June 23, 1953 F. A. LINDGREN 2,642,981

EXTENSIBLE CONVEYER WITH TAKE-UP MEANS

Filed July 13, 1951 3 Sheets-Sheet 1

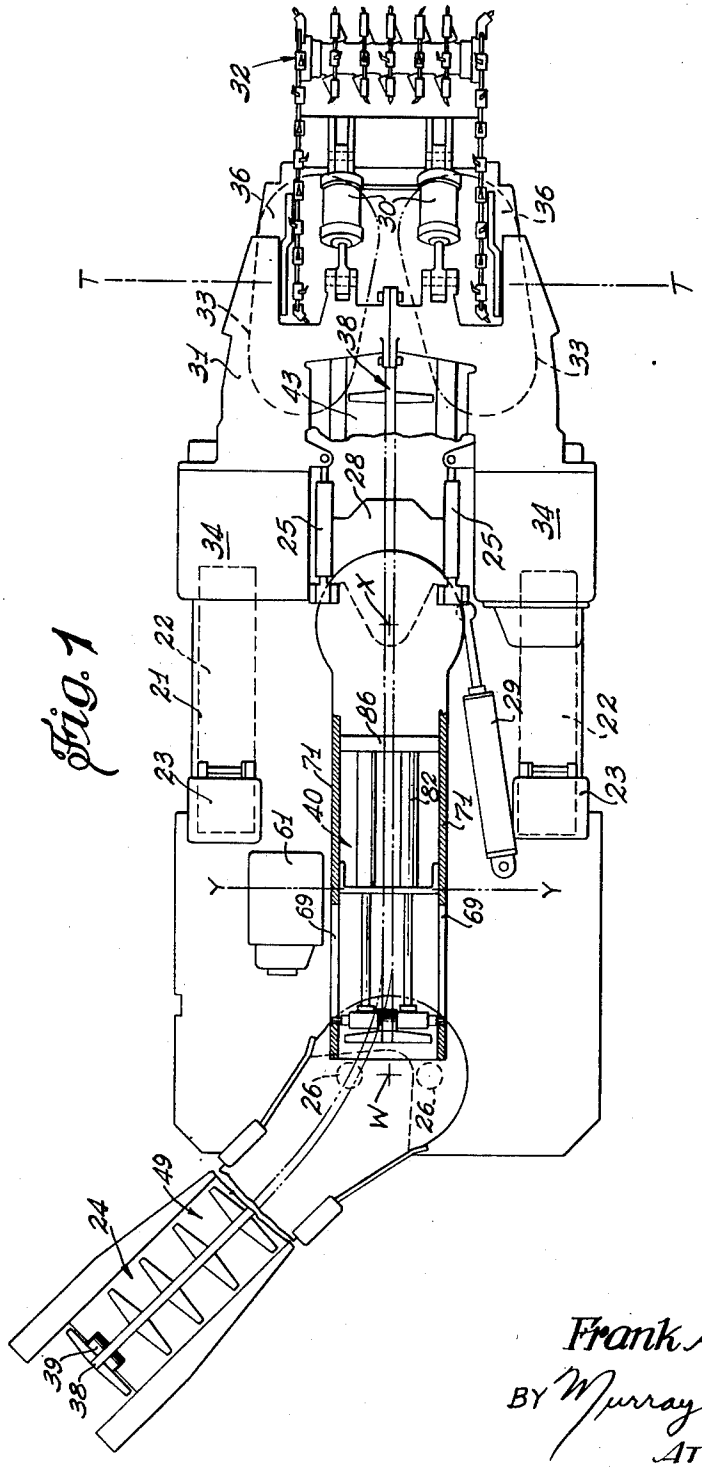


Fig. 1

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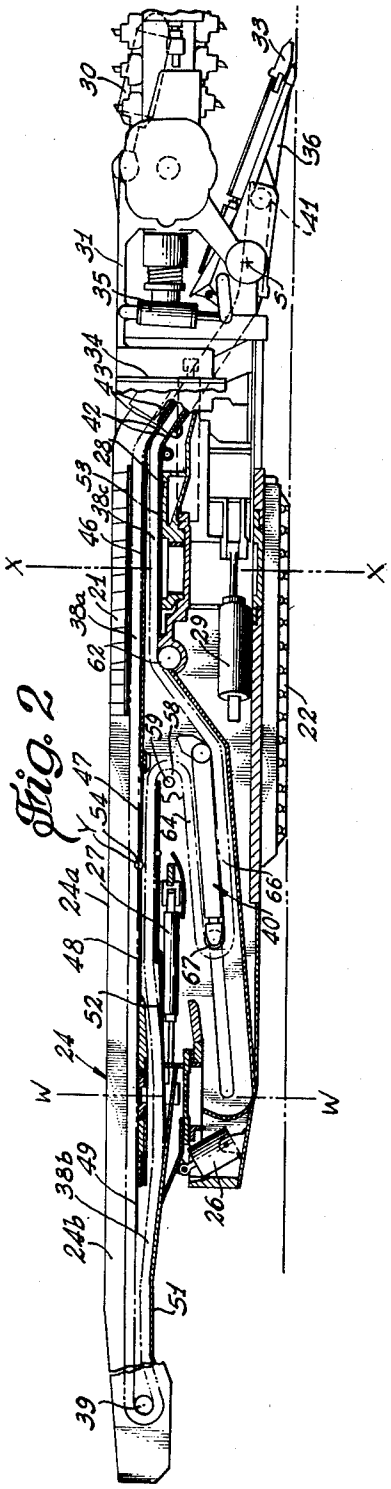


Fig. 2

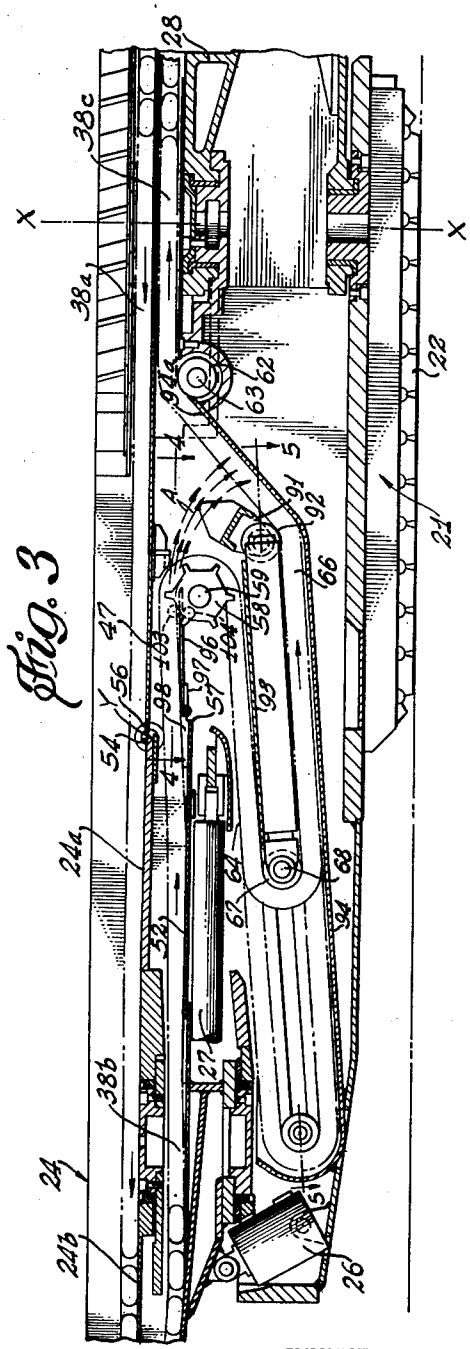


Fig. 3

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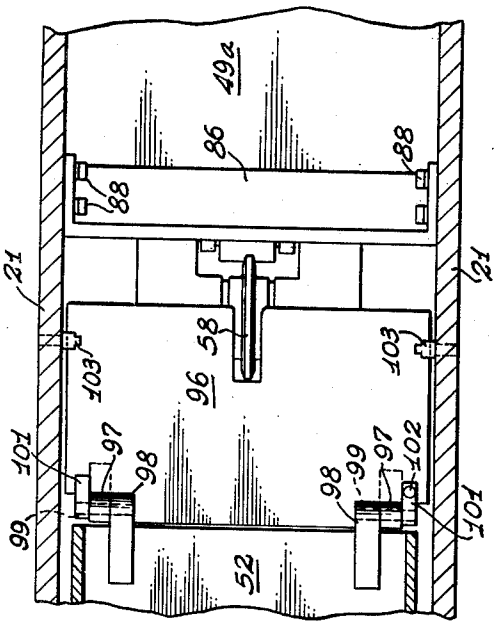


Fig. 4

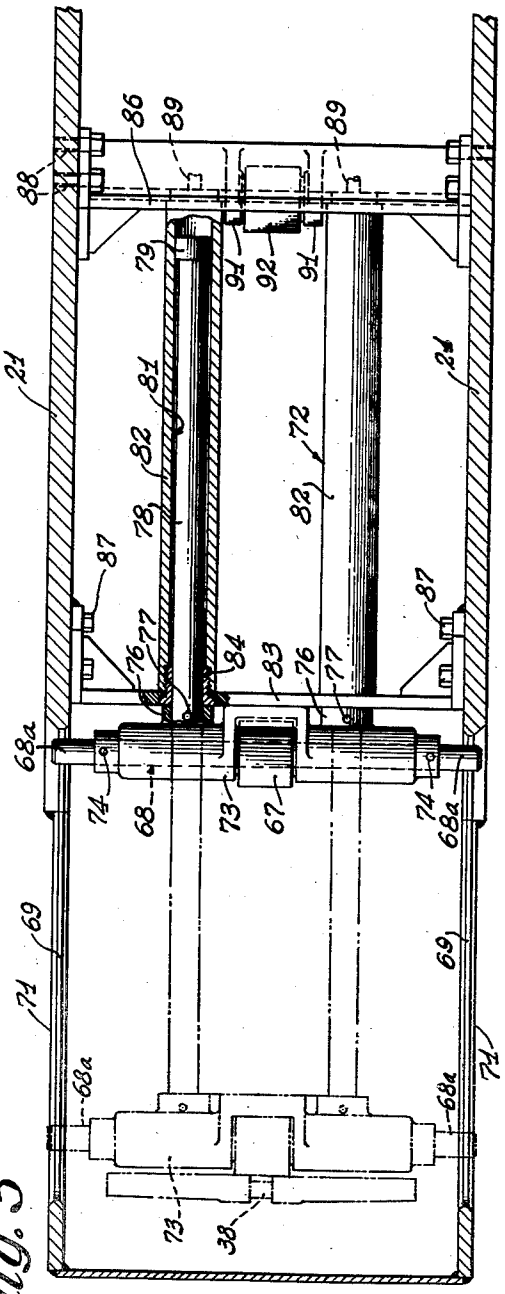


Fig. 5

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EXTENSIBLE CONVEYER WITH TAKE-UP MEANS

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Application July 13, 1951, Serial No. 236,548

6 Claims. (Cl. 198—109)

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This application relates primarily to mining and particularly to an improved extensible conveyor for a continuous mining and loading machine of the kind disclosed in co-pending patent application of Frank A. Lindgren and Richard C. Lundquist, Serial No. 186,326 filed September 23, 1950.

The machine described in the co-pending application has a cutting and dislodging head mounted on a mobile frame provided with a lengthwise flexible chain conveyor element and gathering mechanism at the front end thereof to pick up material dislodged from the mine face and move it to the rear of the machine. To permit the forward end of the conveyor to move with the cutting and dislodging head as the latter is moved, relative to the frame, toward and away from the mine face, the conveyor is made extensible by training a portion of its return reach into the form of a pressure-expanded loop which shortens when the conveyor expands and vice versa. Specifically, that loop included both rear and forward bends connecting respectively with rear and forward halves of the lower or return reach of the conveyor. The top of the rear bend was open all the way back to the connecting pivot point of a tiltable rear boom. That specific loop arrangement was found to be disadvantageous under certain very dirty mining conditions, for dirt and fines would drop in through the open top and would accumulate in the front bend, requiring frequent cleaning.

A specific object of the present invention is the provision of an improved self-cleaning pressure loop arrangement for a mining machine having an extensible conveyor of the character described. Briefly, this end is obtained: by covering the rear bend with a plate hinged between the rear boom and the main frame to reduce the amount of material falling within the loop; by eliminating the second or front loop altogether to prevent accumulation therein; and by recessing the pressure cylinders far enough within the loop to prevent fouling of the material on them.

In the present invention, the pressure loop is in the form of a single bend extending backwardly from a point of connection with the rear half of the return reach and trained about a direction-changing element which is pressure-actuated to extend the loop and which serves to divide the bend into what might arbitrarily be defined as inlet and outlet legs. An important feature is that the outlet leg includes a chain-carrying throat section onto which most of the dirt and fines brought by the rear half of the return reach will be thrown without ever having to pass through the main part of the loop itself. An additional important feature is that the outlet leg and throat supports the conveyor chain in such a way that it continually advances as it

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rises toward the juncture with the forward half of the lower reach.

Other objects and advantages will be apparent from the following description taken in connection with the drawings in which:

Figure 1 is a plan view, partly cut away to show certain components, of a continuous mining machine employing one embodiment of the present invention;

Fig. 2 is a side view, partly cut away to show certain components, of the machine shown in Fig. 1;

Fig. 3 is a fragmentary enlarged view of Fig. 2 showing certain details of the improved self-cleaning chain-tensioning loop;

Fig. 4 is a fragmentary plan view of Fig. 3 taken along the line 4—4; and

Fig. 5 is another fragmentary plan view of Fig. 3 taken along the line 5—5.

Like parts are referred to by like reference characters throughout the drawings.

Referring now more particularly to the drawings, the mining machine is substantially identical to that shown and described in the above-mentioned patent application, Serial No. 186,326, except for the details of the particular chain-tensioning loop and parts associated therewith as shown and described herein. For details of the machine generally, other than the parts described herein, reference should be made to the earlier application.

Briefly, the mining and loading machine shown in the present drawings comprises a main frame 21 mounted for mobility on endless treads 22 which are driven by motors 23 through tramming gearing not shown. A rear auxiliary sub-frame or boom 24 is mounted on the main frame for up and down tilting movement about a horizontal axis Y. A pair of piston and cylinder means 26, acting between the main and rear auxiliary frames, serves to tilt the rear sub-frame up and down about the axis Y. The rear sub-frame 24 is divided into two parts, a forward section 24a and a terminal section 24b pivotally mounted on the former about a vertical axis W. A pair of cylinder and piston means 27, 27 acting between the two sections of the auxiliary frame serve to swing the rear section about the axis W.

At the front of the main frame, a sub-frame 28 is swingable about a vertical axis X by cylinder and piston means 29 acting between the main frame and the sub-frame.

A front auxiliary sub-frame 31 is reciprocably mounted on the swingable sub-frame, being movable forward and backward by piston and cylinder means 25, 25 acting between the auxiliary frame and the swingable sub-frame. The auxiliary frame 31 carries a cutting and dislodging head 32 which is pivoted for up and down tilt-

ing movement about an axis T by a pair of piston and cylinder means 30, 30 acting between the auxiliary frame 31 and the head 32. At a lower level, a gathering apron 36 is pivoted for up and down tilting movement about an axis S on the front of the auxiliary frame. Piston and cylinder means 35, one on each side of the machine, acting between the front auxiliary frame and the gathering apron, serve to tilt the latter up and down as desired. Atop the gathering apron is a pair of conventional side raking gathering elements 33, 33 which, with the cutting and dislodging head 32, are driven by motors 34, 34, housed on the auxiliary frame 31. The gearing by which this driving is effected is not specifically shown in this application.

A flexible, endless conveyor member, in this case a center strand conveyor chain 38, is trained about direction-changing roller elements 39 and 41 carried respectively by the rear and front auxiliary frame members 24 and 31. The apron 36 for the gathering mechanism provides a convenient forward mounting position for the direction-changing element 41 so that the material picked up by the gathering mechanism from the floor or received directly from the cutting head may be conveniently transferred to the conveyor for movement to and discharge from the rear end thereof.

It will be apparent that as the reciprocable frame 31 moves forwardly, the conveyor must extend. This is made possible by the telescopically assembled chain-supporting sections 42 and 43 carried by the swingable sub-frame 28 and the auxiliary frame 31 respectively.

To tension the conveyor chain, it is formed into a loop, on the return side, generally designated by the numeral 40, which is maintained in an extended condition by piston and cylinder means located within it. The present invention is directed to this loop and the parts associated therewith which enable it to function in a self-cleaning manner, all of which will now be described in detail.

It will be seen that the conveyor chain 38 is trained through a path including an upper reach 38*a* and a lower reach which, for convenience, may be divided into a rear half or portion 38*b* and a front half or portion 38c which, respectively, enter and leave the loop 40. As seen from right to left in Fig. 2 the upper reach is supported as follows: on the front auxiliary frame 31 by the upper plate of section 43; on the main frame by the upper plate of section 42 and by the horizontal plate 46 and by plate 47; and on the rear auxiliary frame 24 by plates 48 and 49 on opposite sides of the vertical axis W. As will be seen by reference to Fig. 3, the tilting axis Y for the rear boom or frame substantially intersects the support for the upper reach.

Now, looking from left to right in Fig. 2, the rear half of the lower reach 38*b* is supported on plates 51 and 52 on opposite sides of the axis W, these plates comprising a portion of the rear boom 24. The front half of the lower reach is supported on a horizontal plate 53 which is carried by the main frame; and on the lower plates of sections 42 and 43 which are carried by the main frame and the front auxiliary frame respectively.

As best shown in Fig. 3 the specific structure for tilting the rear boom includes a transverse pin 54 carried on each side of the rear boom section 24*a* trunnioned within a tubular bracket 56 mounted on the main frame. Thus, it will be seen, that as the rear boom tilts up and down about the axis Y, the forward end 57 of the rear boom plate 52 will be swung in an arc about the axis Y.

For driving the conveyor chain in this instance and for changing the direction of the chain as it enters the loop 40, a sprocket 58 is centrally mounted on a transverse shaft 59 in the main frame. The sprocket shaft is driven by motor 61 through suitable gearing (not shown). Thus, the direction-changing member 58 defines the juncture between the rear half of the lower reach and the pressure loop 40. Similarly, an idler 62, centrally mounted on a transverse shaft 63 carried by the main frame defines the juncture between the loop 40 and the front half of the lower reach.

The loop 40 may, for convenience, be described as including inlet and outlet legs 64 and 66 extending backward substantially parallel to the lower reach and underneath the rear half thereof, these legs joining about an idler 67 mounted on a transverse shaft 68.

The shaft 68 is non-rotatable and each of its end portions 68*a* (Fig. 5) is guided for forward and backward movement in a slot 69 formed in a vertical side wall 71 mounted on each side of the main frame.

Fluid operated piston and cylinder means, generally designated 72, maintains the loop 40 in a normally-extended position and will now be described in detail. As shown in Fig. 5, the transverse shaft 68 carries a pressure pad 73, held in place by a pair of through-pins 74 as shown. This pad 73 may be a casting and is provided with a pair of transversely spaced forwardly extending, integral tubular formations 76, 76. Each of the latter has fixed therein, as by means of a through-pin 77, the end of a piston rod 78. At the opposite end each of the latter is provided with a piston 79 acting within a bore 81 of a cylinder 82. At the left end of the cylinders, as shown in Fig. 5, they are connected to a transverse supporting member or crosspiece 83 by bushings 84 which are threadedly engaged with the cylinders as shown. The internal bore of the bushings 84, in each case, is made to snugly embrace the piston rod to serve as a guide for it as well as to act as a wiper or dust seal. At the other end the cylinders 82 are suitably fixed to a crosspiece 86. Both of the crosspieces 83 and 86 are fixedly mounted, as by bolts 87 and 88, between the side walls 71, 71. At the head end each cylinder, which is single-acting in the present case, is connected by a conduit 89 to a suitable pressure source (not shown).

As best shown in Figs. 3, 4 and 5, the crosspiece 86 has a pair of transversely spaced depending arms 91 between which is journaled a rotatable idler roller 92 across which the lower or outlet leg 66 of the loop is trained.

A floor for the inlet leg 64 of the loop is provided in the form of a plate 93 fixed in any suitable manner across the top surfaces of the cylinders 82, 82.

A floor for the outlet leg 66 takes the form of a curved plate 94 having sufficient length to accommodate the maximum extension of the loop and extending transversely between the upright walls 71, 71 to which it is attached in any suitable manner, as by welding. The floor 94 has a forward extension, or throat section, 94*a* which extends forwardly and upwardly from the idler 92 to the idler 62. This throat section and its relation to the other parts is an important part of the

present invention, as will be described. First, it will be observed that the outer crosspiece 86 for the tensioning piston and cylinder means is recessed well within the loop so that material such as dirt and fines being dragged forwardly by the return reach will be thrown forward from the sprocket 58, clear across the crosspiece 86, and will impinge directly on the throat portion 94*a*, all as shown in the direction of the arrows A, without passing into the main portion of the loop 40 at all.

As pointed out previously herein, the forward end portion 57 of the rear boom will move in an arc about the axis Y whenever the rear boom is tilted up and down. Because of this, the space between the edge 57 and the driving sprocket 58 was left uncovered in the construction disclosed in the above-mentioned co-pending application and the material carried forward by the return reach was permitted to fall, in its entirety, through the opening and into the chain tensioning loop. This is obviated in the present case, and the material permitted to clear the loop and move across in the direction of the arrows A, as already described, by means of a plate 96 (Figs. 3 and 4) which is hinged between the rear boom and the main frame. In the specific construction shown the plate 96 is formed with a pair of transversely spaced eyes 97, 97 which match with corresponding eyes 98, 98 mounted, as by welding, onto the plate 52 of the rear boom. Each pair of eyes 97, 98 is pivotally interconnected by a pin 99 extending therethrough and held in a bracket 101 attached by a bolt 102 to the hinge. The other end of the hinge, at each side, is supported for slidable movement relative to the main frame by means of a pair of vertically spaced pins 103, 104 threaded into the corresponding side wall 71. Obviously, if desired, the just-described arrangement might be reversed and the hinge be pivoted onto the main frame and slidable relative to the rear boom if desired.

Another feature of the invention which makes the loop self-cleaning with respect to any of the dirt and fines that does get into it is the angular disposition of the plate 94 and its throat 94*a*. By referring to Fig. 3 it will be seen that this floor section, which is imperforate to prevent spillage onto the ground or mechanism below, continually advances as it rises from the idler 67 to the idler 62 and at no time does it rise at an angle which exceeds about 45 degrees with respect to the horizontal. With this arrangement any foreign material that is carried into the loop will be continuously and automatically removed therefrom and transferred along the lower reach to the front of the machine where it can be picked up by the gathering mechanism and transferred to the rear of the conveyor for discharge therefrom.

While one form in which the present invention may be embodied has been shown and described, it will be understood that various modifications and variations thereof may be effective without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. Extensible conveying apparatus for a mining machine comprising: a mobile main frame having a reciprocable front sub-frame and a vertically tiltable rear sub-frame; an endless flexible conveyor element trained about direction-changing members carried respectively on said sub-frames; means on said main frame and said sub-frames for supporting said conveyor element in upper and lower reaches; driving means for moving said upper reach from front to rear and said lower reach from rear to front; said rear sub-frame being pivotally mounted on said main frame about a transverse axis substantially intersecting the support for the upper reach; means for supporting a portion of the lower reach into the form of a depending, rearwardly extending elongated loop dividing the lower reach into rear and forward parts, said loop comprising a pair of legs substantially parallel to one another, the lower leg having an outlet throat section joining the forward part of the lower reach, and an imperforate supporting floor guiding said lower leg and throat sections in a path that continuously advances as it rises; said rear sub-frame and said main frame having therebetween a horizontal cover plate pivoted to one and slidable relative to the other beneath the lower reach and effective to bridge a gap between the rear sub-frame and the inlet portion of the loop at all tilted conditions of the rear sub-frame; and mechanism for tensioning said loop comprising loop-engaging hydraulic piston and cylinder means supported by said main frame within said loop and recessed in the latter so as to provide clearance across the top of the loop between the inlet and said throat section for the direct transfer of material thereacross without entering the loop proper.

2. Extensible conveying apparatus for a mining machine comprising a mobile main frame having a reciprocable front sub-frame and a vertically tiltable rear sub-frame; an endless flexible conveyor element trained about direction-changing members carried on said sub-frames; means on said main frame and sub-frames for supporting said conveyor element in upper and lower reaches; driving means for moving said upper reach from front to rear and said lower reach from rear to front; said rear sub-frame being pivotally mounted on said main frame about a transverse axis substantially intersecting said upper reach; the means on the main frame for supporting the lower reach including mechanism for training a portion of said conveyor element to follow the path of a depending, rearwardly extending, elongated loop dividing the lower reach into a rear part carried by the rear sub-frame and a front part carried by the main frame and front sub-frame; said loop-training mechanism including direction-changing elements supported by the main frame at the inlet and outlet ends of the loop; means carried by said main frame within said loop for biasing the latter toward an extended condition; the rear sub-frame and said main frame having therebetween a horizontal cover plate pivoted to one and slidable relative to the other and effective to bridge a gap between the rear sub-frame and the direction-changing device at the inlet of said loop at all tilted conditions of the rear sub-frame so as to permit dirt and fines carried by the rear part of the lower reach to be discharged beyond said inlet direction-changing device.

3. Extensible conveying apparatus for a mining machine comprising a mobile, extensible frame; an endless flexible conveyor element trained about direction-changing members carried on receiving and discharge portions of said frame; driving means for moving the upper reach from front to rear and the lower reach from rear to front; means for supporting a portion of the lower reach into the form of a depending, rearwardly extending elongated loop dividing the lower reach into rear and forward parts, said

loop comprising a pair of legs substantially parallel to one another and inclined with respect to said rear part of the lower reach, the lower leg having a throat section joining the forward part of the lower reach, and an imperforate inclined supporting floor in material receiving relation with respect to said rear part of said lower reach and guiding said lower leg and throat sections in a path that continuously advances as it rises to the front part of the lower reach; and mechanism for tensioning said loop comprising loop-engaging hydraulic piston and cylinder means supported by said frame within said loop and recessed in the latter so as to provide clearance across the top of the loop for direct transfer of material from the rear part of the lower reach onto said throat.

4. In an extensible conveying apparatus for a mining machine, a mobile extensible main frame having a rear sub-frame and a front extensible sub-frame reciprocably movable with respect thereto, an endless chain and flight conveyor element movable along said frames from one end of said extensible sub-frame to the opposite end of the other sub-frame, means on said sub-frames for supporting said conveyor element in upper and lower reaches, other means for driving said flight conveyor element, means providing a material take-up and cleaning gap in the lower reach of said conveyor element and supporting a portion of the lower reach in the form of a depending downwardly extending elongated take-up loop, said support means including a direction changing member on said rear sub-frame about which the rear part of said lower reaches reverses its direction of travel to form the upper leg of said loop, a second direction changing member guided for movement along the rear of said sub-frames, hydraulic cylinder and piston means supported by said rear sub-frame within said loop and connected with said second direction changing member to bias the same to maintain said conveyor element under tension and to accommodate extension and retraction of said extensible sub-frame, an imperforate upwardly inclined supporting floor in material receiving relation with respect to said first direction changing member, and elevating the lower leg of the loop to the forward part of the lower reach of the chain.

5. In an extensible conveying apparatus for a mining machine, a mobile extensible frame comprising two sub-frames, one of which is reciprocably movable with respect to the other, an endless chain and flight conveyor element guided for movement along said frames from one end of one frame to the opposite end of the other, means on said frames for supporting said conveyor element in upper and lower reaches, means for driving said flight conveyor element, means providing a material cleaning gap in the lower reach of said flight conveyor element and supporting a portion of the lower reach in the form of a depending inclined take-up loop comprising a direction changing idler journaled in the rear of said sub-frames and about which the lower reach changes its direction to form the upper leg of the loop, inclined guide means extending along said rear sub-frame, a second direction changing idler supported and guided for movement along said guide means and forming the bight of the loop, hydraulic cylinder and piston means extending between the legs of the loop and having connection with said second direction changing idler, a bracket extending across said frame in the gap in the lower reach of the conveyor and having said cylinder and piston means mounted thereon, an idler on said bracket maintaining the lower reach of the conveyor out of engagement with said cylinder and piston means, an inclined imperforate supporting floor guiding said lower leg of the loop upwardly from said idler to the other part of the lower reach of the conveyor element, said supporting floor being in material receiving relation with respect to the rear part of the lower reach of the conveyor element.

6. In an extensible conveying apparatus for a mining machine, a mobile extensible frame having two sub-frames, one of which is reciprocably movable with respect to the other, an endless chain and flight conveyor element movable along said sub-frames from one end of one to the opposite end of the other and means on said frames supporting said conveyor element in upper and lower reaches, means for driving said conveyor element, means providing a take-up and material cleaning gap in the lower reach of said conveyor element and supporting one portion of the lower reach of said conveyor element in material receiving relation with respect to the other comprising a direction changing idler for the rear part lower reach of the conveyor element, parallel downwardly inclined guides extending along the rear of said sub-frames, a direction changing idler guided for slidable movement along said guides and forming the lower reach of the conveyor element in the form of a rearwardly extending downwardly inclined elongated loop having a pair of legs substantially parallel to one another and inclined with respect to the rear part of the lower reach of the conveyor element, the lower leg of the loop having a throat section spaced forwardly of said direction changing member, joining the forward part of the lower reach of the conveyor, and an imperforate inclined supporting floor guiding the lower leg of the loop along said throat section in an upwardly inclined path to the forward part of the lower reach of the conveyor in material receiving relation to the rear part of the lower reach of the conveyor element, hydraulic cylinder and piston means supported by said frame and extending along and within said loop and having operative connection with said last mentioned direction changing idler, for biasing the same along said guides, and an idler guiding the lower leg of the loop to said throat section and inclined floor out of the path of said cylinder and piston means, and maintaining said lower leg in material receiving relation with respect to the discharge end of the rear part of the lower reach of the conveyor element.

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