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CASSETTE FOR COLLECTING LONG SECTIONS OF CONVEYOR BELTS AND ITS POSSIBILITIES OF WINDING

Abstract: In the nineties of 20th century there were plenty of applications of long distance belt conveyors. This tendency has been noticed in many designing centres all over the world [2]. The article presents the project of long distance conveyor in which the belt is vulcanized of few but very long (of kilometre length) sections instead of many (several dozen) short sections. A small amount of sections results in a small amount of connections and has influence on the price and resistance of motion of the belt [1,7].

1. Extended belt sections for long-distance conveyers

Each plant producing belts for conveyors has possibility to manufacture multi-kilometers belt sections. The only problem is with its collecting and transporting. of the most famous 10 kilometer long conveyors called BHP Gregory/Crinum runs in Australian coal mine, it was vulcanized using 18 belts, each about 1120 meters long. Belt was delivered in a special cassettes (fig. 1) [5]. After analyzing those figure we can assume, that diameter of one pulley on which there were winded half of whole belt is about 4 meters. Two pulleys mounted together on one cage makes rectangle in a plane section with length of 9 m and height 4,5 m. The height of such cargo placed on weight wagon or even car will be much bigger than vehicle gauge or building limitations, resulting in deterioration of transport.

2. Operation mode of cassette oriented to collect long distance belt

The idea of operation of such cassette is described in fig. 2 and 3. Each cassette consists of 5 maxi or 3 mini pulleys designed for this special purpose, each one is individually driven. Larger cassette is placed on the axis next to the vulcanizing press, then first section of vulcanized belt (10-12 m long) is being manually hauled through stationary reels in following direction 5-4-3-2-1. For the smaller reel application, belt section (5-6 m long) is being manually hauled in direction 3-2-1. Finally end of the belt is attached to reel with number 1 [6].

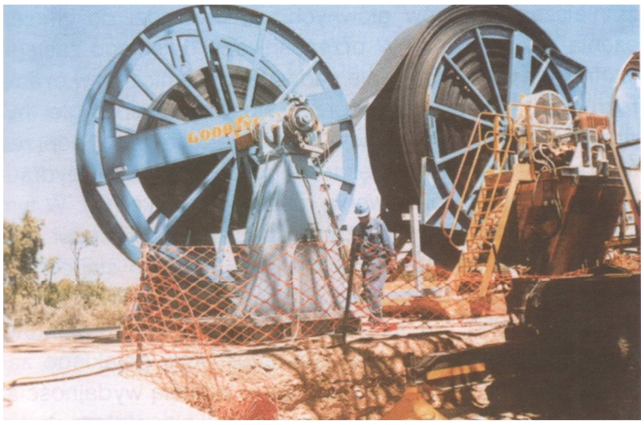

Fig. 1. 1120 meters belt section in as special cassette (Bulk Solids Handling).

3. Mini cassettes way of operation (fig. 2)

Mini cassettes enables to accumulate long belt sections, which can be used to assemble middle and long distance conveyors, especially for coal mine application. It's assumed that on the specified max. pulley diameter there can be reeled belt with a length of x, related to its thickness [4].

The operation mode can be specify in three phases :

- Phase 1- newly vulcanized belt is reeled on pulley number 1 with length of 1,5x , the two others pulleys are fixed
- Phase 2 – 2x long belt is reeled on pulley no 2, with assumption that half of its length is unreeled from pulley no 1 and other half is from newly vulcanized section. Pulley no 3 is fixed.
- Phase 3 – 0,5x long belt is reeled on pulley no 1 from pulley no 2, the other section with similar length is reeled on pulley no 3. Simultaneously, newly vulcanized belt with a length 0,5x is being reeled on pulley no 3.

Above presented functionality effects that belt with length L=3x has been reeled on pulleys.

Unreeling of belts should be made in inverse direction : starting on phase 3 and ending on phase 1, the pulleys should also work in opposite direction.

4. Maxi cassettes way of operation (fig. 3)

Conveyors with a longest range should be made with long belt sections, this is main reason why maxi cassette are applicable. It's assumed that on the specified max. pulley diameter there can be reeled belt with a length of x, related to its thickness [4].

- Phase 1 – newly vulcanized belt with length 2x is reeled on pulley no 1, the others pulleys are fixed. This type of cassette requires pulley no 1 with a diameter greater than the rest of pulleys (comparison fig. 4b).
- Phase 2 – 4x long belt is reeled on pulley no 2, with assumption that half of its length is unreeled from pulley no 1 and other half is from newly vulcanized section . Pulley no 3, 4 and 5 are fixed
- Phase 3 –1x long belt is reeled on pulley no 1 from pulley no 2, the other section with similar length is reeled on pulley no 4. Simultaneously, newly vulcanized belt with a length 1x is being reeled on pulley no 4. Pulley no 3 and 5 are fixed.

- Phase 4 – 0,5x long belt is unreeled from pulley no 2 and then reeled on pulley no 1, the other section with similar length is reeled on pulley no 3. Simultaneously, belt with length 0,5x is unreeled from pulley no 4 and reeled on pulley no 3 and the other section with similar length is reeled on pulley no 5. At the same tim newly vulcanized belt with a length of 0,5x is reeled on pulley no 5.

Above presented functionality effects that belt with length L=5,5x has been reeled on pulleys. Unreeling of belts should be made in inverse direction : starting on phase 4 and ending on phase 1, the pulleys should also work in opposite direction.

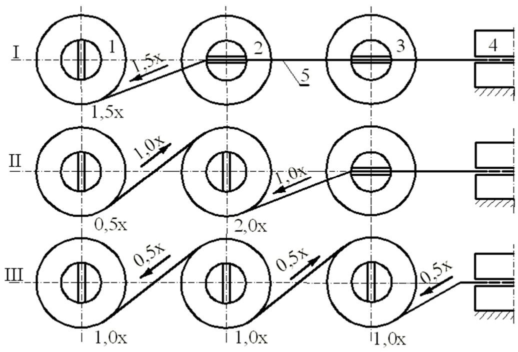

Fig. 2. The idea of operation of the 3-pulley cassette: 1-3 – pulleys for belt reeling, 4 - vulcanizing press, 5 – belt, I-III – consecutive cassette operation phases, x – length of the belt section reeled on the specified pulley diameter

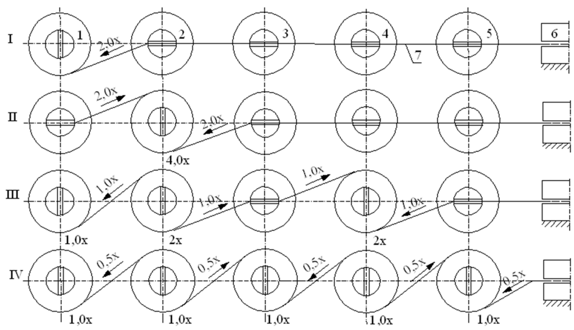

Fig. 3. The idea of operation of the 5-pulley cassette :1-5 – pulleys for belt reeling, 4 - vulcanizing press, 5 – belt, I-IV – consecutive cassette operation phases, x – length of the belt section reeled on the specified pulley diameter

5. General remarks concerning cassette designing and transporting

The operation of reeling and unreeling of belts results that following parameter of pulley varies : rotational speed and direction of rotation, exceptionally pulleys have speed of rotation equal to 0. Those functionality could be provided using microcontroller, which consist of sensor to measure changes in diameter of pulley belt layer and controllers to collect signals from sensors. The whole system should be driven by asynchronous motor controlled using frequency converter and specially designed controller program.

Supporting structure for the maxi cassette could be made of space truss with a dimension closed to train containers. Such solution will guarantee feasible reloading of cargo using container crane, truck-mounted crane of reachstacker type or TTREX Demag type.

Depending on cassette size it can be transported by flat wagon, pocket wagon or articulated road train (fig. 4b).

For mini cassette, supporting structure should be adequately smaller spacer truss. However its reloading and transportation will be similar to maxi one. Important notice is that transport of cassette must be possible using mine's pit-shaft (fig. 4a). Such possibility will allow to assembly mine conveyor using one segment of belt.

Total load limit for above mentioned wagon is 900 kN, which is the same as maximum allowable load for railway line of class C4 with max. velocity of 100 km/h. Maximal load of large-size cassette is 180 kN [3].

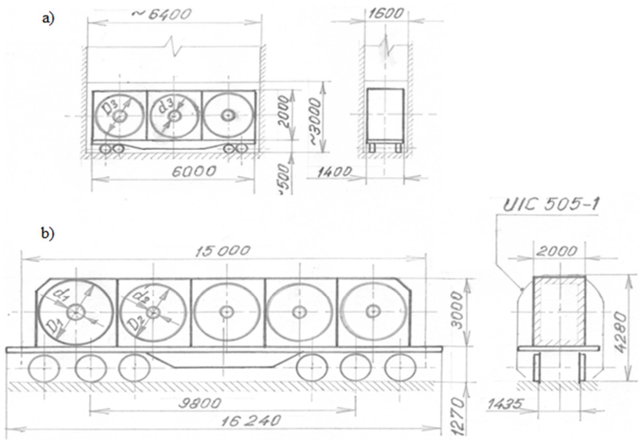

Fig. 4. Possibilities of cassettes transport : transporting of 3-pulleys large-size cassettes using mine pit-shaft b) 5-pulleys cassette transport by Samos 622Za flat wagon

6. Summary

The production of belts conveyor using long sections will allow to reduce amount of joints on the conveyor route. Consequently, it will bring economical and utilization benefits to both its users and to belt producers.

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