Abstract: A continuous conveyor system (1) for bulk material including a feed end (2) and a discharge end (3), and an endless conveyor belt adapted to convey material, the belt extending in out and return fashion between the feed (2) and discharge ends (3) and having a feed section to receive bulk material, a discharge section to remove bulk material. The endless belt is carried on articulated frames providing a flexibly adaptive conveying path allowing for movement of the feed or discharge end and maintaining a continuous conveying path.
Published:

— with international search report (Art. 21(3))
ARTICULATED CONVEYOR SYSTEM

FIELD OF THE INVENTION

The present invention relates to bulk solids material conveyor systems. Bulk solids materials include grain, ores, coal, minerals, and other bulk flowable and pulverulent solids materials.

BACKGROUND OF THE INVENTION

The present applicant is the owner of International PCT patent application number PCT/AU00/01358 published as WO 01/30363, the contents of which are incorporated herein by reference.

Conveyor systems for bulk materials typically have at least one feed end and at least one corresponding discharge end. A feed end for such bulk materials typically includes a fixed hopper for receiving the material onto the conveyor belt. The feed may come from a vehicle, storage silo, or other similar conveyor system. When a typical fixed bulk material conveyor system needs to change direction, for example, to go around a building, one conveyor will discharge into a receiving hopper of a second conveyor arranged at an angle e.g. 90° to the first. Thus it is common for known systems to have permanently fixed feed ends, which receive the material and convey it typically in a straight line to the next change point or a discharge point.

Similarly, a discharge end of a typical bulk material conveyor system will either be rigidly fixed, or will have some degree of linear movement, such as a predetermined arc of rotation, say 45° arc, or some restricted forward reach, for example through a luffing boom which allows the end of the conveyor to be raised from a fixed pivot point thereby adjusting the reach within certain restricted limits.

Examples of known discharge ends for such conveyor systems are feed conveyors for stockpiles of iron ore. These consist of a fixed inclined conveyor taking the material to a fixed height, which dictates the maximum height of the stockpile with the natural angle of repose of the material dictating the base spread of the resultant (cone) pile. For large stockpiles requiring substantial height, the inclined conveyors can be several hundred metres long. Such arrangements are an expensive investment in permanent infrastructure, and if needed to be moved
or increased in size, require either dismantling of the entire incline to increase the incline angle, or substantial additional work in relocating the stockpile and lengthening the present incline. Such works attract significant costs, and perhaps more importantly significant downtime of the conveyor system. Typically stockpiles are designed to provide a supply of the bulk material for a predetermined number of days or weeks, before the material is needed to be used for another purpose, or transported elsewhere. Downtime of the conveyor system can rapidly lead to running down or exhaustion of that stockpile. Consequently other arrangements need to be made to maintain the stockpile elsewhere, which requires spare land or buildings and additional transport or infrastructure to cope with the new stockpile. This adds significantly to the overall financial and time burden to the owner/operator.

Conveyor systems with a moveable discharge ends, such as a horizontally swinging boom or vertically luffing boom, are more adaptable than fixed systems. These can create a larger stockpile. The horizontally swinging type pivot within a fixed arc to produce a fan shaped stockpile. Vertically luffing types adapt to changing heights of the stockpile so that it is not necessary to convey material to a great height before discharge when the stockpile is low. Conveying material to unnecessary heights increases material transportation costs and adds wear and stress to the conveying system, which leads to more frequent repair and maintenance. In addition, where such systems are used for stockpiling spoil or waste solid materials, or for long term stockpiling, the amount of material of the stockpile is ultimately limited by the physical reach capacity of the system. Additional vehicles are typically then employed to move and adjust the stockpile to suit the amount of material and the shape of the site.

Similarly, the fixed feed end of a bulk material conveyor system is dependent upon vehicles or other conveyor systems supplying that feed end. Such feed ends have extremely limited or no capacity for adapting to the changing stockpile supply of material.

For example, a container ship would typically have a number of discrete holds for the bulk material. In either loading or unloading the ship, the respective feed or discharge end of the conveyor is typically either fixed or on an extending luffing boom to reach out to the holds of the ship. A suction hose may be
employed to unload the bulk material, particularly in the case of grain, but this is then connected to the conveyor system to discharge the material to the conveyor system.

In the case of discharging to spoil heaps or stockpiles, traditional unloading of conveyors cannot shape the pile other than at most forming a fan (discharging in an arc) or cone shape (discharging via an inclined conveyor). This does not enable maximisation of the available space for the heap or pile.

It would therefore be advantageous to have a conveyor system for bulk material that has adaptive positioning of at least one of its feed and discharge ends whilst continuously receiving or discharging the material.

**SUMMARY OF THE INVENTION**

With the aforementioned in mind, the present invention provides in one aspect a continuous conveyor system for bulk material including an endless belt, wherein the system provides a mobile adaptive path continuously connecting a respective moveable feed or discharge station of the system to the system, thereby allowing for movement of the feed or discharge station whilst maintaining a continuous path for flow of material.

An alternative form of the present invention provides a continuous conveyor system for bulk material including a feed end and a discharge end, and an endless conveyor belt adapted to convey material, the belt extending between the feed and discharge ends and having a feed end section, a discharge end section and an intermediate belt section therebetween, wherein at least one of the feed and discharge ends of the system is moveable, and the corresponding feed or discharge belt section provides a flexibly adaptive path continuously connecting the respective moveable feed or discharge end to the intermediate section allowing for movement of the feed or discharge end and maintaining a continuous path.

Thus, the present invention provides at least one advantage in being adaptable to permit an uninterrupted transport path for material despite a continuous or intermittent change of path for the conveyor due to operational travel of a feed or discharge station/end. In this way, the present invention can provide dynamic umbilical continuous conveying of material despite the conveying path becoming convoluted, curvilinear, multi-curved or linear.
The system may continue to transport material whilst the feed/discharge station or ends are/is moving. This maintains an uninterrupted flow of material despite repositioning of the flow path and station/end. However, it is envisaged that the flow may be stopped whilst the station or end is repositioned, which can help reduce stress and strain forces on the mobile section, thus helping to reduce maintenance issues.

Both ends of the conveyor belt may be of the dynamic umbilical type allowing for adaptive feed and discharge positions and paths for the material.

Thus, one or more forms of the present invention may permit feed or discharge machinery, such as a traveling reclaimer, traveling stacker or harvester, to follow a required pattern or path to receive or discharge material from/to desired positions. For example, a discharge end of the conveyor system may be driven or programmed to discharge material into a desired area or discharge pattern. This is particularly advantageous in constructing stepped (e.g., ziggurat type pyramids) of material whereby the feed or discharge machinery can move around on the top level adding/removing material in a desired pattern as necessary. Also, where the shape of land space dictates, material can be heaped into a shape to suit that space because the adaptive path of the umbilical belt can move to follow the machinery or end of the belt.

The system may include multiple conveyor belt support frames, the support frames connected together for relative movement with respect to each other. The support frames may each include support wheels, idlers or rollers allowing the conveyor belt to convey bulk material along a path defined, at least in part, by a linear extent of the connected support frames.

The support frames may be connected one to another by respective coupling means allowing relative pivot motion between the connected support frames. The coupling means can be releasable to allow separation of support frames from each other. Release may be by a removable or releasable pivot pin in each coupling. The respective coupling means may include at least one pivot device disposed on a central longitudinal axis of the connected support frames. The respective coupling means between each of two adjacent connected support frames includes multiple pivot devices disposed vertically with respect to one another. For example, two pivots may be provided one above the other along a
central axis of extent of the system. This centralisation of the connection between frames allows maximum articulation for an adaptable path, whilst the vertically disposed pivots provide vertical support to the connected adjacent frames.

The support frames may include at least one ground engaging means to support said frames on the ground surface. For example, a plurality of said support frames may each include at least two said ground engaging means with at least one of said ground engaging means disposed at either side of said frame parallel to a direction of direction of conveying the bulk material. Thus, providing ground engaging means, such as wheels, at either side or one or more of the support frames, preferably for each said support frames, allows longitudinal movement of the conveyor system as well as sideways movement through the combination of articulation between support frames and the ground engaging means. The said support frames may each include multiple said ground engaging means. The ground engaging means may include one or more of wheels, solid tracks or articulated tracks, or combinations thereof.

The conveyor system may be self propelled, such as by having its own means of ground propulsion, such as electric or hydraulic drive motors, battery power, or a combustion engine.

At least one contact buffer/bumper may be provided between at least two adjacent connected said support frames, preferably between all of the connected said support frames. The contact buffer/bumper may include at least one motion damped or rubber or polymeric bump stop. A position of the contact buffer/bumper on a support frame may be adjustable so as to extend forward or retract with respect to the support frame on which it is mounted and/or to adjust inboard or outwards of the support frame.

A continuous conveyor system according to any one of claims 12 to 22, further including drive means mounted to at least one of the support frames, the drive means arranged to drive the conveyor belt.

The system may include a drive means supported on a said support frame, the drive means including at least one electrically or hydraulically driven motor to power at least one drive pulley or wheel applying pressure to a portion of the conveyor belt between the drive pulley or wheel and an idler wheel or roller.
Preferably, each said support frame is fabricated as a discrete unit for articulation connection to another said support frame.

A method of utilising a continuous conveyor system for bulk material including an endless belt, the method including moving a mobile conveyor belt path continuously connecting a respective moveable feed or discharge station of the system to the system thereby allowing for movement of the feed or discharge station whilst maintaining a continuous path for flow of material.

A further aspect of the present invention provides a method of utilising a continuous conveyor system for bulk material including an endless belt, the method including moving a mobile conveyor belt path continuously connecting a respective moveable feed or discharge station of the system to the system thereby allowing for movement of the feed or discharge station whilst maintaining a continuous path for flow of material.

Another aspect of the present invention provides a method of utilising a continuous conveyor system for bulk material including a feed end and a discharge end, and an endless conveyor belt adapted to convey material, the belt extending between the feed and discharge ends and having a feed end section, a discharge end section and an intermediate belt section therebetween, the method including moving at least one of the feed and discharge ends of the system dependent on position of material to be fed to the conveyor system or discharged from the conveyor system, and adapting the feed or discharge belt section to a flexibly adaptive path continuously connecting the respective moveable feed or discharge end to the intermediate section allowing for movement of the feed or discharge end and maintaining a continuous path.

The method may include transporting material on the continuous conveyor whilst said feed/discharge station or ends are/is moving.

The feed or discharge machinery may be arranged to travel a required pattern or path and receives or discharges material from/to desired positions with the conveyor system fed from or feeding to the respective feed or discharge machinery.

The method may include articulating or segmenting sections permitting the belt to flex and travel around corners and/or inclines.

The present invention may incorporate a conveyor system according to one or more embodiments of the system described in PCT publication WO 01/30363 or any
application or patent deriving therefrom. To this end the contents of PCT publication
WO 01/30363 in their entirety are incorporated herein by reference and considered to
form part of the present application.

5 BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a typical prior art conveying system utilising an inclined linear stockpiling conveyor.

Figure 2 shows a conveyor system according to an embodiment of the present invention including flexibly adaptive feed and discharge sections.

Figure 3 shows a side view of an embodiment of the present invention with the system ascending/descending an incline of a stepped stockpile.

Figure 4 shows a plan view of an embodiment of the present invention with complex adaptable arcuate conveyor path and mobile end.

Figure 5 shows an embodiment of a system of the present invention in the form of a train of support frames for an endless conveyor belt, the train shown translating between positions A and B.

Figures 6a to 6c show an example of a mobile support frame for use in a system according to an embodiment of the present invention.

Figures 7a to 7c show an alternative mobile support frame according to an embodiment of the present invention with drive means mounted thereto to drive a conveyor belt.

DESCRIPTION OF PREFERRED EMBODIMENTS

At least one embodiment of the present invention will hereinafter be described with reference to accompanying drawings. It will be appreciated that the following description is not to be deemed limiting to the scope of the invention, rather serves to describe at least exemplary form of the present invention.

By way of background, Figure one depicts a typical arrangement for a working industrial plant 1, with a stockpile 2 of coarse ore material. The ore is to be processed in the plant. Supply of ore is delivered to the stockpile via a fixed inclined ramp conveyor 3.

The inclined conveyor 3 discharges the iron ore to form a cone stockpile 2. The size, and therefore the total amount of material, of the cone is dictated by the
maximum height of the discharge of the conveyor and the natural angle of repose of the material to be stockpiled. The fixed inclined conveyor cannot readily be moved to a new position to create of second or subsequent stockpile. Consequently, feed of material cannot be continuous if the stockpile is to be maintained within a maximum capacity. Also, removal of the material for use in the industrial plant dictates that the stockpile is only sufficient for a particular period, usually a few days or weeks at the maximum.

Should the conveyor system be stopped due to maintenance or damage, the maximum size of the stockpile dictates how long the plant can remain running without additional auxiliary stockpiling taking place.

Remedies for this problem have previously been to build larger and larger inclined conveyors to reach a higher maximum, thereby allowing a larger stockpile to be created, or building multiple inclines ramps for additional stockpiles. Such remedies require not only a significant capital input into the inclined ramp systems, but downtime in rebuilding or building such system has significant costs to the overall project. In addition, in order to properly maintain this type of stockpile, numeral vehicles are required to maintain the base shape of the cone within required boundaries and to remove or transfer material for processing within the plant. For example, material delivered to the stockpile by the inclined conveyor will need to be either transferred by a vehicle to another conveyor system or transferred by vehicle to a processing feed hopper to supply the plant.

Other known conveyor system utilise a boom of fixed length which can discharge material in a fan shape within a predetermined radial arc of the boom. Such systems improve over the fixed inclined conveyor to some extent, though are extremely limited in the positioning and amount of material that they can deliver. Luffing boom i.e., up and down in a fixed vertical arc type conveyors can assist in delivering material to stockpiles of variable height and some minimal reach variation, and thus can be useful for, in particular, loading ships. However, such luffing boom type systems are again very limited in the position and amount of material they can provide.

Figure 2 shows an embodiment of the adaptive conveyor system 1 of the present invention. The conveyor system 1 includes a feed end 2 including a
mobile bulk material reclaimer 3 connected to an intermediate section 4 by a flexibly adaptable conveyor section 5. Similarly, the discharge end 6 is mobile and is connected to the intermediate section 4 via a flexibly adaptable discharge end 7.

The conveyor system is shown discharging into alternate holds of a ship 8. It will be appreciated that the adaptive conveyor system can be reversed to supply bulk material from the ship to a stockpile 9. In the example shown, the discharge end 6 travels linearly transversely parallel to the dockside, with two alternative positions shown 10a and 10b. The flexibly adaptive section 7 allows the discharge end (or the respective feed end) to travel whilst maintaining a continuous feed path without interrupting flow of material. Should the feed or discharge end need to move forwards or backwards, left or right, up or down, the flexibly adaptive feed and discharge ends maintain the continuous feed regardless of the path of the conveyor belt. Thus, convoluted or complex paths are accommodated, which may be curvilinear, sinusoidal, designed to travel around buildings or vehicles as required by the mobile feed or discharge ends.

As a further example, the feed or discharge end can include mobile machinery, such as a travelling reclaimer, travelling crusher, in a form of a vehicle. Such vehicles can be directly connected to the conveyor system of the present invention and thus travel over large stockpiles, which therefore allows for stockpiling or removal of material from a stockpile, can be carried at different height levels by positioning the machinery on top of a part of the stockpile of material, as shown by the reclaimer on top of the first plateau 11 of the stockpile 9. In the embodiment shown, the reclaimer is taking material from a second step 12 of the stockpile.

Figure 3 shows a side view of an embodiment of the adaptive conveyor system according to the present invention, with the conveyor travelling on an incline and connected to machinery operating at the second plateau of the stepped stockpile.

Figure 4 shows an example of a plan view of the adaptive conveyor system according to an embodiment of the present invention, with the feed/discharge conveyor section able to travel in a radial arc and to extend forwards and backwards to take material from or supply material to the stockpile.
This adaptive conveyor system demonstrates an example of the convoluted path potential for the flexible conveyor. In this example, the feed end 20 is connected to a reclaimer 21 at the face of a stockpile of bulk material 22. The reclaimer is actually shown standing on a plateau 23 of stockpile material and working at the face of the next level with material 22. As is shown, the adaptively flexible and dynamic umbilical form of the conveyor allows the system to travel backwards and forwards, and traverse sideways left and right, within no directional or extent limitation other than the maximum reach of the system and the nature of the area and stockpile being worked. In this way, chosen patterns of material can be received or created. One area of the stockpile could be removed, and with the conveyor system subsequently reversed, a second or subsequent area could be filled.

It is envisaged that the conveyor system will permit transverse radial arcs of at least 180°, preferably up to 300° or arc, though in practice it is expected that 50° or arc to either side would be sufficient for most operations. The conveyor system also allows for operation on an incline or decline of up to 85 - 90° from horizontal, without significant decrease in transport of the material due to flow back or flow forward which can otherwise cause blockage. Whilst the conveyor system shown in Figure 4 is depicted with a left and right sinusoidal curve, it will be appreciated that the system allows for other curvilinear or convoluted paths, such as a combination of horizontal and vertical curvature, and forwards and backwards positioning. The directional arrows 24a - 24e are exemplary, and are therefore not taken to be limiting to the system. The position arrows 24a - 24e merely demonstrate suggested positional movement of the system. 24e in particular demonstrates the ability for forward or backward mobile movement of the end of the conveyor, and 24a-24d demonstrate the ability for multiple alternate arcuate paths.

Figure 5 depicts examples of an articulated conveyor support system 30 according an embodiment of the present invention. In particular, the articulated (or dynamic umbilical) system is shown in two positions. Firstly, position A shows the individual conveyor support frames 32a..n connected in series one to another to form a train of support frames. The support frames are mobile support frames. However, it is envisaged that one or more support frames at one or both ends of
the train may be temporarily fixed in situ and the rest of the train allowed to be mobile. This is particularly helpful where a feed or discharge end of the system needs to remain in a fixed position, such as an end receiving feed from a fixed long run endless conveyor. This train forms a generally V shaped configuration.

Position B shows the same train of support frames translated to a sinuous 'S' form, demonstrating flexibility in articulation of the connected support frames. As an example, support frame 32v is shown translating from one position to the other. It will be appreciated that the other support frames in the train are connected in series and will likewise translate to their new position maintaining their sequence in the train. Support frames 32aa and 32bb show where the common end of the train for either position A or B is transposed. The opposite end at support frame 32a, of course, has moved a significant distance to a new position.

Figures 6a to 6c show an example of a support frame 32 in top (figure 6a), end (figure 6b) and side (figure 6c) views. The support frame supports the loaded 34a,34b and return 34b,34a portions of an endless conveyor belt 34. Which portion is the loaded portion and which is the empty return portion depends on where the loading and unloading stations are and which direction the belt is travelling. It will be appreciated the endless belt may be driven in either direction to carry material to or from a location in either direction. The belt sections are suspended at either of the two side edges of each belt section from idlers 38, such as idler wheels or rollers. These idlers may be freely rotating when not loaded or may be driven/powered idlers for use applying a moving force to the belt to drive the belt. The support frame has a pair of ground engaging wheels 36a,36b at either side mounted to the frame via a suspension arrangement. Each support frame also has a pair of couplings 40 such as coupling means. The couplings 40 include a pair of vertically disposed pivot pins 42 in holders 44 arranged to receive in each holder a corresponding eye 46 from an opposite end of a next adjacent support frame. The pivot pins retaining the eyes in the respective holders. The vertical displacement of the pair of couplings 40 provides support in the vertical plane for the connected support frames and allows relative articulated movement between connected adjacent frames. Additional idlers are also supported on an auxiliary frame section 50 which allows the idlers to support
the conveyor belt when spanning the gap between adjacent support frames. Thus, the belt has continuity of support between frames. The auxiliary frame section is adjustable to allow for movement between the support frames and to compensate for the varying gap between adjacent support frames which can vary given on which direction left or right to the side the train articulates.

Each support frame can include one or more bump stops or articulation limiters 52. These can be arranged to move inwards and move outwards, and remain in position outwards when in use. Figures 6a to 6c show one of these bump stops 52a in its retracted position and one bump stop 52b.

In figures 7a to 7c, the belt has been removed to help show features of the frame. One side of the drive support frame 33 has drive means 54 mounted thereto. The drive means includes one or more electric motor, hydraulic motor or otherwise powered drives. The drive(s) provide power to drive rollers, tracks or wheels 56. These apply a driving force to the conveyor belt that is suspended from them and/ or from additional wheels, tracks or rollers.

Thus, in a train there will usually be drive support frames 33 and non-drive, hanger support frames 32.

The entire train may be self propelled, such as by battery or umbilical electrical supply powering electric drive motors, or with an onboard combustion engine powering hydraulic or electric motors.

The drive means 54 can be mounted to any support frame via mounting points provided. Thus, each frame can be used as a hanger frame or as a drive frame. This allows the system to be adapted to various specifications and needs. For example, if it is found that an additional drive means is needed on a corner or incline, the drive means 54 can be added. Alternatively, a support frame with drive means can be swapped in to replace a hanger frame simply by uncoupling the couplings 40 between adjacent support frames.

The ground engaging means 36, which may be wheels, tracks or rollers, can be mounted to suspension means which allows pivoting of the ground engaging means about an upright or vertical axis. This can be locked to prevent rotation or released to allow rotation, and may be powered or un-powered rotation, as required. Thus, steering can be provided for.
Preferred embodiments of the system include articulated or segmented sections permitting the belt to flex and travel around corners and/or inclines. In articulated forms, sections would be connected together in relative movable configurations, and in segmented forms the sections may remain unconnected.

It will be appreciated that combinations and variations of articulated and segmented forms are envisaged and encompass within the scope of the present invention.
CLAIMS:

1. A continuous conveyor system for bulk material, the system including an endless belt conveyor, wherein the system provides a mobile adaptive path continuously connecting a respective moveable feed or discharge station of the system to the system, thereby allowing for movement of the feed or discharge station whilst maintaining a continuous path for flow of material.

2. A continuous conveyor system for bulk material including a feed end and a discharge end, and an endless conveyor belt adapted to convey material, the belt extending between the feed and discharge ends and having a feed end section, a discharge end section and an intermediate belt section therebetween, wherein at least one of the feed and discharge ends of the system is moveable, and the corresponding feed or discharge belt section provides a flexibly adaptive path continuously connecting the respective moveable feed or discharge end to the intermediate section allowing for movement of the feed or discharge end and maintaining a continuous path.

3. A continuous conveyor system according to claim 1 or 2, arranged to transport material whilst the feed/discharge station or ends are/is moving.

4. A continuous conveyor system according to any one of the preceding claims, wherein both ends of the conveyor belt are articulated or umbilical types allowing for adaptive feed and discharge positions and paths for the material.

5. A continuous conveyor system according to any one of the preceding claims in combination with feed or discharge machinery, such as a travelling reclaimer, travelling stacker or harvester.

6. A continuous conveyor system according to claim 5, wherein the feed or discharge machinery is arranged to travel a required pattern or path to receive or discharge material from/to desired positions with the conveyor system fed from or feeding to the respective feed or discharge machinery.
7. A continuous conveyor system according to any one of the preceding claims, including articulated or segmented sections permitting the belt to flex and travel around corners and/or inclines.

8. A continuous conveyor system according to claim 7, wherein at least some of the articulated sections are connected together in relative movable configurations.

9. A continuous conveyor system according to claim 7, wherein at least some of the segmented sections remain unconnected to each other.

10. A continuous conveyor system according to any one of the preceding claims including a number of mobile support frames, the belt supported through idler rollers on the number of mobile support frames.

11. A continuous conveyor system according to claim 10, wherein one or more said mobile support frames includes drive means, such as one or more electric motors, arranged to drive the belt.

12. A continuous conveyor system according to any one of the preceding claims, including multiple conveyor belt support frames, the support frames connected together for relative movement with respect to each other.

13. A continuous conveyor system according to claim 12, wherein the support frames each include support wheels, idlers or rollers allowing the conveyor belt to convey bulk material along a path defined, at least in part, by a linear extent of the connected support frames.

14. A continuous conveyor system according to claim 12 or 13, wherein the support frames are connected one to another by respective coupling means allowing relative pivot motion between the connected support frames.
15. A continuous conveyor system according to claim 14, wherein the respective coupling means include at least one pivot device disposed on a central longitudinal axis of the connected support frames.

16. A continuous conveyor system according to claim 15, the respective coupling means between each of two adjacent connected support frames includes multiple pivot devices disposed vertically with respect to one another.

17. A continuous conveyor system according to claim 12, wherein the support frames include at least one ground engaging means to support said frames on the ground surface.

18. A continuous conveyor system according to claim 17, wherein a plurality of said support frames each includes at least two said ground engaging means with at least one of said ground engaging means disposed at either side of said frame parallel to a direction of direction of conveying the bulk material.

19. A continuous conveyor system according to claim 17 or 18, the said support frames each including multiple said ground engaging means.

20. A continuous conveyor system according to claim 17, 18 or 19, wherein the ground engaging means include(s) one or more of wheels, solid tracks or articulated tracks.

21. A continuous conveyor system according to any one of claims 12 to 20, further including at least one contact buffer between at least two adjacent connected said support frames.

22. A continuous conveyor system according to claim 21, wherein the contact buffer includes at least one motion damped or rubber or polymeric bump stop.

23. A continuous conveyor system according to any one of claims 12 to 22, further including drive means mounted to at least one of the support frames, the drive means arranged to drive the conveyor belt.
24. A continuous conveyor system according to claim 23, including said drive means supported on a said support frame, the drive means including at least one electrically or hydraulically driven motor to power at least one drive pulley or wheel applying pressure to a portion of the conveyor belt between the drive pulley or wheel and an idler wheel or roller.

25. A continuous conveyor system according to any one of claim 12 to 24, each said support frame provided as discrete unit for articulation connection to another said support frame.

26. A method of utilising a continuous conveyor system for bulk material including an endless belt, the method including moving a mobile conveyor belt path continuously connecting a respective moveable feed or discharge station of the system to the system thereby allowing for movement of the feed or discharge station whilst maintaining a continuous path for flow of material.

27. A method of utilising a continuous conveyor system for bulk material including a feed end and a discharge end, and an endless conveyor belt adapted to convey material, the belt extending between the feed and discharge ends and having a feed end section, a discharge end section and an intermediate belt section therebetween, the method including moving at least one of the feed and discharge ends of the system dependent on position of material to be fed to the conveyor system or discharged from the conveyor system, and adapting the feed or discharge belt section to a flexibly adaptive path continuously connecting the respective moveable feed or discharge end to the intermediate section allowing for movement of the feed or discharge end and maintaining a continuous path.

28. A method of utilising a continuous conveyor system for bulk material according to claim 26 or 27, including transporting material on the continuous conveyor whilst said feed/discharge station or ends are/is moving.

29. A method of utilising a continuous conveyor system for bulk material according to any one of claims 26 to 28, wherein the feed or discharge machinery travels a required pattern or path and receives or discharges material from/to desired
positions with the conveyor system fed from or feeding to the respective feed or discharge machinery.

30. A method of utilising a continuous conveyor system for bulk material according to any one of claims 26 to 29, including articulating or segmenting sections permitting the belt to flex and travel around corners and/or inclines.
INTERNATIONAL SEARCH REPORT

PCT/AU20 12/0003 11

A. CLASSIFICATION OF SUBJECT MATTER

InL Cl.

B65G 21/16 (2006.01) B65G 41/00 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP-DOC,WPI: IPC: B65G41/00/LOW, B65G21/00/LOW, B65G47/00/LOW, E21C 47/00/LOW, B65G15/00/LOW, B65G17/00/LOW, B65G19/00/LOW; keywords: convey+, ENDLESS+, MOBIL+, FEED+, PATH+ (with their similar keywords); Google Patent, Esp@cenet: endless, conveyor, flexible, modular (with their similar keywords); Best Documents were researched with COMBI.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<td>X</td>
<td>US 4256213 A (SHAW et al) 17 March 1981 (see abstract, figures 1-9, col 1 line 28 - col 3 line 5).</td>
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<tr>
<td>X</td>
<td>US 4951801 A (MRAZ) 28 August 1990 (see abstract, figures 1-5, col 1 line 12-63, col 2 line 48 - col 4 line 29, col 5 line 14-45, col 7 line 55 - col 8 line 9)</td>
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* Further documents are listed in the continuation of Box C

X See patent family annex

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This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX