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ERRATA

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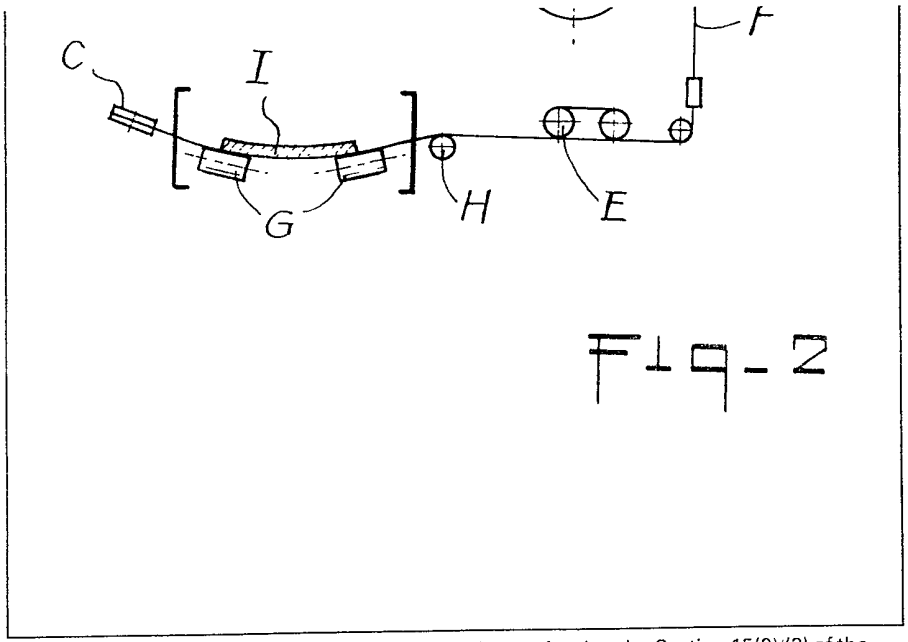

FIG-2

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The references to Figure 3 of the drawings in the printed specification are to be treated as omitted under Section 15(2)(3) of the Patents Act 1977.

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(54) **Method and apparatus for cleaning conveyor belts by means of a vibrating cable or group of cables**

(57) A conveyor belt I is cleaned by means of a transverse cable which is supported independently of the belt by support C, H at a level higher than the belt in its rest position whereby the lateral edges of the belt are raised. This arrangement causes the cable to vibrate in the longitudinal direction of the belt to effect cleaning. A plurality of parallel cable runs may be used, which can be achieved by the same cable passing several times across the belt between suitable supports e.g. pulleys.

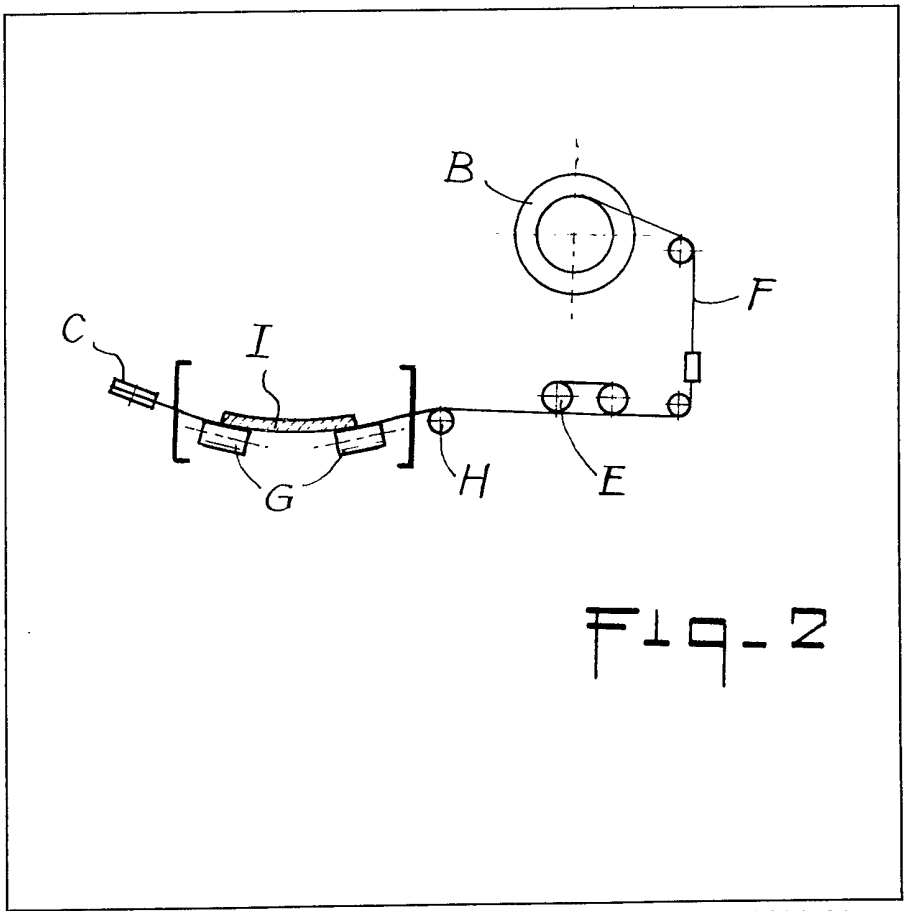

Fig-2

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The references to Figure 3 of the drawings in the printed specification are to be treated as omitted under Section 15(2)/(3) of the Patents Act 1977.

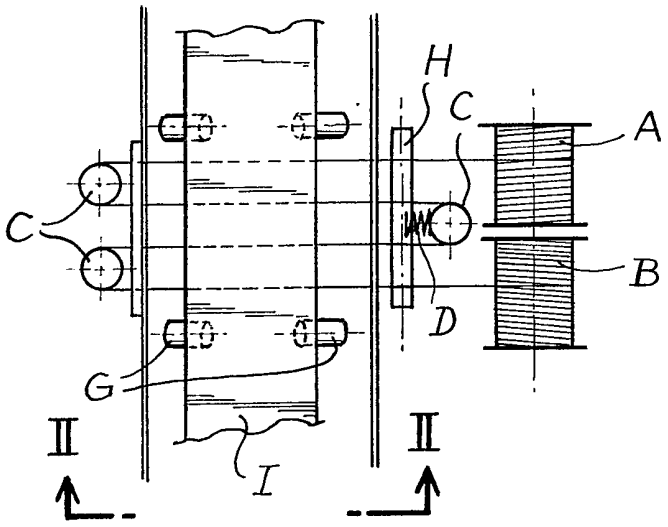

Fig. 1

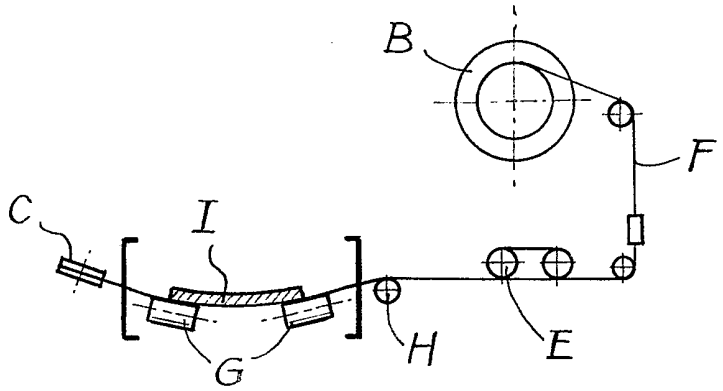

Fig. 2

SPECIFICATION

Method and apparatus for cleaning conveyor belts by means of a vibrating cable or group of cables

The present invention relates to a cleaning device for removing the deposits of products which remain on the conveyor belt.

As is known, poor cleaning leads to deterioration of the conveyor belt.

In the state of the art, systems with scrapers, brushes and the like have been proposed, which are relatively ineffective, wear and damage the belt, must frequently be replaced and rapidly lose their effectiveness.

The cleaning of conveyor belts by means of a wire, piano string or cable has also been known for a very long time. In the majority of these devices, this wire or cable is located on the periphery of the main drum. The wire is either immobile or driven with a receiprocating movement, transversely relative to the belt.

However, these processes prove to be relatively unsatisfactory. In fact, if the pressure exerted by the wire against the belt is low, the cleaning effectiveness is virtually zero, and if the pressure exerted is high, the wire wears very rapidly and frequent interventions for its adjustment or replacement are necessary.

The troublesome particles to be removed are subjected to four main forces, namely their weight, their inertia, their actual adhesion to the belt and their adhesion to one another. Placed in contact with the belt, a cable at rest or driven with a movement along its axis only makes it possible to overcome the inertia forces and, partially, the forces of adhesion to the belt. In fact, the particles encountering the obstacle created by the cable stick to the latter and finally pass between the belt and the cable. By causing the cable to vibrate, an attempt has thus been made to free the cable of the agglomerates, which thus become dislodged.

In the state of the art, the vibrations can be caused in a number of ways using various emitter sources, namely an electromagnet, an unbalanced motor or the like.

It would be desirable to increase cleaning effectiveness with a special vibratory movement of the cable or wire (and to reduce the need for interventions, which are always a significant cause of accidents) by producing an improved device.

It has been discovered that, surprisingly, it is possible to make use of the resistance offered by the conveyor belt. In fact, it has been discovered that raising the edges of the belt transversely creates, on the cable which passes underneath it, a longitudinal variation, that is to say a variation along the cable, in the frictional force. The effect of this force, the minimum amplitude of which lies essentially along the axis of the belt, is to cause the cable to vibrate in the plane of advance of the belt. The explanation of this is complex, in the same way as for any vibratory phenomenom. The determining component seems to be the longitudinal variations in the frictional forces on the cable, due to the actual curvature of the belt (increase in the internal tension on the edges of the belt). These forces together cause complex elastic deformations of the cable, causing its periodic "detachment" and its vibration.

Thus according to a first aspect of the invention there is provided a method of cleaning conveyor belts by means of a run of cable arranged transversely, relative to the direction of travel of the belt, between two support points independent of the belt and in contact with the underside of the slack belt, the method comprising raising of the lateral edges of the slack belt by means of the arrangement of each support point for the cable being slightly above the plane defined by the slack belt in the rest position, that is to say when the belt is not subjected to any stress from the cable, whereby the tension of the cable, which thus exerts a pressure at every point over the whole width of the belt, the pressure passing through a minimum value at the level of the longitudinal axis of symmetry of the belt, so as to cause the cable to vibrate effectively, each point on the cable thus being driven with an oscillatory movement in the direction of travel of the belt, whilst at the same time remaining in close contact with that part of the said belt which corresponds thereto.

A second aspect of the invention provides apparatus for cleaning a conveyor belt having lateral edges and a longitudinal axis, the apparatus comprising at least two support points independent of the belt and at least one run of cable arranged transversely, relative to the direction of travel of the belt, between the support points and in contact with the underside of the slack belt, the arrangement being such that in use the lateral edges of the slack belt are raised by means of each support point for the cable being slightly above the plane defined by the slack belt in the rest position, that is to say when the belt is not subjected to any stress from the cable, and the tension of the cable, which thus exerts a pressure at every point over the whole width of the belt, the pressure passing through a minimum value at the level of the longitudinal axis of the said belt, so as to cause the cable to vibrate effectively, each point on the cable thus being driven with an oscillatory movement in the direction of travel of the belt, whilst at the same time remaining in close contact with that part of the belt which corresponds thereto.

According to the invention, a high pressure is thus exerted upwards on the slack side of the belt with the aid of a transverse cable located under the slack side. This pressure is not exerted in a constant manner over the whole width of the belt, but on the contrary, with the aid of a system which causes the lateral edges of the belt to be raised by the cables. The central part of the belt must be virtually unaffected.

Advantageously, a system of this type consists of device for supporting the cable, which are placed on each side and slightly above the plane of the slack side, in the rest position. When the cable is stretched between these supporting devices, the slack side is deformed as indicated above.

It has been discovered that this results not in a permanent deformation of the cable in the direction of travel of the slack side, but, on the contrary, in a

forwards-and-backwards oscillatory movement of the cable, relative to the direction of travel of the belt, the cable remaining essentially in contact with the slack side and thus ensuring very effective cleaning.

It has also been found that, contrary to the expectations of those skilled in the art, a high pressure exerted by the cable on the belt does not always cause high wear on the cable and/or the belt. On the contrary, and suprisingly, the device according to the invention reduces the wear on the cable and the belt, despite the very high pressure which it uses.

Pulleys for guiding the cable were used, in particular, as the supporting device. By arranging a system of idler pulleys for the cable, in a known manner, it is possible to use a group of parallel portions of the cable, and this of course increases the effectiveness.

It is thus possible to clean rubberised belts (textile, plastics or metal core). These belts must not possess roughness, and this excludes herring-bone belts and connections made by fasteners.

All the ordinary cables or wires, or netting, are suitable; the constituent material and the diameter affect the rate of wear and hence the period for which an exchangeable reel can be left unattended.

The best results have been obtained with a steel cable of diameter 6 to 8 mm, with a base wire of 7/10 mm.

The raising of the edges of the belt and the tension of the cable are the essential components in the adjustment of the device. This tension must enable the edges to be raised to the chosen extent. The order of magnitude is 1,000 N (100 kgf) for belt widths of less than 1,000 mm and 2 to 3,000 N for greater widths.

Raising of the edges of the belt by 1 to 2% of its width generally gives the best results. 10% appears to be a maximum.

It has not been possible to define a limiting speed of travel; in fact, at the usual speeds of travel, which are of the order of 0.2 - 1 m/second, and usually up to 1.5 - 3 m/second, the device according to the invention is effective.

With four doubled-back sections of one and the same cable, stretched between pulleys on either side of the belt, it has been possible to achieve a degree of removal of the residual materials of more than 95%, regardless of the customary product conveyed, under the above conditions. That product may be any pulverized material in a more or less agglomerated state, such as sand, coke, coal, soil, ashes, clays and especially cementitious products.

It is possible to renew the portion or portions of active cable by simply winding the cable between a feed reel and a take-up reel; the renewal advantageously represents about 1% of the running rate of the installation; the wear is thus minimal and the maintenance is virtually zero.

The invention will be further described by way of example with reference to the accompanying drawings, in which:-

Figure 1 schematically shows a top view of the preferred device;

Figure 2 schematically shows the device of Figure 1 in section along II-II; and

Figure 3 is a further view of the preferred device.

The illustrated device consists of 2 reels, one (A) being a feed reel which carries the new cable, and the other (B) being the take-up reel which stores the worn cable which has been rendered unusable.

Between the two reels, a conventional set of idler pulleys (C) makes it possible to increase the number of sections in service under the slack side of the conveyor belt (I) and thus to obtain the desired degree of cleaning effectiveness. A damper, which is placed on the path of the cable and which can consist of a spring (D) or any other system, permits the controlled slackening of the cable in the event of a significant impact or the passage of a foreign body, thus ensuring a degree of safety in use, and protection of the conveyor belt.

The group of sections formed in this way is then positioned and stretched so as to ensure a certain raising of the edges of the belt until the desired degree of vibration is obtained, as indicated above.

This raising is effected by simply adjusting the height of the apparatus, if appropriate with the aid of one or more support rollers (H). For more rigid belts, raising rollers (G) can be positioned.

The cable is renewed by driving the reel (B). The period for which the device can be left unattended depends only on the length of the cable stored on the reel (A), which can be as much as several hundred metres. The maintenance operations, which are always dangerous, can thus be dispensed with for more than a year.

The cable is wound onto the reel (B) by means of a geared motor or other system (for example a ratchet wheel), which acts, on the one hand on a capstan (E), which is provided with an adjustable braking system ensuring a constant tension and a constant speed of unwinding of the cable and, on the other hand, on the reel (B) via a torque-limiting device, which makes it possible to compensate the variations in linear speed of the cable on the reel. The cable is guided, during winding, by means of a movable arm (F).

An adjustable clock and the timer unit controlled by the running of the conveyor belt makes it possible to trigger the renewal cycle of the cable as a function of its wear. This cycle can be continuous.

The cycle can also be triggered by any system which measures the actual wear on the cable.

Figure 3 corresponds to the preferred embodiment containing four cable sections.

With 400 m of cable, it has been possible to achieve at least 2,000 hours of operation without any manual intervention.

CLAIMS

1. A method of cleaning conveyor belts by means of a run of cable arranged transversely, relative to the direction of travel of the belt, between two support points independent of the belt and in contact with the underside of the slack belt, the method comprising raising of the lateral edges of the slack belt by means of the arrangement of each support point for the cable being slightly above the plane defined by the slack belt in the rest position,

that is to say when the belt is not subjected to any stress from the cable, whereby the tension of the cable, which thus exerts a pressure at every point over the whole width of the belt, the pressure passing through a minimum value at the level of the longitudinal axis of symmetry of the belt, so as to cause the cable to vibrate effectively, each point on the cable thus being driven with an oscillatory movement in the direction of travel of the belt, whilst at the same time remaining in close contact with that part of the said belt which corresponds thereto.

2. A method according to claim 1, wherein several such runs of cable are used, these cables being arranged approximately parallel to one another in the direction of travel of the belt.

3. A method according to claim 2, wherein the runs of cables are formed by a single cable which, by means of suitable support points, is doubled back several times, transversely relative to the belt, each support point being located slightly above the plane defined by the slack belt in the rest position, that is to say when it is not subjected to any stress from the cables.

4. A method according to claim 3, wherein the support points consist of idler pulleys, some of which can be mounted elastically.

5. A method according to any one of claims 1 to 4, wherein the cable is fed transversely, relative to the belt from a feed reel and towards a take-up reel.

6. A method according to any one of claims 1 to 4, wherein part of the raising of the belt edges by the cable is by means of lateral bearing rollers.

7. Apparatus for cleaning a conveyor belt having lateral edges and a longitudinal axis, the apparatus comprising at least two support points independent of the belt and at least one run of cable arranged transversely, relative to the direction of travel of the belt, between the support points and in contact with the underside of the slack belt, the arrangement being such that in use the lateral edges of the slack belt are raised by means of each support point for the cable being slightly above the plane defined by the slack belt in the rest position, that is to say when the belt is not subjected to any stress from the cable, and the tension of the cable, which thus exerts a pressure at every point over the whole width of the belt, the pressure passing through a minimum value at the level of the longitudinal axis of the said belt, so as to cause the cable to vibrate effectively, each point on the cable thus being driven with an oscillatory movement in the direction of travel of the belt, whilst at the same time remaining in close contact with that part of the belt which corresponds thereto.

8. An apparatus according to claim 7, wherein several such runs of cable are used, these cables being arranged approximately parallel to one another in the direction of travel of the belt.

9. An apparatus according to claim 8, wherein the runs of cable are formed by a single cable which, by means of suitable disposition of said support points, is doubled back and forth several times, transversely relative to the belt, each support point being located slightly above the plane defined by the slack belt in the rest position, that is to say when it is not subjected to any stress from the cables.

10. An apparatus according to claim 9, wherein the support points consist of idler pulleys, some of which can be mounted elastically.

11. An apparatus according to any one of claims 7 to 10 and comprising a feed reel and a take-up reel, being arranged to travel transversely, relative to the belt from the feed reel to the take-up reel.

12. Apparatus according to any one of claims 7 to 10 and comprising lateral bearing rollers, part of the raising of the belt edges by the cable being by means of said lateral bearing rollers.

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