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R. F. LO PRESTI
EXTENSIBLE CONVEYORS

2,858,935

Original Filed May 3, 1956

2 Sheets-Sheet 1

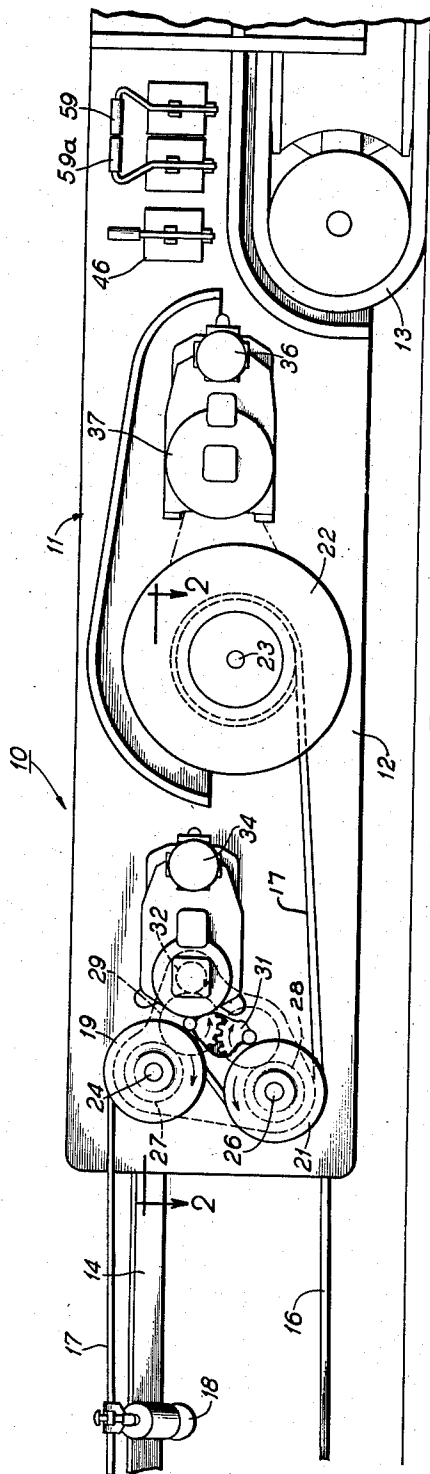


Fig. 1

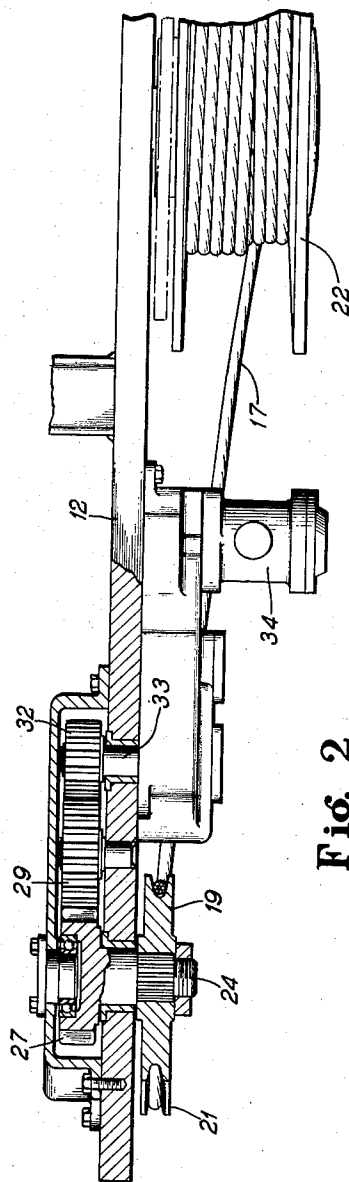


Fig. 2

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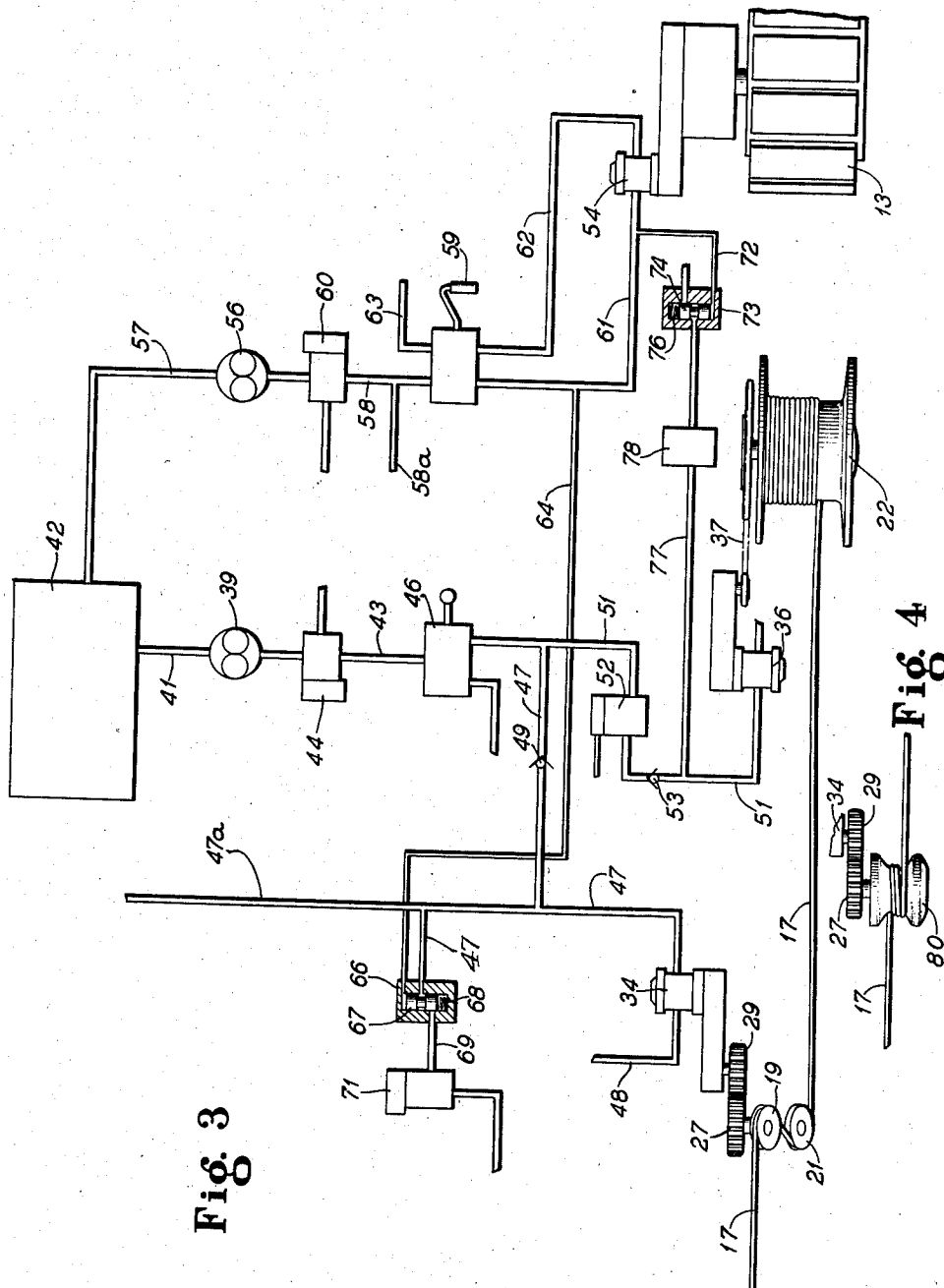


Fig. 3

Fig. 4

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EXTENSIBLE CONVEYORS

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Continuation of abandoned application Serial No. 582,564, May 3, 1956. This application January 15, 1958, Serial No. 709,437

11 Claims. (Cl. 198—139)

This invention relates to extensible conveyors of the kind where the conveying reach is supported upon laterally spaced flexible strands, and more particularly to improvements in apparatus for maintaining a desired amount of tension in the support strands both while the conveyor is stationary and while the length thereof is changing.

In extensible conveyors of the type as disclosed in Craggs et al. Patent No. 2,773,257, issued December 4, 1956, for Rope Frame Conveyor and Troughing Roller Assembly Therefor, the conveying reach is supported upon a pair of laterally spaced support strands, one end of each strand being anchored either to a fixed abutment or upon a head section, the other end of the strand being wrapped about a storage reel disposed on a movable tail section. As a general thing, the storage reel is driven by an hydraulic motor having a uniform torque output, and the tension in the strand wound thereon accordingly varies as the amount of storage on the reel changes in accordance with the length of the conveyor.

The support strands are supported at intervals throughout their length upon spaced standards, the strand being generally anchored in some fashion to the support standard. When a change in tension occurs in the support strand, the strand is accordingly deformed, and such deformation is additive between support standards to cause them to shift longitudinally. Such displacement of the standards often causes tipping, and may at times cause improper training of the conveying reach supported by the strands.

With the foregoing considerations in mind it is a principal object of the invention to maintain a uniform tension upon the support strands.

A further object is to maintain the proper tension upon the support strand anchored to a movable end section of the extensible conveyor, and to wind or reeve the strand about a power driven snubbing roller, a suitable tension being maintained on the slack end of the strand to keep the tension on the taut side of the strand at a uniform value, the slack end of the strand being supported or wound upon a storage reel.

A further object is to provide a snubbing drive for the support strand, and to vary both the tension for the slack end of the strand and the tension imposed by the snubbing drive when the end section is in stationary position or moving in a direction to shorten the conveyor, and when the head section is being trammed in a direction to increase the length of the conveyor.

Other objects and important features of the invention will be apparent from a study of the specification following taken with the drawings which together describe and illustrate a number of preferred embodiments of the invention and what are now considered to be the best modes of practicing the principles thereof. Other embodiments may be suggested to those having the benefit of the teachings herein, and such other embodiments are intended to be reserved especially as they fall within the scope and spirit of the subjoined claims.

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This application is a continuation of application Serial No. 582,564, filed May 3, 1956, now abandoned.

In the drawings:

Fig. 1 is a side elevational view of the tail section of an extensible conveyor having the improvements according to the present invention embodied therein;

Fig. 2 is a section taken along the line 2—2 of Fig. 1 looking in the direction of the arrow, and showing details of a fluid driven motor for imposing tension on the support strand of the extensible conveyor seen in Fig. 1, and showing also a storage reel for the support strand;

Fig. 3 is a circuit diagram showing an hydraulic system and controls therefor for controlling the apparatus seen in Fig. 2; and

Fig. 4 is a detailed view of a capstan providing a snubbing drive for the support strand.

Referring now to Fig. 1 of the drawings, there is shown an extensible conveyor indicated generally by the reference numeral 10. The extensible conveyor 10 includes a tail section 11 having side frames 12, which are arranged for tramping movement upon crawler treads 13.

The tail section 11 forms a means of reversing a conveying reach 14 of an endless belt, the return reach 16 thereof moving in the opposite direction beneath the conveying reach 14. A pair of laterally spaced support strands 17 extend from the tail section 11 and are supported at intervals throughout their length upon support strands, not shown, as may be disclosed in more detail in the aforesaid Craggs et al. patent. The conveying reach 14 is supported by the flexible strands 17 by means of troughing roller assemblies indicated generally by the reference numeral 18 spanning the distance between the strands 17.

Means are provided for imposing proper tension upon each support strand 17, and to this end the support strands are reeved about a pair of snubbing sheaves 19 and 21, the slack end of the strand 17 being stored upon a reel 22 turning on a shaft 23. The sheaves 19 and 21 turn respectively on shafts 24 and 26, and the respective sheaves 19 and 21 have turning therewith driving pinions 27 and 28. A pair of meshed pinions 29 and 31 mesh respectively with the pinions 27 and 28, and pinion 29 meshes with a driving pinion 32 fast on the output shaft 33 of an hydraulic motor 34, see also Fig. 2.

An hydraulic motor 36 drives the storage reel 22 through a drive housing 37, sufficient torque being applied by the hydraulic motor 36 to impose enough tension on the slack side of the strand 17 to prevent slipping of the strand 17 upon the snubbing sheaves 19 and 21.

Referring now to Fig. 3, pressure fluid is supplied to the motor 34 at a controlled working pressure to maintain the tension on the strand 17 at a desired value.

Means for supplying pressure fluid includes a pump 39 connected by a line 41 to a tank 42. An output line 43 from the pump 39 has a pressure relief valve 44 therein which controls the output pressure from the pump 39. The operation of the motor 34 is controlled by a strand control valve 46 having a working line 47 therefrom connected to the motor 34, fluid from the motor 34 exhausting to the tank 42 by way of a line 48. The working line 47 has a check valve 49 therein, and a similar working line 47a is connected to the fluid motor for the other strand 17 on the other side of the tail section 11.

Fluid is also supplied at reduced pressure to the reel motor 36 to impose but a slight tension on the slack end of the strand 17. A line 51 branches from the working line 47 and has a pressure reducing valve 52 therein, pressure fluid moving past a check valve 53 to supply the fluid motor 36.

Pressure fluid is also supplied to a tram motor 54 for

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driving the crawler tread 13, there being a separate tram pump 56 connected by an intake line 57 to the tank 42. The output from the pump 56 is regulated by a relief valve 60, and the output from the pump 56 is connected by a line 58 to a control valve 59, see also Fig. 1, there being a similar control valve 59a for the crawler tread for the opposite side of the vehicle connected to the tram pump 56 by a pressure line 58a branching from the pressure line 58.

The fluid motor 54 is connected by a pair of working lines 61 and 62 to the control valve 59, line 61 supplying pressure fluid to the motor 54 to drive the crawler tread 13 in the forward direction. Upon reversal of control valve 59, line 62 becomes the pressure line to supply motor 54 and line 61 becomes an exhaust line, the control valve 59 including a line 63 therefrom to tank. Under such condition tram motor 54 is driven in the reverse direction to shorten the conveyor 10.

It should be noted at this point that when strand control valve 46 is operated and tram control valve 59 is in the off or neutral position, pressure will be manifested against fluid motors 34 and 36 to impose tension on the strand 17, there being a high tension portion in by of the driving sheaves 19 and 21, and a low tension portion between the driving sheaves and storage drum 22.

When strand control valve 46 is operated and tram valve 59 is in the reverse position, motor 34 will drive sheaves 19 and 21 in a direction to shorten the effective length of the strands 17, the tension therein in by of the tail sections being maintained as before. Motor 36 will drive storage drum 22 at the same time to impose a lower tension on the portion of strand 17 between the driving sheaves 19 and 21 and storage drum 22.

However, when tram control valve 59 is operated to drive the tail section 11 in a conveyor extending direction, storage drum 22 must pay out strand 17, and motors 34 and 36 will be driven in reverse direction as pumps. When driven in reverse, fluid is swept out in the reverse direction against the back pressure determined by relief valves 71 and 73.

The back pressure across the fluid motor 36 when driven by the storage reel 22 during such operation is maintained at a value to correct for the tendency of the strand 17 to have increased tension when the tail section 11 moves in the forward direction.

To this end the operation of the control valve 59 in a forward direction causes pressure fluid to be supplied to a line 64 branching from line 61 and connected to a blocking valve 66 having a spool valve member 67 therein. The spool valve member 67 moves against a spring 68 to connect the pressure line 47 and a line 69 connected to the pressure relief valve 71 connected therein and set at a lower value than the pressure relief valve 44, thus making the effective pressure across the motor 34 at a lesser value. The motor 34 now acting as a pump, its intake being line 48 and its output being pumped against relief valve 71.

The operation of the control valve 59 in a forward direction also causes pressure to be manifested in a line 72 connected to the working line 61. Line 72 is connected to a blocking valve 73 having a spool valve member 74 therein movable against a light spring 76. The spool valve member 74 is shiftable to a position to cause the supply line 51 to be maintained at a lower pressure by means of a line 77 branching therefrom and connected through the relief valve 78 therein, the spool valve member being shifted to a position so that the relief valve 78 will relieve any excess of pressure thereat to tank, as shown. Motor 36 is now being driven as a pump and its output is at a low pressure as determined by the setting of relief valve 78.

It is believed evident that the effective restraining torque caused by motor 36 now acting as a pump will maintain a snubbing tension in the low tension portion

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of the strand 17 between the snubbing sheave 21 and the storage reel 22.

As seen in Fig. 4, the snubbing sheaves 19 and 21 may be replaced by a capstan 80 driven through a pinion 27 and a driving pinion 29 from the fluid motor 34. As seen in Fig. 4, the strand 17 may be wrapped several times about the capstan 80, the low tension portion of the strand 17 being stored on the reel as with the embodiment seen in Figs. 1 and 2.

From the foregoing description it is believed evident that an improved form of extensible rope conveyor has been provided, wherein the tendency of the tension in the support strands to increase upon forward tramping movement of the tail section is compensated for.

When the tail section 11 is trammed in the forward direction, the effective restraining torque across the drive motor for the snubbing sheaves, now acting as pump, and across the drive motor for the storage reels, also acting as a pump, is kept at a value so as to maintain the tension in the support strand at substantially the same value.

While the invention has been described in terms of a number of preferred embodiments thereof, its scope is intended to be limited only by the claims here appended.

I claim as my invention:

1. In an extensible conveyor of the type wherein the conveying reach is supported on a flexible strand, an end section, a power driven sheave around which said strand is reeved so as to provide strand portions at high tension and low tension, means for storing said low tension portion, hydraulic power means for driving said power driven sheave and said storing means, a valve operable to control the pressure of motive fluid to said power driven sheave and said storage means to maintain a desired tension on said strand, and means for varying the tension in said low tension portion and said high tension portion when the said end section is moved in a conveyor extending direction comprising a valve shiftable to reduce the back pressure against the hydraulic power means for said power driven sheave, and a further valve shiftable to reduce the back pressure against the hydraulic power means for said storage means.

2. In an extensible conveyor of the type wherein the conveying reach is supported on a flexible strand, an end section, a power driven sheave around which said strand is reeved so as to provide strand portions at high tension and low tension, means for storing said low tension portion, hydraulic power means for driving said power driven sheave and said storing means, a valve operable to control the pressure of motive fluid to said power driven sheave and said storing means to maintain a desired tension on said strand, and means for varying the tension in said low tension portion and the tension in said high tension portion when the said end section is moved in a conveyor extending direction comprising valve means operable upon movement of said end section to reduce the back pressure of the motive fluid on the hydraulic power means for said power driven sheave and said strand storing means.

3. In an extensible conveyor of the type wherein the conveying reach is supported on a flexible strand, an end section having hydraulic power means for driving same, a power driven sheave around which said strand is reeved so as to provide strand portions at high tension and low tension, means for storing said low tension portion, hydraulic power means for driving said power driven sheave and said storing means, and means for varying the tension in said low tension portion and the tension in said high tension portion when the said end section is moved in a conveyor extending direction comprising a control valve for the hydraulic power means for said movable end section, and means shiftable upon movement of said end section for reducing the back pressure of the motive fluid swept by the hydraulic power means for said power driven sheave and said storing means.

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4. In an extensible conveyor of the type wherein the conveying reach is supported on a flexible strand, an end section having hydraulic power means for moving same, a power driven sheave around which said strand is reeved so as to provide strand portions at high tension and low tension, means for storing said low tension portion, means for placing a desired tension on said low tension portion as a function of the tension in said strand, hydraulic power means for driving said power driven sheave and said storing means, and means for varying the tension in said low tension portion and the restraint by said power driven sheave when the said end section is moved in a conveyor extending direction for maintaining the tension in said high tension portion at a desired value comprising means for reducing the back pressure of the motive fluid swept by the hydraulic power means for said power driven sheave and said storing means.

5. In an extensible conveyor of the type wherein the conveying reach is supported on a flexible strand, an end section, a power driven sheave around which said strand is reeved so as to provide strand portions at high tension and low tension, means for storing said low tension portion, hydraulic power means for driving said power driven sheave and said storing means, a valve operable to control the pressure of motive fluid to said power driven sheave and said storage means to maintain a desired tension on said strand, and means for varying the tension in said low tension portion and the restraint by said power driven sheave when the said end section is moved in a conveyor extending direction comprising a valve shiftable upon operation of said last named means to reduce the back pressure of the motive fluid swept by the hydraulic power means for said power driven sheave, and a further valve shiftable to reduce the back pressure of motive fluid swept by the hydraulic power means for said storage means.

6. In a variable length conveyor of the type wherein the conveying reach is supported on a flexible strand; an end section; a power driven sheave around which said strand is reeved so as to provide strand portions at high tension and low tension on opposite sides of said sheave; means for storing said low tension portion; power means for driving said power driven sheave and said storing means; said sheave being urged by said power means in a direction to take in said strand responsive to movement of said end section in a conveyor shortening direction, said sheave being effective to pay out said strand responsive to movement of said end section in a conveyor lengthening direction; said power means applying restraint to movement of said sheave in a pay out direction; means operable to control said power means to maintain desired tensions in said strand portions; and varying means for varying the tension in said low tension portion and for varying the restraint upon said power driven sheave comprising means operable to reduce said restraint and to reduce the tension in said low tension portion when said end section is moved in a conveyor lengthening direction.

7. In a variable length conveyor of the type wherein the conveying reach is supported on a flexible strand; an end section; a power driven sheave around which said strand is reeved so as to provide strand portions at high tension and low tension on opposite sides of sheave; means for storing said low tension portion; power means for driving said power driven sheave and said storing means, said sheave and said storing means being re-

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spectively urged by said power means in a direction to take in said strand responsive to movement of said end section in a conveyor shortening direction, said sheave and storing means being effective to pay out said strand responsive to movement of said end section in a conveyor lengthening direction, said power means applying restraints to movements of said sheave and of said storing means in pay out directions; means operable to control said power means for maintaining desired tensions in said strand portions; and varying means for varying the tensions in said low and high tension portions comprising means for reducing said restraints responsive to movement of said end section in a conveyor lengthening direction.

8. In an extensible conveyor of the type wherein the conveying reach is supported on a flexible strand, an end section, a power driven sheave around which said strand is reeved so as to provide strand portions at different tensions, means for storing one of said tensioned portions, power means for driving said sheave and said storing means, said power means being effective to apply restraints to movements of said sheave and of said storing means in directions to pay out said strand, means operable to control said sheave and said storage means to maintain predetermined different tensions in said strand portions, and means for varying the tensions in said strand portions when the end section is moved comprising means operable upon movement of said end section in a conveyor extending direction to reduce said restraints.

9. In an extensible conveyor of the type wherein the conveying reach is supported on a flexible strand, an end section, first and second tensioning members carried by said end section and being successively engageable with said strand to define a first strand portion exterior of the first tensioning member on which said conveying reach is supported and a second strand portion between said tensioning members, and means for driving said tensioning members to differentially tension said strand portions with a higher tension in the first portion than in the second.

10. In an extensible conveyor of the type wherein the conveying reach is supported on a flexible strand, an end section, first and second winding members carried by said end section and about which said strand is successively wound, power means for driving said winding members in a winding direction, and control means for said power means effective to apply a higher tension in that portion of the strand supporting the conveying reach than that portion of the strand between said winding members.

11. In an extensible conveyor of the type wherein the conveying reach is supported on a flexible strand, an end section, said end section having a power driven winding member around which an end portion of said strand is reeved, power driving means coupled to said winding member and being effective to urge said winding member in a winding direction to apply a predetermined conveyor-supporting tension in said strand, said strand having an extension beyond said winding member, and auxiliary power means effective to maintain in said strand extension a tension which is less than said conveyor-supporting tension.

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