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Conveyor belt cleaning apparatus

Abstract

A conveyor belt cleaning apparatus configured to be operably coupled to a conveyor belt and provide cleaning thereof. The present invention includes a housing having an upper portion and a lower portion. The upper portion of the housing includes walls defining the shape thereof and includes an interior volume with an upper and lower opening. A cleaning member support element is moveably disposed within the interior volume of the upper portion. A plurality of cleaning members extend upward from cleaning member support element and are finger like in arrangement. The lower portion of the housing includes a first segment and a second segment being adjacent each other. The first segment and second segment are cone-shaped and are operably coupled to a vacuum source. A movement member is operably coupled to the cleaning member support element and is configured to provide an upwards-downwards movement thereof.

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Background/Summary

FIELD OF THE INVENTION

(1) The present invention relates generally to conveyor belt maintenance, more specifically but not by way of limitation, a conveyor belt cleaning apparatus that is configured to be operably coupled to a conveyor belt and provide cleaning thereof wherein the present invention provides many advantages over the existing technology.

BACKGROUND

(2) Belt conveyors will accumulate dirt on the return strand, as the conveyed material is constantly being scraped by other parts of the installation and therefore enters the conveyor line. To prevent the accumulation of dirt or to reduce it to acceptable levels, conveyor belts must be cleaned after the discharge point. High-performing belt cleaners keep belts clean, eliminating carryback and make conveyor systems safer and more productive. Eliminating carryback reduces fugitive material and minimizes the cost of unnecessary cleanup and maintenance of the conveyor belt system. Scraping the conveyor belt clean at the head pulley will eliminate carryback and keep bulk materials moving in the right direction through transfer points or into containers. If the conveyor belt is not properly and routinely cleaned the material that is carried back under the belt often ends up inside the conveyor system and can damage rollers and idlers which can further causes the conveyor belt to wander and fray.

(3) Controlling fugitive material in the form of dust and spillage has been recognized as a key factor in maximizing conveyor efficiency and safety. One way that users of conveyor belts minimize fugitive material is by using belt cleaners to remove carryback before it can escape from the system. Most designs of conveyor belt cleaning technologies available today are blade-type

units using a scraper mounted on the head pulley to remove material from the belt's surface. These devices typically require a tensioner to hold the cleaning edge against the belt. Because the scraper directly contacts the belt, the scraper is subject to abrasive wear and must be regularly adjusted and periodically replaced to maintain effective cleaning performance. Additionally, conventional scrapers will often have a blade that is wider than the material load which can cause the center section of the blade to wear faster than the edges because there is more abrasive cargo in the middle. This results in an increase in carryback as the scraper shape has been comprised and doesn't execute the desired task over a sufficient period of time.

(4) Accordingly, there is a need for a conveyor belt cleaning apparatus that is configured to provide improved cleaning of a conveyor belt that employs elements such as but not limited to belt engagement members and dual cone lower portions so as to provide improved cleaning of conveyor belts.

SUMMARY OF THE INVENTION

(5) It is the object of the present invention to provide a conveyor belt cleaning apparatus operable to provide cleaning of a conveyor belt during operation thereof wherein the present invention includes a housing having an upper portion and a lower portion.

(6) Another object of the present invention is to provide an apparatus operably coupled to a conveyor belt so as to provide removal of material therefrom wherein upper portion of the housing is rectangular in shape having an interior volume and with an upper opening and a lower opening.

(7) A further object of the present invention is to provide a conveyor belt cleaning apparatus operable to provide cleaning of a conveyor belt during operation thereof wherein the upper portion includes a cleaning member support element moveably disposed therein.

(8) Still another object of the present invention is to provide an apparatus operably coupled to a conveyor belt so as to provide removal of material therefrom wherein the cleaning member support element includes a plurality of cleaning members operably coupled thereto extending upwards therefrom.

(9) An additional object of the present invention is to provide a conveyor belt cleaning apparatus operable to provide cleaning of a conveyor belt during operation wherein the present invention further includes a lifting member operably coupled to the cleaning member support element so as to provide vertical adjustment thereof.

(10) Yet a further object of the present invention is to provide an apparatus operably coupled to a conveyor belt so as to provide removal of material therefrom wherein the lower portion of the housing includes a first cone shaped segment and a second cone shaped segment.

(11) Another object of the present invention is to provide a conveyor belt cleaning apparatus operable to provide cleaning of a conveyor belt during operation wherein the first cone shaped segment and second cone shaped segment are comprised of outer walls having an angular orientation so as to inhibit buildup of material on the inner surface thereof.

(12) Still another object of the present invention is to provide an apparatus operably coupled to a conveyor belt so as to provide removal of material therefrom wherein the lower portion is operably coupled to a vacuum source.

(13) An additional object of the present invention is to provide a conveyor belt cleaning apparatus operable to provide cleaning of a conveyor belt during operation wherein the upper portion of the housing includes a drop gate member extending generally the width thereof wherein the drop gate member is configured to provide access to the interior volume of the upper portion.

(14) Yet a further object of the present invention is to provide an apparatus operably coupled to a conveyor belt so as to provide removal of material therefrom wherein the upper portion of the housing further includes an inspection window formed in one side thereof.

(15) Still an additional object of the present invention is to provide a conveyor belt cleaning apparatus operable to provide cleaning of a conveyor belt during operation wherein the present invention is positioned underneath a conveyor belt on the return side thereof.

(16) To the accomplishment of the above and related objects the present invention may be embodied in the form illustrated in the accompanying drawings. Attention is called to the fact that the drawings are illustrative only. Variations are contemplated as being a part of the present invention, limited only by the scope of the claims.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) A more complete understanding of the present invention may be had by reference to the following Detailed Description and appended claims when taken in conjunction with the accompanying Drawings wherein:

(2) FIG. 1 is a perspective view of a preferred embodiment of the present invention; and

(3) FIG. 2 is a top view of the present invention; and

(4) FIG. 3 is a first side view of the present invention; and

(5) FIG. 4 is a second side view of the present invention; and

(6) FIG. 5 is a first end view of the present invention; and

(7) FIG. 6 is a cross-sectional view of the present invention; and

(8) FIG. 7 is a detailed view of the upper portion of the housing of the present invention.

DETAILED DESCRIPTION

(9) Referring now to the drawings submitted herewith, wherein various elements depicted therein are not necessarily drawn to scale and wherein through the views and figures like elements are referenced with identical reference numerals, there is illustrated a conveyor belt cleaning apparatus **100** constructed according to the principles of the present invention.

(10) An embodiment of the present invention is discussed herein with reference to the figures submitted herewith. Those skilled in the art will understand that the detailed description herein with respect to these figures is for explanatory purposes and that it is contemplated within the scope of the present invention that alternative embodiments are plausible. By way of example but not by way of limitation, those having skill in the art in light of the present teachings of the present invention will recognize a plurality of alternate and suitable approaches dependent upon the needs of the particular application to implement the functionality of any given detail described herein, beyond that of the particular implementation choices in the embodiment described herein. Various modifications and embodiments are within the scope of the present invention.

(11) It is to be further understood that the present invention is not limited to the particular methodology, materials, uses and applications described herein, as these may vary. Furthermore, it is also to be understood that the terminology used herein is used for the purpose of describing particular embodiments only, and is not intended to limit the scope of the present invention. It must be noted that as used herein and in the claims, the singular forms “a”, “an” and “the” include the plural reference unless the context clearly dictates otherwise. Thus, for example, a reference to “an element” is a reference to one or more elements and includes equivalents thereof known to those skilled in the art. All conjunctions used are to be understood in the most inclusive sense possible. Thus, the word “or” should be understood as having the definition of a logical “or” rather than that of a logical “exclusive or” unless the context clearly necessitates otherwise. Structures described herein are to be understood also to refer to functional equivalents of such structures. Language that may be construed to express approximation should be so understood unless the context clearly dictates otherwise.

(12) References to “one embodiment”, “an embodiment”, “exemplary embodiments”, and the like may indicate that the embodiment(s) of the invention so described may include a particular feature, structure or characteristic, but not every embodiment necessarily includes the particular feature, structure or characteristic.

(13) Referring in particular to the Figures submitted as a part hereof, the conveyor belt cleaning apparatus **100** includes a housing **5** wherein the housing **5** includes an upper portion **10** and a lower portion **15**. The upper portion **10** and lower portion **15** are operably coupled utilizing suitable mechanical techniques. The housing **5** is manufactured from a durable rigid material such as but not limited to metal. The upper portion **10** in a preferred embodiment is rectangular in shape having four walls **11** wherein the walls **11** are operably coupled utilizing suitable techniques. The four walls **11** define an interior volume **12**. The upper portion **10** includes an upper opening **13** and a lower opening **14** wherein the upper opening is proximate the upper end **16** of the upper portion **10** and the lower opening **14** is proximate the lower end **17** of the upper portion **10**. Circumferentially present to the upper opening **13** is flange member **20**. Flange member **20** is positioned so as to be perpendicular to the upper edge of the upper portion **10** and extend outward therefrom. The flange member **20** is utilized to secure the conveyor belt cleaning apparatus **100** in a desired position underneath a conveyor belt. It should be understood within the scope of the present invention that the conveyor belt cleaning apparatus **100** could employ alternate elements in addition to or in conjunction with the flange member **20** to achieve the desired objective as discussed herein.

(14) The upper portion **10** has disposed in the interior volume **12** thereof a cleaning member support element **25**. The cleaning member support element **25** includes a first longitudinal support member **26** and a second longitudinal support member **27**. Operably coupled to opposing ends of the first longitudinal support member **26** and second longitudinal support member **27** are the lateral support members **28, 29**. The cleaning member support element **25** is rectangular in shape and further includes a cross support member **30** for structural support of the cleaning member support element. It should be understood within the scope of the present invention that the cleaning member support element **25** could include more than one cross support member **30** or be provided without a cross support member **30**. The cleaning member support element **25** as is further discussed herein is movable within the interior volume **12** in an upwards-downwards direction. The movement of the cleaning member support element **25** is operable to ensure the ability to place the plurality of cleaning members **35** in the desired position adjacent to and against the surface of a conveyor belt to which the conveyor belt cleaning apparatus **100** is operably coupled.

(15) The cleaning members **35** are secured to the first longitudinal support member **26** and second longitudinal support member **27** utilizing suitable techniques and extend upwards therefrom. The cleaning members **35** are manufactured from urethane or similar material and are arranged such that a plurality of the cleaning members **35** are adjacent each other along the first longitudinal support member **26** and second longitudinal support member **27**. The ends **36** of the cleaning members **35** are configured to engage a surface of a conveyor belt wherein each cleaning member **35** can independently flex and move depending upon the surface of the belt and any material thereon. Providing a plurality of independently moving cleaning members **35** provides improved cleaning of the conveyor belt and ensures a consistent engagement therewith across the width of the belt as opposed to a conventional scraper blade. Specifically, the independent cleaning members **35** have a longer dwell time on a conveyor belt as opposed to a conventional blade structure. It should be understood within the scope of the present invention that the cleaning members **35** could be configured to be either independently replaced or be replaced as a single set along either the first longitudinal support member **26** and second longitudinal support member **27**.

(16) The upper portion **10** includes an inspection window **40** formed in a wall **11** thereof. The inspection window **40** is formed in wall **11** utilizing suitable techniques and is rectangular in shape. A transparent covering **41** is mounted over the inspection window **40** so as to allow viewing into the interior volume **12** and further inhibit debris from egressing the inspection window **40**. It should be understood within the scope of the present invention that the inspection window **40** could be provided in alternate sizes and shapes. Additionally, the upper portion **10** could have more than one inspection window **40** located in alternate walls **11**. Located on the opposing side of the upper portion **10** from the inspection window **40** is a drop gate member **50**. The drop gate member **50** is

movably coupled to wall **11** and covers an aperture (not particularly illustrated herein) in the wall **11**. The drop gate member **50** is movable between a first position and second position wherein in the second position the drop gate member **50** is moved downwards so as to permit access to the aperture adjacent thereto. Movement of the drop gate member **50** to its second position is performed during cleaning or maintenance procedures of the belt to which the conveyor belt cleaning apparatus **100** is operably coupled. It should be contemplated within the scope of the present invention that the drop gate member **50** could be provided in alternate sizes and shapes in order to achieve the desired objective discussed herein.

(17) Secured to the exterior surface of the walls **11** on opposing ends of the upper portion **10** are lifting members **55**. Lifting members **55** include base plate **56** secured to the wall **11** wherein the base plate **56** has a support plate member **57** operably coupled thereto and being angular in orientation therewith. The support plate **57** is perpendicular to the base plate **56** and includes an aperture **58** formed therein distal to the base plate **56**. The lifting members **55** are provided so as to offer an element to engage during installation of the conveyor belt cleaning apparatus **100**. It should be understood within the scope of the present invention that the lifting members **55** could be provided in alternate shapes and sizes so as to achieve the desired objective discussed herein.

(18) The lower portion **15** of the conveyor belt cleaning apparatus **100** is operably coupled to the upper portion **10** utilizing suitable mechanical techniques. The lower portion **15** includes a first segment **60** and a second segment **70** wherein the first segment **60** and second segment **70** are identically constructed. The ensuing description of the first segment **60** should be understood as to apply to the second segment **70** as the first segment **60** and second segment **70** are identical. The lower portion **15** includes the first segment **60** and second segment **70** which are cone-shaped having a hollow interior volume and are operably coupled to a vacuum source (not illustrated herein). Having a first segment **60** and a second segment **70** allows the lower portion **15** to be manufactured at a lower height which is advantageous for certain applications wherein installation of the conveyor belt cleaning apparatus **100** can be difficult due to vertical clearance issues underneath a conveyor belt. Additionally, employment of the first segment **60** and second segment **70** facilitates the requirement of a lower cubic feet per minute for the vacuum source to effectively operate and remove material scraped from the conveyor belt by the cleaning members **35**. This allows a vacuum source to be utilized that is smaller and more energy efficient as well as provides flexibility in the proximity of the vacuum source to the conveyor belt cleaning apparatus **100** in order to provide effective operation.

(19) The first segment **60** includes walls **61** that are integrally formed utilizing suitable techniques. The walls **61** form a cone shape wherein the first segment **60** tapers in width from the upper end **62** to the lower end **63**. The tapered angle of the walls **61** ensures minimal buildup within the interior volume of the first segment **60**. In a preferred embodiment of the present invention the angles of the walls **61** are provided at an angle between thirty-five and seventy-five degrees. The angular orientation of the walls **61** promotes the movement of material cleaned from the conveyor belt to be transferred effectively out the end port **65** that is operably coupled to a vacuum hose (not illustrated herein). Formed in one of the walls **61** is clean-out port **77**. The clean-out port **77** provides access to the interior volume of the first segment **60** so as to perform desired cleaning and maintenance thereof. The clean-out port **77** has releasably secured therein a port cover **71**. Port cover **71** is manufactured from rubber and is configured to be press fit into the clean-out port **77**. A handle **72** is provided to facilitate removal of the port cover **71**. It is contemplated within the scope of the present invention that the first segment **60** and second segment **70** could have more than one clean-out port **77** and wherein the clean-out port **77** could be formed in alternate shapes and sizes.

(20) Referring to FIG. **6** submitted herewith, a cross-sectional view of the housing **5** is illustrated therein. The cleaning member support element **25** has operably coupled thereto vertical support members **80**, **81**. Vertical support members **80**, **81** are coupled to the cleaning member support element **25** utilizing suitable techniques and are manufactured from a rigid material such as but not

limited to metal. The vertical support members **80, 81** are movably mounted within channels **82, 83**. This mounting configuration inhibits any type of movement other than the upwards-downwards movement of the cleaning member support element **25**.

(21) Flexing, twisting and other movements that could occur during use of the conveyor belt cleaning apparatus **100** due to influence from a moving conveyor belt or vacuum is inhibited by the vertical support members **80, 81**. While not particularly illustrated herein, it should be understood within the scope of the present invention that the cleaning member support element **25** could have vertical support members **80, 81** operably present on the opposing end of the cleaning member support element **25** so as to have the vertical support members **80, 81** on both ends of the cleaning support member **25**. It should be further understood within the scope of the present invention that the vertical support members **80, 81** could be manufactured in alternate lengths and widths.

(22) The conveyor belt cleaning apparatus **100** further includes movement member **90**. Movement member **90** is operably mounted in cavity **91** formed in the lower portion **15**. The movement member **90** has a portion that extends into the interior volume **12** of the upper portion **10** and operably engages the cleaning member support element **25**. The movement member **90**, specifically the lower portion **93** thereof, is engaged utilizing an appropriate tool and rotatably moved. The rotational movement of the movement member **90** results in either the raising or lowering of the cleaning member support element **25**. This provides a desired positioning of the cleaning members **35** against the conveyor belt. While not particularly illustrated herein, it should be understood within the scope of the present invention that the movement member **90** is present on both opposing ends **3, 4** of the lower portion **15**. It is contemplated within the scope of the present invention that the movement member **90** could be constructed in alternate manners and achieve the desired objective of facilitating the upwards-downwards movement of the cleaning member support element **25**.

(23) While the lower portion **15** has been illustrated and discussed herein as having a first segment **60** and a second segment **70**, it is contemplated within the scope of the present invention that the lower portion **15** could have more than two segments formed and constructed as discussed herein for the first segment **60** and second segment **70** of the lower portion **15**.

(24) In the preceding detailed description, reference has been made to the accompanying drawings that form a part hereof, and in which are shown by way of illustration specific embodiments in which the invention may be practiced. These embodiments, and certain variants thereof, have been described in sufficient detail to enable those skilled in the art to practice the invention. It is to be understood that other suitable embodiments may be utilized and that logical changes may be made without departing from the spirit or scope of the invention. The description may omit certain information known to those skilled in the art. The preceding detailed description is, therefore, not intended to be limited to the specific forms set forth herein, but on the contrary, it is intended to cover such alternatives, modifications, and equivalents, as can be reasonably included within the spirit and scope of the appended claims.

Claims

1. A conveyor belt cleaning apparatus that is configured to provide cleaning of a conveyor belt during operation thereof wherein the conveyor belt cleaning apparatus comprises: a housing, said housing having an upper portion and a lower portion, said upper portion of said housing having a plurality of walls defining a shape thereof, said upper portion having an upper end and a lower end, said upper portion having a hollow interior volume, said upper portion having a first opening proximate said upper end and a second opening proximate said lower end, said lower portion being operably coupled to said upper portion proximate the lower end of said upper portion, said lower portion having at least two segments, said at least two segments having an identical shape, said at least two segments of said lower portion having hollow interior volume; a cleaning member

support element, said cleaning member support element being disposed within the interior volume of said upper portion, said cleaning member support element configured to move in an upwards-downwards direction within said interior volume of said upper portion, said cleaning member support element further comprising two vertical support members, said two vertical support members operably coupled to a bottom of the cleaning member support element and extending downward therefrom, said two vertical support members configured to inhibit twisting of said cleaning member support element; and a plurality of cleaning members, said plurality of cleaning members being coupled to said cleaning member support element, said plurality of cleaning members being perpendicular to said cleaning member support element and extending upward therefrom, said plurality of cleaning members being adjacent each other and independently movable.

2. The conveyor belt cleaning apparatus configured to provide cleaning of the conveyor belt as recited in claim 1, wherein said at least two segments of the lower portion of the housing are shaped wherein each of the at least two segments taper down in width from an upper end to a lower end thereof.

3. The conveyor belt cleaning apparatus configured to provide cleaning of the conveyor belt as recited in claim 2, and further including a movement assembly, said movement assembly being operably coupled to said cleaning member support element, said movement assembly having a portion thereof extending outward from said housing.

4. The conveyor belt cleaning apparatus configured to provide cleaning of the conveyor belt as recited in claim 3, wherein said upper portion further includes at least one inspection window, said at least one inspection window being formed in one of said plurality of walls of said upper portion of said housing.

5. The conveyor belt cleaning apparatus configured to provide cleaning of the conveyor belt as recited in claim 4, wherein said upper portion of said housing further includes a drop gate member, said drop gate member being movably coupled to one of said plurality of walls of said upper portion, said drop gate member being movable between a first position and a second position, wherein in said second position said drop gate member providing access to said interior volume of said upper portion.

6. The conveyor belt cleaning apparatus configured to provide cleaning of the conveyor belt as recited in claim 5, and further including lifting members, said lifting members being mounted on opposing ends of said upper portion, said lifting members configured to provide an element for assisting in movement of the housing.

7. The conveyor belt cleaning apparatus configured to provide cleaning of the conveyor belt as recited in claim 6, wherein said at least one inspection window further includes a cover member, said cover member mounted over said at least one inspection member, said cover member being transparent.

8. The conveyor belt cleaning apparatus configured to provide cleaning of the conveyor belt as recited in claim 7, wherein said lower portion of said housing further includes at least one clean-out port, said clean-out port having an opening operable to provide access to the interior volume of said lower portion.

9. A conveyor belt cleaning apparatus that is configured to provide cleaning of a conveyor belt during operation thereof wherein the conveyor belt cleaning apparatus comprises: a housing, said housing having an upper portion and a lower portion, said upper portion of said housing having four walls being rectangular in shape, said upper portion having a first end and a second end, said upper portion having an upper end and a lower end, said upper portion having a hollow interior volume, said upper portion having a first opening proximate said upper end and a second opening proximate said lower end, said upper portion having a flange member circumferentially present said first opening, said lower portion being operably coupled to said upper portion proximate the lower end of said upper portion, said lower portion having a first segment and a second segment,

said first segment and said second segment being laterally adjacent, said first segment having a hollow interior volume, said second segment having a hollow interior volume, said first segment being comprised of a plurality of walls, said plurality of walls being angular in form and structured to create a width that is greater proximate an upper end of the first segment than a width proximate a lower end of the first segment, said second segment being comprised of a plurality of walls, said plurality of walls being angular in form and structured to create a width that is greater proximate an upper end of the second segment than a width proximate a lower end of the second segment, wherein the angular orientation of the plurality of walls of said first segment and said second segment inhibits material from accumulating within the interior volume of said first segment and said second segment; a cleaning member support element, said cleaning member support element being disposed within the interior volume of said upper portion, said cleaning member support element configured to move in an upwards-downwards direction within said interior volume of said upper portion, said cleaning member support element having a first longitudinal support member and a second longitudinal support member, said cleaning member support element further having a first lateral support member and a second lateral support member being operably coupled between said first longitudinal support member and said second longitudinal support member at opposing ends thereof forming a rectangular shape for the cleaning member support element, the cleaning member support element further comprising two vertical support elements, said two vertical support elements being coupled to a bottom of the cleaning member support element and extending downward therefrom, said two vertical support elements movably mounted within a channel formed in one of said four walls of said upper portion of said housing; and a plurality of cleaning members, said plurality of cleaning members being coupled to said cleaning member support element, said plurality of cleaning members being perpendicular to said cleaning member support element and extending upward therefrom, said plurality of cleaning members being adjacent each other and independently movable.

10. The conveyor belt cleaning apparatus configured to provide cleaning of the conveyor belt as recited in claim 9, wherein said upper portion of said housing further includes a drop gate member, said drop gate member being movably coupled to one of said plurality of walls of said upper portion, said drop gate member being movable between a first position and a second position, wherein in said second position said drop gate member providing access to said interior volume of said upper portion.

11. The conveyor belt cleaning apparatus configured to provide cleaning of the conveyor belt as recited in claim 10, wherein plurality of cleaning members are independently movable and are manufactured from urethane.

12. The conveyor belt cleaning apparatus configured to provide cleaning of the conveyor belt as recited in claim 11, wherein said upper portion further includes at least one inspection window, said at least one inspection window being formed in one of said plurality of walls of said upper portion of said housing.

13. The conveyor belt cleaning apparatus configured to provide cleaning of the conveyor belt as recited in claim 12, and further including a movement assembly, said movement assembly being operably coupled to said cleaning member support element, said movement assembly having a portion thereof extending outward from said housing, said movement assembly configured to be engaged to facilitate the upwards-downwards movement of the cleaning member support element.

14. The conveyor belt cleaning apparatus configured to provide cleaning of the conveyor belt as recited in claim 13, wherein the angles of the walls of the first segment and second segment of the lower portion are between thirty-five and seventy-five degrees.
