

Pneumatic Conveying System And Method And Pneumatic Creator

Field of Art

The invention relates to pneumatic conveying system used for conveying small objects or particulate matter. The invention also relates to methods of pneumatically conveying small objects and particulate matter through such systems. The invention also relates to a pneumatic creator useable in such systems.

Prior Art

Pneumatic conveying is a process which involves using a pneumatic flow condition to convey small objects or particulate through tubes or ducts. The pneumatic condition in the tubes may consist of air pressure, air currents, or even vacuum conditions. Pneumatic conveying is a particularly cost effective method of conveying bulk particulate matter which includes materials such as cement, sand, mortar, flour, rice, beans, wheat, grains, chemical pellets, plastics granules and even hay, for example. The bulk particulate matter is usually in the form of powder, granules and/or pellets. The process is useful for moving large quantities of particulate matter, for example, when transporting particulate from a bulk carrier, such as a truck or ship, to a silo.

Pneumatic conveying may involve the movement of huge quantities of air through a duct system, or may even involve establishing a vacuum condition in the pipe system. Therefore, the movement of particulate matter through the pipes is dependent on the continuance of the movement of air, or whatever pneumatic condition is being used. As an example, Figure 1 illustrates an earlier prior art pneumatic conveying system 7. A compressor 10 supplies compressed air into a duct system which, in this case, is in the form of a network of pipes 20. An air valve 21 is used to control the flow of air entering the pipes 20. Particulate matter 30 is stored in a bulk storage source in

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the form of a silo 40 that is connected to the network of pipes 20. A silo valve 42 is used to control the release of particulate matter from the silo 40. The interior of the silo 40 is open to the atmosphere through inlet tube 41. The compressed air is continuously generated by the compressor 10 and flows through the pipes 20. In the example, the flowing air forms a pneumatic condition in the pipes 20 that conveys the particulate matter 30 from the region of the silo valve 42 to a particulate receiving point 50 which may be another silo, or may even be a transport means such as a truck or ship. In Figure 1, the direction of flow of the pneumatic condition is illustrated with arrows.

A problem arises when the pneumatic conveying condition in the pipes ceases or fails to be sustained. This might, for example, be as a result of breakdown of the compressor 10, or because the air source is purposely shut down for maintenance or because the pneumatic process has completed the task of emptying the silo 40. Other reasons for the cessation of the pneumatic conveying condition could be failure of the power supply or depletion of the fuel source for the compressor engine, as the case may be. Thus, there may be a variety of reasons for the cessation.

A problem arises if, at the cessation of the pneumatic conveying condition, a portion of the particulate matter remains in the pipes so as to block the pipes. In the prior art example of Figure 2, the particulate matter settles in the pipe under the influence of gravity. In the example in Figure 2, blockage of the pipes 20A, 20B tends to occur at the bottom of upright segments of the pipe system (20A), and at horizontal pipe segments (20B). The task of clearing the blocked pipes is difficult and time consuming, and leads to loss of efficiency in the overall conveying process due to unnecessary down-time.

Another problem that is perhaps less severe than complete blockage is the problem of particulate matter remaining in the pipes to form a coating on the inner walls of the pipes. This problem happens especially with particulate matter, such as flour and cement, which can combine with moisture to form a coating that will eventually lead to narrowing of the pipe passages and ultimately to complete blockage

of the pipes. If the coating is not cleared immediately or at least periodically, it may harden and accumulate and therefore becomes more difficult to remove later on.

It is an object of the present invention to overcome or substantially ameliorate at least one of the problems mentioned in relation to the prior art, and it is not necessary for the present invention, in its broadest aspect, to address and/or overcome each and every one of the problems mentioned.

Summary of Invention

According to the present invention, there is provided a pneumatic conveying system including:

- a duct system for pneumatically conveying particulate;

- a primary pneumatic creator for creating a main pneumatic conveying condition in the duct system sufficient to convey the particulate through the duct system;

- a secondary pneumatic creator adapted to create a temporary pneumatic conveying condition in the duct system when the primary pneumatic creator ceases to sustain the main pneumatic conveying condition,

- the temporary pneumatic conveying condition being sufficient to move at least some of the particulate that remains in the duct system at the time of cessation.

Preferably, the temporary pneumatic conveying condition is sufficient to substantially remove from the duct system any particulate that remains therein at the time of cessation.

The primary and secondary pneumatic creators may each be an air current source.

The air current source of the secondary pneumatic creator may be in the form of pressurised air stored under pressure in a container. Alternatively, the secondary pneumatic creator may be in the form of pressurised air from a particulate storage

container that is connected to the duct system, the system being provided with a controllable diversion duct for diverting pressurised air from the particulate storage container to the duct system in order to create the temporary pneumatic conveying condition when the primary pneumatic creator ceases to sustain the main pneumatic conveying condition.

According to one embodiment, the primary pneumatic creator at least during the main pneumatic conveying condition may be able to maintain the pressurised air in the secondary pneumatic creator at least at a level required to create the temporary pneumatic conveying condition. The primary pneumatic creator may be connected to the secondary pneumatic creator through a controllable valve, and the secondary pneumatic creator may be provided with a pressure sensor adapted to monitor the pressurised air therein such that when the pressure sensor detects that the pressurised air in the secondary pneumatic creator has fallen to a level that would be insufficient to create the temporary pneumatic conveying condition, the controllable valve may be opened by a controlling means to enable air from the primary pneumatic creator to increase the pressurised air in the secondary pneumatic creator.

The secondary pneumatic creator may also be in the form of a secondary air compressor which generates the air current.

The primary pneumatic creator is in the form of a primary air compressor, or it may include a fan or propellor.

In other embodiments, the primary and secondary pneumatic creators may each be a vacuum generator, and the main and temporary pneumatic conveying conditions would then be vacuum conditions

The pneumatic conveying system may include a plurality of secondary pneumatic creator arranged and adapted to act in relay to move the particulate in the duct system.

The controlling means that opens and closes the controllable valve may include a microprocessor circuit. Alternatively, the controlling means may be a mechanical mechanism.

According to another aspect of the invention, there is provided a method of pneumatically moving particulate through a duct system in which a primary pneumatic creator is ordinarily used for creating in the duct system a main pneumatic conveying condition that conveys particulate therethrough, the method involving the step of:

creating a temporary pneumatic conveying condition in the duct system when the primary pneumatic creator ceases to sustain the main pneumatic conveying condition,

the temporary pneumatic conveying condition being sufficient to move at least some of the particulate that remains in the duct system at the time of cessation.

According to a further aspect of the invention, there is provided a secondary pneumatic creator adapted to be connected to a duct system of a pneumatic conveying system used for pneumatically conveying particulate in which system a primary pneumatic creator creates a main pneumatic conveying condition in the duct system sufficient to convey the particulate through the duct system;

the secondary pneumatic creator being adapted to create a temporary pneumatic conveying condition in the duct system when the primary pneumatic creator ceases to sustain the main pneumatic conveying condition,

the temporary pneumatic conveying condition being sufficient to move at least some of the particulate that remains in the duct system at the time of cessation.

Drawings

In order that the invention might be more fully understood, embodiments of the invention will be described, by way of example, with reference to the accompanying

drawings, in which:

Figure 1 illustrates a prior art pneumatic conveying system;

Figure 2 illustrates the prior art pneumatic conveying system of Figure 1 showing accumulation of particulate in the pipes as a result of the cessation of the pneumatic conveying conditions in the pipes;

Figure 3 is a schematic illustration of a first embodiment of a pneumatic conveying system having a secondary pneumatic creator, the system being used in relation to a non-pressurised silo;

Figure 4 is a schematic illustration of the embodiment of Figure 3 in which the secondary pneumatic creator is used to create a temporary pneumatic conveying condition in the duct system when the primary air compressor ceases to sustain the main pneumatic conveying condition;

Figure 5 is an illustration of a second embodiment of a pneumatic conveying system which is used in relation to a pressurised silo;

Figure 6 is a schematic illustration of the embodiment of Figure 5 in which pressurised air from the pressurised silo is used to create the temporary pneumatic conveying condition in the duct system when the primary air compressor ceases to sustain the main pneumatic conveying condition; and

Figure 7 is a schematic illustration of a yet further embodiment, similar to the one in Figures 5 and 6, except that in the embodiment of Figure 7 the air pressure in the silo is supplied by the primary air compressor.

Figure 8 illustrates another embodiment which is a modification of the earlier embodiment of Figures 3 and 4 in which the system is provided with an automatic re-

pressurisation mechanism in which the primary air compressor is used to re-pressurise the secondary pneumatic creator;

Figure 9 illustrates a further embodiment which is a modification of the embodiment in Figures 5 and 6 in which the system is provided with another automatic re-pressurisation mechanism; and

Figure 10 illustrates an embodiment of a control valve that is contained in an enclosure of a transportable device.

In the drawings of the different embodiments of the invention, like parts are designated with like numerals throughout, wherever possible, only for the sake of ease of understanding the specification.

Embodiments

Referring to the drawings from Figure 3 onwards, Figure 3 illustrates a first embodiment of a pneumatic conveying system 70. The pneumatic conveying system includes a duct system in the form of a network of pipes 200 and is used for pneumatically conveying particulate through the pipes. The particulate may be in the form of powder, granules and/or pellets. These include materials such as cement, sand, mortar, flour, rice, beans, wheat, grains, chemical pellets, plastics granules and even hay, for example, and any other particulate or particulate matter that can be carried by a pneumatic flow condition.

In the embodiment of Figure 3, the duct system is provided with multiple outlets 510A, 510B, 510C, and is also provided with further exit points 520 to which further outlets may be added. However, the invention in its broadest aspect is not limited to being a network of pipes or to having multiple outlets. The invention in its simplest form may cover a single pipe or duct leading to a single outlet.

The pneumatic conveying system 70 is provided with a primary pneumatic creator which, in this embodiment, is an air current source in the form of a primary air compressor 100. The primary air compressor 100 supplies compressed air into the network of pipes 200. In the diagrams, the compressor is illustrated only schematically since the actual configuration of the compressor is not critical to the invention in its broadest aspect. For example, the primary air compressor 100 may be run by an electric motor or a combustion engine.

Particulate material 300 is stored in a bulk storage source in the form of a non-pressurised silo 400 that is connected to the network of pipes 200. The silo 400 in this embodiment is not pressurised because the interior of the silo 400 is open to the atmosphere through inlet tube 410. The primary air compressor 100 generates a continuous stream of air which flows through the pipes 200. The flowing air acts as a main pneumatic conveying condition in the pipes 200 that is sufficient to convey the particulate 300 from the silo 400 through the pipes 200 to a particulate receiving point 500. In Figure 3, the main pneumatic conveying condition is illustrated with arrows.

An important feature of the pneumatic conveying system 70 is that it is provided with a secondary pneumatic creator which is adapted to create a temporary pneumatic conveying condition in the duct system when the primary pneumatic creator ceases or fails to sustain the main pneumatic conveying condition. In the embodiment in Figure 3, the secondary pneumatic creator is a further air current source 110 in the form of air stored under pressure in a container. The air may be stored in a pressurised container. In other embodiments, the secondary pneumatic creator may be in the form of a secondary air compressor which generates the air current source temporarily for a limited period of time.

In Figure 3, during the main pneumatic condition, a compressor control valve 210 and a main control valve 220 are opened so as to direct air flow from the primary air compressor 100 into the pipe system 200. Under normal conditions, the air flow from the primary air compressor 100 will not flow into the further air current source

110 because the further air current source 110 is also provided with a secondary control valve 230 which, under normal conditions, is closed to prevent the pressurised air inside the further air current source 110 from escaping. A particulate valve 420 controls the rate of entry of particulate into the pipes 200. Thus, particulate enters the pipes 200 at the point of the particulate valve 420, and is carried by the pneumatic flow condition created by the air stream from the primary air compressor 100. The particulate is carried through the pipes to the particulate receiving point 500.

The embodiment of Figure 3 is provided with a back-up system that comes into action when the primary air compressor 100 is not able to sustain the necessary pneumatic conveying condition in the pipes 200. This may be due to unforeseen failure of the compressor 100 or due to a cut in its power supply, or may be due to periodic shutdown of the compressor 100 or a host of other reasons.

In Figure 4, when the main pneumatic conveying condition falls below an acceptable limit, the particulate valve 420 closes to prevent more particulate from entering the pipes 200. The compressor control valve 210 closes to prevent air or particulate flowing back into the compressor 100 which could clog the mechanism. The main control valve 220 and the secondary control valve 230 are opened to allow air flow from the further air current source 110 to enter the pipes 200 in order to create a temporary pneumatic conveying condition in the pipes. In Figure 4, the temporary pneumatic conveying condition is illustrated with arrows. To create the temporary pneumatic condition, the secondary control valve 230 is opened to release the compressed air from the further air current source 110. After the further air current source 110 releases its store of pressurised air and is eventually depleted, the secondary control valve 230 is then closed, while the main control valve 220 is allowed to remain open.

The temporary pneumatic conveying condition, created by the air current from the further air current source 110, is sufficient to move at least some of the particulate that remains in the duct system at the time of cessation. This at least minimises the

likelihood of the pipes 200 becoming blocked or choked. Preferably, the temporary pneumatic conveying condition is also sufficient to substantially remove from the duct system any particulate that remains therein at the time of cessation. This will minimise the problem of particulate accumulating along the pipes 200 and reduce the likelihood of coatings forming on the inner walls of the pipes 200.

Although the secondary pneumatic creator may be connected to the system of pipes 200 at any point, it is preferably connected up-stream from the point at which the particulate enters the system of pipes 200. This ensures that all particulate found in the pipes at the time of cessation of the primary air compressor will be affected by the further air current source 110. If, however, the further air current source 110 were to be placed down-stream from the point of entry of the particulate into the pipes, the air current from the further air current source 110 may unintentionally force the particulate backwards towards the silo 400 and the primary air compressor 100, rather than forwards towards the particulate receiving point 500 as intended.

Figure 5 shows a second embodiment in which a pneumatic conveying system 70A is connected to a bulk storage source in the form of a pressurised silo 400A. Particulate material 300 is stored in the silo 400A. The silo 400A in this other embodiment is pressurised because the interior of the silo 400 contains pressurised air 110A.

In Figure 5, the system of pipes 200 is in communication with an upper region of the pressurised silo 400A, through a controllable diversion duct in the form of diversion pipe 440. The diversion pipe 440 is adapted to divert pressurised air from the silo 400A into the duct system, when the primary air compressor 100 ceases to sustain the main pneumatic conveying condition, in order to create the temporary pneumatic conveying condition at the time.

In Figure 5, the main pneumatic conveying condition is illustrated with arrows. During the main pneumatic conveying condition, the compressor control valve 210 and

main control valve 220A are opened so as to direct air flow from the primary air compressor 100 into the pipe system 200. The secondary control valve 230A, which is found on the diversion pipe 440, is closed to ensure that the air flow from the primary air compressor 100, under normal conditions, will not flow up the diversion pipe 440 into the silo 400A. The particulate valve 420 controls the rate of entry of particulate 300 into the pipes 200. Thus, particulate enters the pipes 200 at the point of the particulate valve 420, and is carried by the main pneumatic flow condition created by the air stream from the primary air compressor 100. The particulate 300 is carried through the pipes to the particulate receiving point 500.

In Figure 6, the temporary pneumatic conveying condition is illustrated with arrows. In the embodiment, when the main pneumatic conveying condition falls below the acceptable limit, the particulate valve 420 closes to prevent more particulate from entering the pipes 200. The compressor control valve 210 closes to prevent air or particulate flowing back into the compressor 100 which could clog the mechanism. The main control valve 220A and the secondary control valve 230A are both opened to allow the compressed air 110A from the pressurised silo 400A to pass through the diversion pipe 440 and enter the pipes 200. After the compressed air 110A from the silo 400A has been eventually depleted, the secondary control valve 230A is then closed, while the main control valve 220A is allowed to remain open.

Thus, the pressurised air 110A from the pressurised silo 400A functions as an air current source, thus fulfilling the role of a secondary pneumatic creator. Thus, as seen in Figure 6, when the primary compressor 100 ceases to sustain the main pneumatic conveying condition, the pressurised air 110A from the silo 400A flows through the pipes with sufficient intensity and for sufficient duration to move at least some of the particulate that remains in the pipes 200 at the time of cessation, and preferably to substantially remove any particulate that remains in the pipes 200 at the time of cessation.

In the case of either the further air current source 110 in Figures 3 and 4, or the pressurised air in the silo 400A which acts as a supply of pressurised air 110A, it is preferable that the pressurised air is created by a different air source other than the primary air compressor 100. This ensures that the air current source 110 or the air in the pressurised silo 400A, as the case may be, has sufficient pressure to move through the pipes 200 when the primary air compressor 100 ceases to sustain the main pneumatic condition. However, it is also still possible in some embodiments such as in Figure 7 for the further air current source 110 or the interior of the silo 400A to be in the form of pressurised air that originates from the primary air compressor 100 but this requires that the amount of air pressure remaining in the silo 400A, at the time of cessation of the primary air compressor 100, is at least sufficient to move at least some of the particulate that remains in the pipes 200 at the time of cessation, and preferably to substantially remove any particulate that remains in the pipes 200 at the time of cessation. There are numerous variations of how the primary air compressor 100 may be connected to the further air current source 110 or the pressurised silo 400A to create the necessary air pressure in each, but as seen in Figure 7 it is preferred that a valve mechanism 120 be provided on the connection between the primary air compressor 100 and silo 400A, so that at the time of cessation, the valve mechanism 120 prevents the compressed air 110A of the silo 400A from returning to the primary air compressor 100.

Figure 8 illustrates another embodiment which is a modification of the earlier embodiment of Figures 3 and 4. The embodiment in Figure 8 provides an automatic mechanism whereby the primary pneumatic creator, at least during the main pneumatic conveying condition, is able to maintain the re-pressurised air in the secondary pneumatic creator at least the level required to create the temporary pneumatic conveying condition. This ensures that the level of air pressure in the secondary pneumatic creator is maintained at a state of readiness. Specifically, the compressor 100 is connected to the further air current source 110 through the secondary control valve 230. The further air current source 110 is provided with a pressure sensor 600. In the case where the further air current source is in the form of air stored under pressure in a

container, the pressure sensor 600 monitors the level of pressurised air in the container. When the pressure sensor 600 detects that the pressurised air in the further air current source 110 has fallen to a level that would be insufficient to create the temporary pneumatic conveying condition, a signal from a control means in the form of a microprocessor circuit causes the secondary control valve 230 to be opened momentarily for sufficient time to enable air from the compressor 100 to increase the pressurised air in the further air current source 110 up to the required level. Then the secondary control valve 230 closes again. Under the main pneumatic conveying condition, all three of the compressor control valve 210, the main control valve 220 and the particulate valve 420 are opened, while the secondary control valve 230 is closed. However, when the automatic re-pressurisation mechanism is operating, the main control valve 220 and the particulate valve 420 are closed, and the secondary control valve 230 is opened. This enables air from the compressor 100 to re-pressurise the further air current source 110. When the pressure sensor 600 detects insufficient air pressure in the further air current source 110, the system may either immediately begin the above re-pressurising process regardless of whether or not there is particulate matter being conveyed through the pipes 200. Alternatively, the system is able to postpone the re-pressurising process until after the particulate has been conveyed through the pipes. An advantage of the latter alternative is that the re-direction of air from compressor 100 will not inadvertently cause particulate to remain in the pipes 200.

Similarly, Figure 9 illustrates a further embodiment which is a modification of the embodiment in Figures 5 and 6 in which the system is provided with an automatic re-pressurisation mechanism whereby the compressor 100 is able to re-pressurise the level of air pressure in the pressurised silo 400A. Similarly, another pressure sensor 600A is provided to monitor the level of air pressure in the pressurised silo 400A, and the compressor re-pressurises the silo 400A when required.

In other embodiments, such as in Figure 10, the secondary control valve 230B and the pressure sensor 600B are able to be provided on or in a transportable device 700 or at least attached to the main conveying system as external attachments. The control

valve 230B is contained in an enclosure of the transportable device 700. A first coupling 710 enables the control valve 230B to be attached to a secondary pneumatic creator, such as the further air current source 110 or the pressurised silo 400A or an external compressor, for example. The second coupling 720 enables the control valve 230B to be attached to a duct system such as the series of pipes 200, for example. Many forms of couplings may be used to achieve a suitable connection. The transportable device 700 enables an external secondary pneumatic creator to be attached to a new or existing system using the transportable device 700 as a connection. Such transportable controllable valves 230B may be used in place of the permanent control valves described in the earlier embodiments described above.

The main and secondary control valves 220, 230 are preferably in the form of pinch valves, which have a diaphragm design, since these are found to provide maintenance-free service.

A number of the above advantages of the embodiments are due to the presence of the secondary pneumatic creator which creates the temporary pneumatic condition. Hence, in the embodiments, the various structural components of the pneumatic conveying system, such as the shape of the pipes and ducts, may be modified to perform substantially the same function.

The silo 400, 400A, which is attached to the pneumatic conveying system, is not considered part of the system, since other embodiments of the pneumatic conveying system may be used to convey particulate directly from mobile bulk storage sources, such as trucks and ships, which are not permanently attached to the conveying system.

The construction materials and manner of construction of the silos, connections, pipes and valves are not critical to the invention in its broadest aspect, and these items may be constructed from conventional building materials and designed according to any appropriate known methods.

In the embodiments, the co-ordination of the various components is controlled by an electric control system (not shown in the diagrams) which includes a number of sensors (also not shown). The control system co-ordinates such events as the sensing of when the main pneumatic conditions drops below the acceptable limit, the sequence involved in the starting of the secondary pneumatic creator, and other such parameters. The control system also governs the opening and closing of the various valves. The invention is not limited to any particular form of electric control system and indeed the control functions may be governed by mechanical gauges.

Moreover, the degree and extent of the temporary pneumatic condition will, of course, depend on the size and design of the duct system and the type and weight of particulate matter being conveyed, to name a few parameters. Hence, the degree and extent of the temporary pneumatic condition may be varied to suit the prevailing conditions.

Embodiments of pneumatic conveying systems may be designed as an integrated system that incorporate a secondary pneumatic creator as part of the original design. Alternatively, other embodiments relate to a stand-alone secondary pneumatic creator that may be connected to an existing pneumatic conveying system.

Embodiments of the invention may also include multiple silos or storage containers, and multiple secondary pneumatic creators. More than one secondary pneumatic creator may be required for extremely lengthy duct systems. A series of secondary pneumatic creator may be used in combination to relay the remaining particulate matter out of the lengthy duct system. In some such embodiments, one secondary pneumatic creator may act for a certain period of time to move the particulate a certain distance, after which, a second secondary pneumatic creator may then be used to further convey the particulate, and so forth.

The primary pneumatic creator need not be in the form of an air compressor, and may for instance be in the form of fans or propellers. Furthermore, even though the

embodiments have been described in relation to pneumatic conveying system which use air flow conditions to convey the particulate matter, other embodiments may use vacuum conditions to convey the particulate in which the primary and secondary pneumatic creators would each be in the form of a vacuum generator.

In the embodiments, the opening and closing of the valves are controlled by controlling means in the form of a microprocessor circuit. However, mechanical forms of controlling means may be used to control the valves.

The invention is not limited to addressing the cessation of the main pneumatic conveying condition which is caused by any one reason, and it is likely that there may be a number of possible causes for the cessation.

The embodiments have been advanced by way of example only, and modifications are possible within the spirit and scope of the invention as defined by the appended claims.

CLAIMS:



1. A pneumatic conveying system including:
 - a duct system for pneumatically conveying particulate;
 - a primary pneumatic creator for creating a main pneumatic conveying condition in the duct system sufficient to convey the particulate through the duct system;
 - a secondary pneumatic creator adapted to create a temporary pneumatic conveying condition in the duct system when the primary pneumatic creator ceases to sustain the main pneumatic conveying condition,
 - the temporary pneumatic conveying condition being sufficient to move at least some of the particulate that remains in the duct system at the time of cessation.
2. A system according to claim 1 wherein the temporary pneumatic conveying condition is sufficient to substantially remove from the duct system any particulate that remains therein at the time of cessation.
3. A system according to either claim 1 or 2 wherein the primary and secondary pneumatic creators are each an air current source.
4. A system according to claim 3 wherein the air current source of the secondary pneumatic creator is in the form of pressurised air stored under pressure in a container.
5. A system according to claim 3 wherein the air current source of the secondary pneumatic creator is in the form of pressurised air from a particulate storage container that is connected to the duct system, the pneumatic conveying system being provided with a controllable diversion duct for diverting pressurised air from the particulate storage container to the duct system in order to create the temporary pneumatic conveying condition when the primary pneumatic creator ceases to sustain the main pneumatic conveying condition.



6. A system according to either claim 4 or 5 wherein the primary pneumatic creator at least during the main pneumatic conveying condition is able to maintain the pressurised air in the secondary pneumatic creator at least at a level required to create the temporary pneumatic conveying condition.
7. A system according to claim 6 wherein the primary pneumatic creator is connected to the secondary pneumatic creator through a controllable valve, and wherein the secondary pneumatic creator is provided with a pressure sensor adapted to monitor the pressurised air therein such that when the pressure sensor detects that the pressurised air in the secondary pneumatic creator has fallen to a level that would be insufficient to create the temporary pneumatic conveying condition, the controllable valve is opened by a controlling means to enable air from the primary pneumatic creator to increase the pressurised air in the secondary pneumatic creator.
8. A system according to claim 7 wherein the controlling means that opens and closes the controllable valve includes a microprocessor circuit.
9. A system according to claim 3 wherein the secondary pneumatic creator is in the form of a secondary air compressor which generates the air current.
10. A system according to any one of the preceding claims wherein the primary pneumatic creator is in the form of a primary air compressor.
11. A system according to either claim 1 or 2 wherein the primary and secondary pneumatic creators are each a vacuum generator and wherein the main and temporary pneumatic conveying conditions are vacuum conditions.
12. A system according to any one of the preceding claims wherein the system includes a plurality of secondary pneumatic creators arranged and adapted to act in relay to move the particulate in the duct system.



13. A method of pneumatically moving particulate through a duct system in which a primary pneumatic creator is ordinarily used for creating in the duct system a main pneumatic conveying condition that conveys particulate therethrough, the method involving the step of:

creating a temporary pneumatic conveying condition in the duct system when the primary pneumatic creator ceases to sustain the main pneumatic conveying condition,

the temporary pneumatic conveying condition being sufficient to move at least some of the particulate that remains in the duct system at the time of cessation.

14. A method according to claim 13 wherein the temporary pneumatic conveying condition is sufficient to substantially remove from the duct system any particulate that remains therein at the time of cessation.

15. A method according to either claim 13 or 14 wherein the primary and secondary pneumatic creators are each an air current source.

16. A secondary pneumatic creator adapted to be connected to a duct system of a pneumatic conveying system used for pneumatically conveying particulate in which system a primary pneumatic creator creates a main pneumatic conveying condition in the duct system sufficient to convey the particulate through the duct system;

the secondary pneumatic creator being adapted to create a temporary pneumatic conveying condition in the duct system when the primary pneumatic creator ceases to sustain the main pneumatic conveying condition,

the temporary pneumatic conveying condition being sufficient to move at least some of the particulate that remains in the duct system at the time of cessation.

17. A secondary pneumatic creator according to claim 16 wherein the temporary pneumatic conveying condition is sufficient to substantially remove from the duct system any particulate that remains therein at the time of cessation.



18. A secondary pneumatic creator according to either claim 16 or 17 wherein the primary and secondary pneumatic creators are each an air current source.
19. A secondary pneumatic creator according to any one of claims 16 to 18 wherein, at least during the main pneumatic conveying condition, the primary pneumatic creator is able to maintain the pressurised air in the secondary pneumatic creator at least at the level required to create the temporary pneumatic conveying condition.
20. A secondary pneumatic creator according to claim 19 wherein the secondary pneumatic creator is connectable to the primary pneumatic creator through a controllable valve, and wherein the secondary pneumatic creator is provided with a pressure sensor adapted to monitor the pressurised air therein such that when the pressure sensor detects that the pressurised air in the secondary pneumatic creator has fallen to a level that would be insufficient to create the temporary pneumatic conveying condition, the controllable valve is opened to enable air from the primary pneumatic creator to increase the pressurised air in the secondary pneumatic creator.