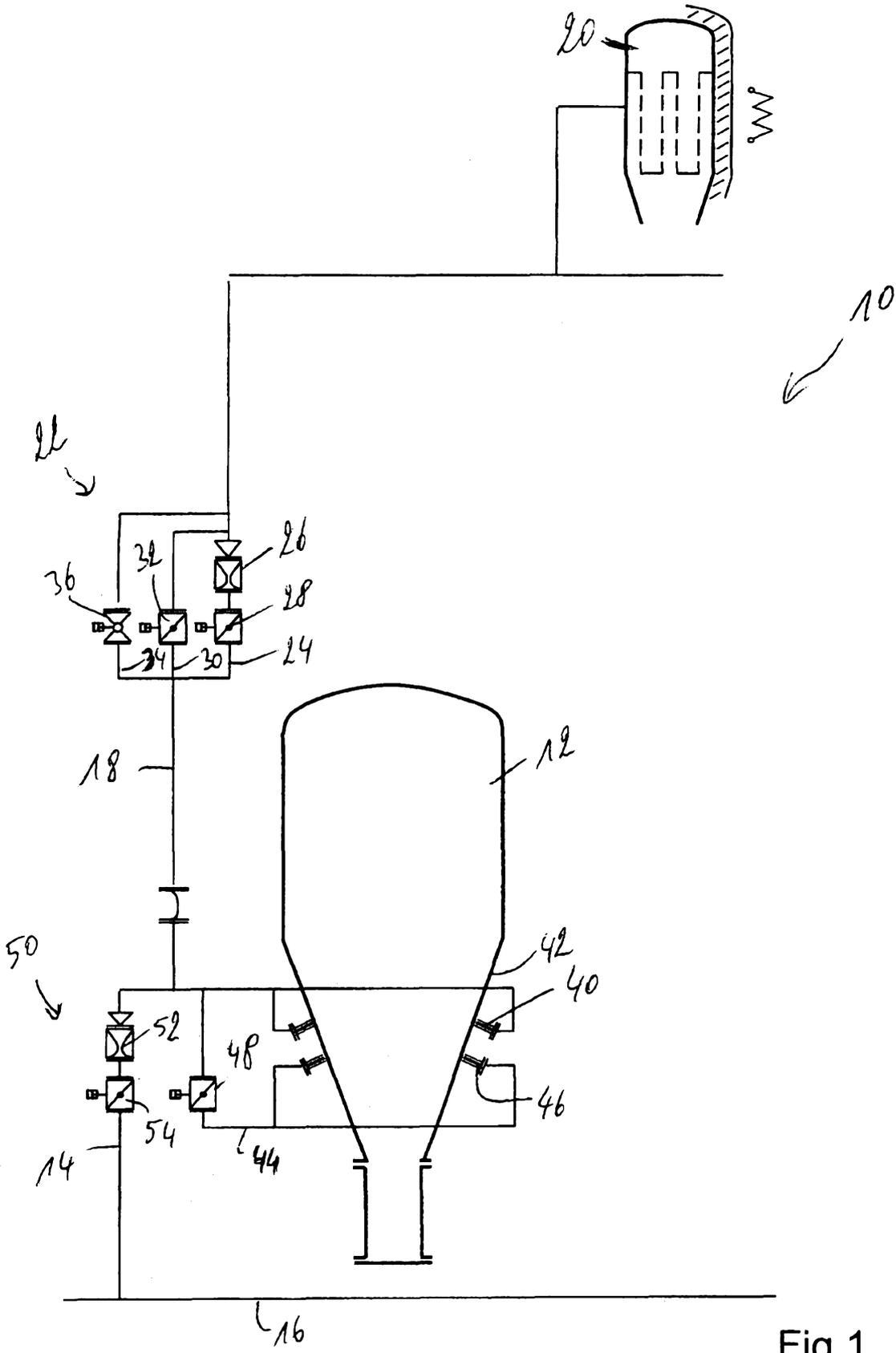


Fig. 1

Abstract

An installation (10) for distribution of granular or powder material via pneumatic transport comprising at least one dispensing hopper (12) for temporary storage of the granular or powder material, the dispensing hopper (12) being suited for being, alternately, pressurized for emptying the dispensing hopper (12) and depressurized to permit filling thereof. The installation (10) comprises a device for pressurizing and depressurizing the dispensing hopper (12) with a pressurizing duct (14) associated with the dispensing hopper (12) for feeding pressurizing gas into the dispensing hopper (12) through at least one pressurizing nozzle (40), the pressurizing duct (14) being fluidly connected to a feed line (16) for receiving pressurizing gas from a gas source. The device further comprises a depressurizing duct (18) associated with the dispensing hopper (12) for evacuating pressurizing gas from the dispensing hopper (12). The depressurizing duct (18) is fluidly connected to the at least one pressurizing nozzle (40), wherein the at least one pressurizing nozzle (40) comprises a filter element.

(Fig. 1)



SEARCH REPORT
in accordance with Article 35.1 a)
of the Luxembourg law on patents
dated 20 July 1992

LO 1295
LU 92978

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 5 033 914 A (WUERTELE FREDERICK S [US] ET AL) 23 July 1991 (1991-07-23)	1-3,12, 14	INV. B65G53/22
Y	* column 4, line 42 - column 6, line 29 * * figures 1-3 *	4,7,10, 11,13	B65G53/42 B65G53/60
Y,D	----- LU 92 470 A1 (WURTH PAUL SA [LU]) 7 December 2015 (2015-12-07) * page 4, paragraph 0012 - page 12, paragraph 0045 * * figures 1,2 *	4,7,10, 11,13	
A	----- EP 0 105 249 A1 (KOCKUMS IND AUSTRALIA [AU]) 18 April 1984 (1984-04-18) * column 1, line 9 - column 2, line 39 * * figure 1 *	1,12	

			TECHNICAL FIELDS SEARCHED (IPC)
			B65G
1 The present search report has been drawn up for all claims			
		Date of completion of the search	Examiner
		7 October 2016	Papatheofrastou, M
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (F04C55)

**ANNEX TO THE SEARCH REPORT
ON LUXEMBOURG PATENT APPLICATION NO.**

LO 1295
LU 92978

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

07-10-2016

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
US 5033914	A	23-07-1991	CA	2020107 A1	30-03-1991
			US	5033914 A	23-07-1991

LU 92470	A1	07-12-2015	NONE		

EP 0105249	A1	18-04-1984	DE	3272266 D1	04-09-1986
			EP	0105249 A1	18-04-1984
			JP	S59500712 A	26-04-1984
			WO	8303593 A1	27-10-1983



WRITTEN OPINION

File No. LO1295	Filing date (<i>day/month/year</i>) 12.02.2016	Priority date (<i>day/month/year</i>)	Application No. LU92978
International Patent Classification (IPC) INV. B65G53/22 B65G53/42 B65G53/60			
Applicant Paul Wurth			

This report contains indications relating to the following items:

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the application
- Box No. VIII Certain observations on the application

Form LU237A (Cover Sheet) (January 2007)	Examiner Papatheofrastou, M
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WRITTEN OPINION

Application No.

LU92978

Box No. I Basis of the opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - a sequence listing
 - table(s) related to the sequence listing
 - b. format of material:
 - on paper
 - in electronic form
 - c. time of filing/furnishing:
 - contained in the application as filed.
 - filed together with the application in electronic form.
 - furnished subsequently.
3. In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

Box No. V Reasoned statement with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty	Yes: Claims	2-11, 13, 15
	No: Claims	1, 12, 14
Inventive step	Yes: Claims	5, 6, 8, 9, 15
	No: Claims	1-4, 7, 10-14
Industrial applicability	Yes: Claims	1-15
	No: Claims	

2. Citations and explanations

see separate sheet

WRITTEN OPINION

Application No.

LU92978

Box No. VII Certain defects in the application

The following defects in the form or contents of the application have been noted:

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following documents:

- D1 US 5 033 914 A (WUERTELE FREDERICK S [US] ET AL) 23 July 1991 (1991-07-23)
- D2 LU 92 470 A1 (WURTH PAUL SA [LU]) 7 December 2015 (2015-12-07)
- D3 EP 0 105 249 A1 (KOCKUMS IND AUSTRALIA [AU]) 18 April 1984 (1984-04-18)

Lack of novelty

2 The present application does not meet the criteria of patentability, because the subject-matter of claims 1, 12 is not new.

Claim 1

2.1 The document D1 discloses (the references in parentheses applying to this document):

An installation (10) for distribution of granular or powder material via pneumatic transport comprising at least one dispensing hopper (12) for temporary storage of said granular or powder material, { *functional features - the dispensing hopper being suited for being, alternately, pressurized for emptying the dispensing hopper and depressurized to permit filling thereof* }, and a device (50) for pressurizing and depressurizing said dispensing hopper, said device for pressurizing and depressurizing comprising

- a pressurizing duct (40e, 40c, 40b, 40) associated with said dispensing hopper for feeding pressurizing gas into said dispensing hopper through at least one pressurizing gas nozzle (inlet port, column 5, line 4), said pressurizing duct being fluidly connected to a feed line (40b to 50) for receiving pressurizing gas from a gas source;
- a depressurizing duct (40d, 40a, 40) associated with said dispensing hopper for evacuating pressurizing gas from said dispensing hopper; whereby
- said depressurizing duct is fluidly connected to said at least one pressurizing

nozzle (figure 1), wherein said at least one pressurizing nozzle comprises a filter element (46).

2.2 Therefore document D1 discloses all features of claim 1.

Claim 12

2.3 The document D1 discloses (the references in parentheses applying to this document):

A method for operating an installation (10) according to any of claims 1 to 11, said method comprising:

- feeding (26) granular or powder material into said dispensing hopper (12);
- operating said device (50) for pressurizing and depressurizing said dispensing hopper in a pressurizing mode (figure 2);
- evacuating said granular or powder material from said dispensing hopper (figure 2);
- operating said device for pressurizing and depressurizing said dispensing hopper in a depressurizing mode (figure 1).

2.4 Therefore document D1 discloses all features of claim 12.

Dependent claims 2-4, 7, 10, 11, 13, 14, negative assessment

3 Dependent claims 2-4, 7, 10, 11, 13, 14 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of inventive step, see documents D1, D2 and the corresponding passages cited in the search report.

Dependent claims 5, 6, 8, 9, 15, positive assessment

4 The combination of the features of dependent claims 5, 6, 8, 9, 15 is neither known from, nor rendered obvious by, the available prior art.

Re Item VII

Certain defects in the application

5 The features of claims 1-15 are not provided with reference signs placed in parentheses.

6 The relevant background art disclosed in D1 is not mentioned in the description, nor is one of these documents identified therein.