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(54) Title: DRY MATERIAL TRANSPORTING DEVICE

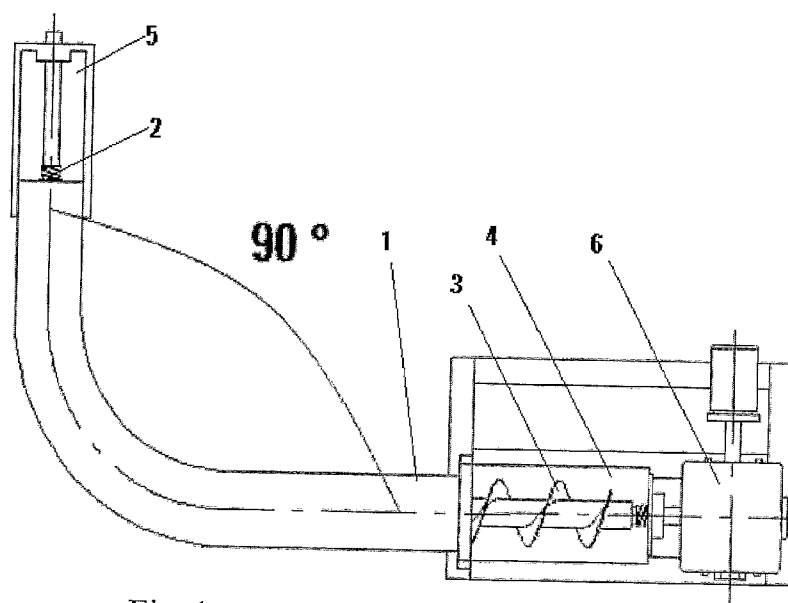


Fig. 1

(57) Abstract: This invention relates to the transportation of solid materials, more specifically, bulk and fiber materials, and can be used in oil and mining industries, agriculture and other fields of engineering where fine solid materials are transported through pipe sleeves.

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Dry Material Transporting Device

This invention relates to the transportation of solid materials, more specifically, bulk and fiber materials, and can be used in oil and mining industries, agriculture and other fields of engineering where fine solid materials are transported through pipe sleeves.

Problem of exact and uninterrupted transport of dry additives, such as fibers, granules, sand, powder, plastic stripes, cement, metallic pellets, derived timber materials, cellulose and lignocelluloses-containing products, cotton, rag material used in oil field services is an important issue.

There are many devices that are used for dry material transport, with different schemes and principals of work such as screw transport, conveyer belts, spring and pneumatics transport.

Typically screw conveyor device is used for transport of dry additives, such as fibers, granules, powder, plastic stripes, cement, metallic pellets, derived timber materials, cellulose and lignocelluloses-containing products, cotton, rag material and mixture of thereof.

During transport of cohesive materials through by screws, the screw plugging can easily occur. This phenomenon happens because a friction force between material and feeder housing becomes higher than a maximum force that can be developed by screws pushing material in axial direction.

Exact material dosing is an important issue in screw transporting. It is often necessary to convey finely divided particulates such as fine chemicals, powders and pharmaceuticals through tubular conduits for the purpose of mixing or dosing them to another system.

The utilization of conventional mechanical screw feeders often disadvantageously results in heating of the particulates due to the compaction forces exerted thereupon by the rigid screw. This heating often results in unwanted degradation of the physical and/or chemical properties of the particulate material. In addition, conventional rigid screw feeders may also result in unwanted agglomeration or lumping of the particulates as well as a reduction of the particle sizes of the particulates.

Patent (WO/0121368) describes a device and method for disaggregating derived timber products. The invention relates to a device for disaggregating pieces of derived timber products from cellulose and/or lignocelluloses-containing products, especially particle boards, medium-density fiber boards and the like, with a transport device and at least one disaggregating container. The inventive device is also characterized in that the disaggregating container and the transport device are configured as at least one common densifier screw with a housing- mounted outer shell and a driven shaft located therein.

The shaft is provided with helices of a pre-defined pitch. The pieces of derived timber products are transported in the axial direction of the densifier screw from a feed opening in the outer shell towards an outlet opening on the front side thereof in the axial direction (direction of transport). A feed opening for vapor is provided in the outer shell between the inlet opening and the outlet opening.

In case of high friction materials transport screw can be easily jammed and plug the mechanism.

Known is (US Patent 67224894) a device for transferring bulk material from a storage facility to a transport vehicle includes a pair of pivotally interconnected upper and lower screw conveyors. The upper screw conveyor is pivotally connected at its receiving end on a vertical axis

to the storage facility and is pivotally connected at its discharge end on a vertical axis to the receiving end of a lower screw conveyor. The conveyors each have an auger driven by an electric motor and electric motors are provided to pivot the upper screw conveyor relative to the storage facility and to pivot the lower screw conveyor relative to the upper screw conveyor. A hand held controller may be used for remote control of the electric motors.

Known is (US Patent 7036658) a conveyor including a plurality of links, each link having a length extending across the direction of transport and a width extending along the direction of transport. Each link may have at least one gripping member having two positions. The gripping member when in the first position is disposed below the conveying surface of the link, and the gripping member when in the second position is disposed above the conveying surface of the link for contacting one of the objects to hold the object during transport. Various designs of gripping members and related elements are disclosed, including spring loaded, cam driven, rack and pinion, and overhead designs. Various elements of the disclosed designs may be combined in various ways to form numerous link and conveyor options.

Also known is (US Patent 7055676) a conveyor with links and gripping members further having arms for gripping the transported objects. The gripping arm is located so as to be able to contact one of the objects when the gripping member is in the second position to hold the object relative to the link body during transport. Various options for link designs are disclosed, including slidable and/or pivotable designs.

(WO Application 9912786) discloses a system for moving work pieces in carriage assemblies along a flexible track.

An option of a flexible conveyor is disclosed in (JP Application 2005239426). This flexible conveyor hourglass-shaped rollers that are orthogonal to a conveying direction. The rollers are situated behind each other. Transported objects are placed between the rollers. The angle between the planes in which the elements are oriented may be 180° or more.

To prevent plugging phenomenon of powder and grain which easily stick, form bridge or the like, screw conveyor (JP Application 2000233817) is provided with a hollow and helical conveyance screw inside a transport pipe for powder and grain, a helical clogging preventive screw is arranged inward of the conveyance screw in an eccentric state with respect to the conveyance screw, and the powder and grain is conveyed, while being agitated by the clogging preventive screw.

A disadvantage of said helical conveyance screw is its unsuitability for the transportation of fibrous materials.

The technical task solved by the implementation of this technical solution is providing a wide application conveyor.

The technical result achieved by the implementation of this technical solution is increasing the time of uninterrupted operation of conveyors for the transportation of fibrous and granulated materials.

To achieve said technical result it is suggested to use a transporting device comprising a flexible steel channel, a flexible steel-cord rubber cable with coil flat spring, a bunker, a discharge channel and an engine preferably electric one with smoothly adjustable rotation speed.

The design suggested herein is based on flexible screw conveyor principle. Main difference is that screw consists of flexible steel-cord rubber cable, with coil flat spiral attached to cable. Screw axis is flexible

hanging on face (discharge) and end fittings to allow both ends to move in transverse direction. Flexible screw conveyer can be used for uninterrupted and regular transport of fibers, granular, sand, crushed rocks, powder, plastic, cement, metal particles, sawdust, timber products, cotton, rag material.

The general appearance of the device is shown in Fig. 1. The device consists of a flexible steel channel 1 with built in flexible steel-cord rubber cable 2 and a coil flat spring 3 attached to cable. The transporting channel is between the feeding bunker 4 and the discharge zone 5.

The device operates as follows. Material from bunker 4 is fed to the spiral 3 of the flexible cable and then transported through the transporting channel 1 to the discharge zone 5 (discharge channel). The flexible screw is driven by the electric engine 6. Rotation speed can be smoothly adjusted.

The flexible transporting channel 1 is used to restrict the path in which the transported material moves. Flexible steel channel 1 can have round cross-section. Channel diameter can vary from 50 to 200 mm depending on material feeding rate and transporting speed. Flexible steel channel can be 1-10 meters long, depending on device geometry. Flexible steel channel 1 can have cone shape, which means that its diameter can vary through channel length. Maximum bending radius can be 90° .

Steel channel 1 can be produced from: metal, rubber, plastic, composite materials.

According to the invention flexible steel-cord cable 2 with flat spiral 3 attached to it has round cross-section. The flexible cable with steel cord acts as the axis of the flexible screw. Steel-cord cable 2 diameter can vary from 10 mm to 150 mm depending on specification requirements, transporting rate and feeding rate. Flexible steel-cord cable can be produced from polyurethane, rubber, plastic, spring steel, and etc. Flexible

steel-cord cable 2 can have cone shape constricting and broadening from beginning to the end or vice versa. Flexible steel-cord cable can be attached on the discharge end of the transport channel with the help of special clamps. It is also possible not to use clamps for transporting fibrous materials such as fibers, cotton and rag materials. Without clamp flexible screw has a loose end and can rotate inside the channel in all directions, this can eliminate plugging problem.

Screw flat spiral is made for raking transporting material from feeding bunker and further transport through transporting channel. According to this invention width of coil spiral can vary from 5 to 180 mm. In this case full diameter of flexible screw (flexible steel-cord cable plus coil flat spiral attached to this cable) can vary 30-150 mm. Increasing of spring diameter leads to increasing device feeding rate. Spring step can be 5-100 coils on one running meter. Distance between coils can vary from 10 mm to 200 mm. It is also possible to use spring with constant and variable diameter depending on required feeding rate and transport channel geometry. Spiral can be produced from metal, plastic, rubber and composite materials. Material depends on specification requirements.

Feeding bunker 4 that can perform material loading without plugging. Bunker shape can be square, rectangular, cylindrical and V-shaped depending on specification requirements. Steel channel spiral can go inside feeding bunker to rake material and further transporting. Feeding bunker can be produced from plastic, polymer and composite materials depending on specification requirements.

Maximum bending radius of steel channel 1 is 90° in all directions of air space , as it shown on Fig. 2.

Steel-cord cable can be fixed with a special clamp, as it shown on Fig. 3, or with out clamp that allows to eliminates material plugging on the discharge channel, as it shown on Fig. 4.

According to the invention system can transport: bulk materials, fibers, granular, sand, crushed rocks, powder, plastic, cement, metal particles, sawdust, timber products, cotton, rag material and other materials used in oilfield business. System can be also used for other business such as food industry, fragrance industry, construction industry, agricultural industry, timber industry, mine industry etc.

What is claimed is a

1. Device for transporting dry materials comprising a transporting channel located between the feeding bunker and the discharge zone, transported material driving device attached to the engine wherein said transporting channel is flexible, said transported material driving device is a flexible rubber cable with a steel cord and flat spiral and said engine allows smooth rotation speed adjustment.
2. Transporting device according to Claim 1 wherein said engine is electric.
3. Transporting device according to Claim 1 wherein said flexible cable is flexible hanging on face and end fittings to allow both ends to move in transverse direction.
4. Transporting device according to Claim 1 wherein said transporting channel diameter is 50 to 200 mm.
5. Transporting device according to Claim 1 wherein said transporting channel has cone or cylindrical shape.
6. Transporting device according to Claim 1 wherein said transporting channel can be bent at 90°.
7. Transporting device according to Claim 1 wherein said flexible screw has cylindrical or cone lengthwise section.
8. Transporting device according to Claim 1 wherein said flexible steel cord cable diameter is 10 to 150 mm.
9. Transporting device according to Claim 1 wherein said coil spiral width is 5 to 180 mm.
10. Transporting device according to Claim 1 wherein the distance between said coils can vary from 10 to 200 mm.

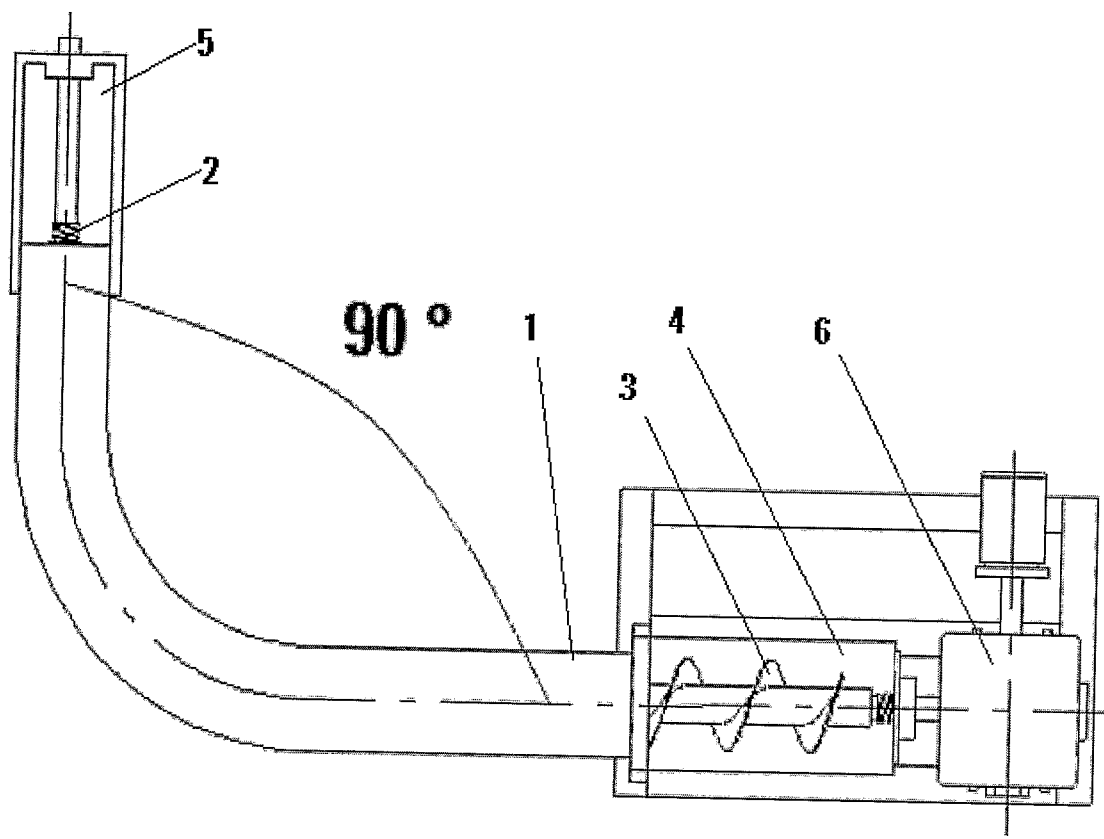


Fig. 1

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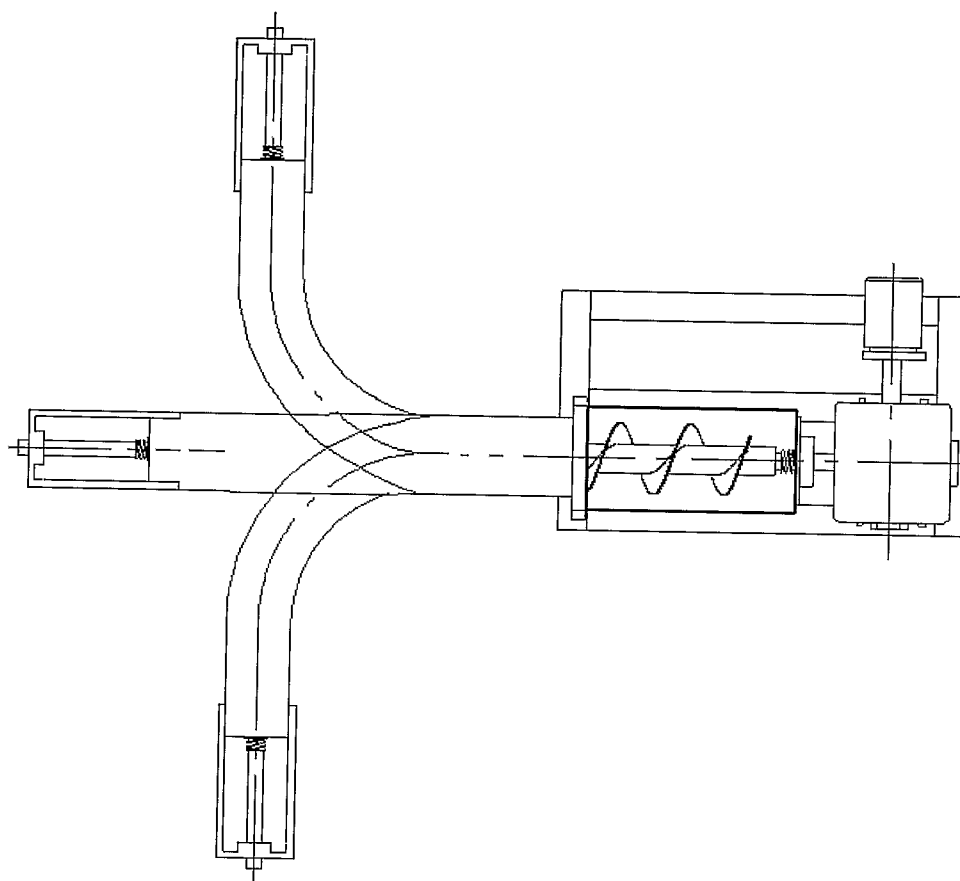


Fig.2

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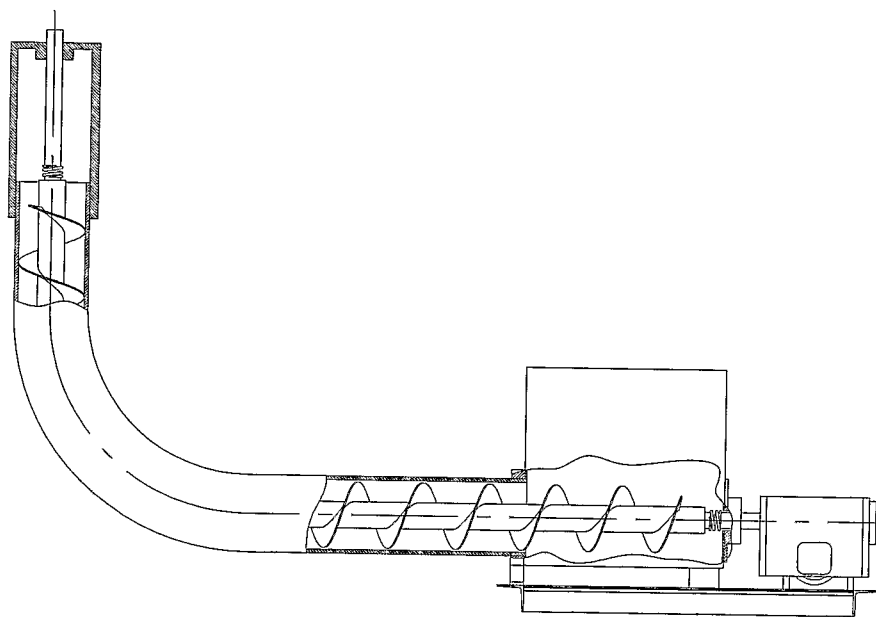


Fig.3

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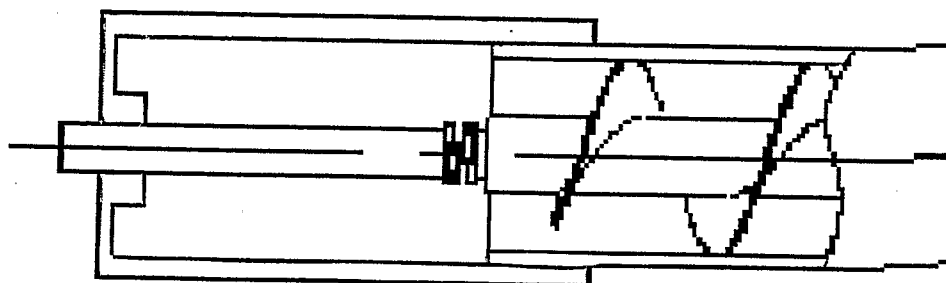


Fig.4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/RU 2007/000281

A. CLASSIFICATION OF SUBJECT MATTER		B65G 33/16 (2006.01) B65G 33/00 (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) B65G 33/00, 33/04, 33/06, 33/08, 33/12, 33/14, 33/16, 33/18, 33/22, 33/24, 33/26, 65/00, 65/02, 65/22, 65/28, 65/30, 65/34, 65/40, 65/46, 65/48, 67/00, 67/02, 67/24		
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) PAJ, Esp@cenet, DWPI, PCT Online, USPTO DB, CIPO (Canada PO), SIPO DB		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB 1248493 A (ERICH AUGUST HINDERMAN) 06.10.1971, p. 2, col. 1, lines 33-58, fig. 1	1-10
Y	US 3709357 A (KENARD D. BROWN) 09.01.1973, p. 7, col. 3, lines 56-61, col. 4, lines 9-16, fig. 3, 5	1-10
Y	JP 58188224 A (TOKYO SHIBAURA ELECTRIC CO) 02.11.1983, abstract	1-10
Y	US 2542476 A (FRED L. CARLOS) 20.02.1951, p. 1, col. 1, lines 29-44, fig. 2	5, 7
A	US 5351806 A (MITSUBISHI CABLE INDUSTRIES, LTD.) 04.10.1994, fig. 1	1-10
A	Mashiny nepreryvnogo transporta, R.L. Zenkov et al., Moscow, Mashinostroenie, 1980, p. 195-198, fig. 58(a)	1-10
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
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Name and mailing address of the ISA/RU FIPS Russia, 123995, Moscow, G-59, GSP-5, Berezhkovskaya nab., 30-1 Facsimile No. 243-3337		Authorized officer K. Grigorev Telephone No. (495) 730-7675