June 23, 1953 C. E. ANDERSHOCK 2,642,982

ARTICULATED CONVEYER WITH SWIVELING MEANS

Filed Aug. 14, 1951 3 Sheets-Sheet 1

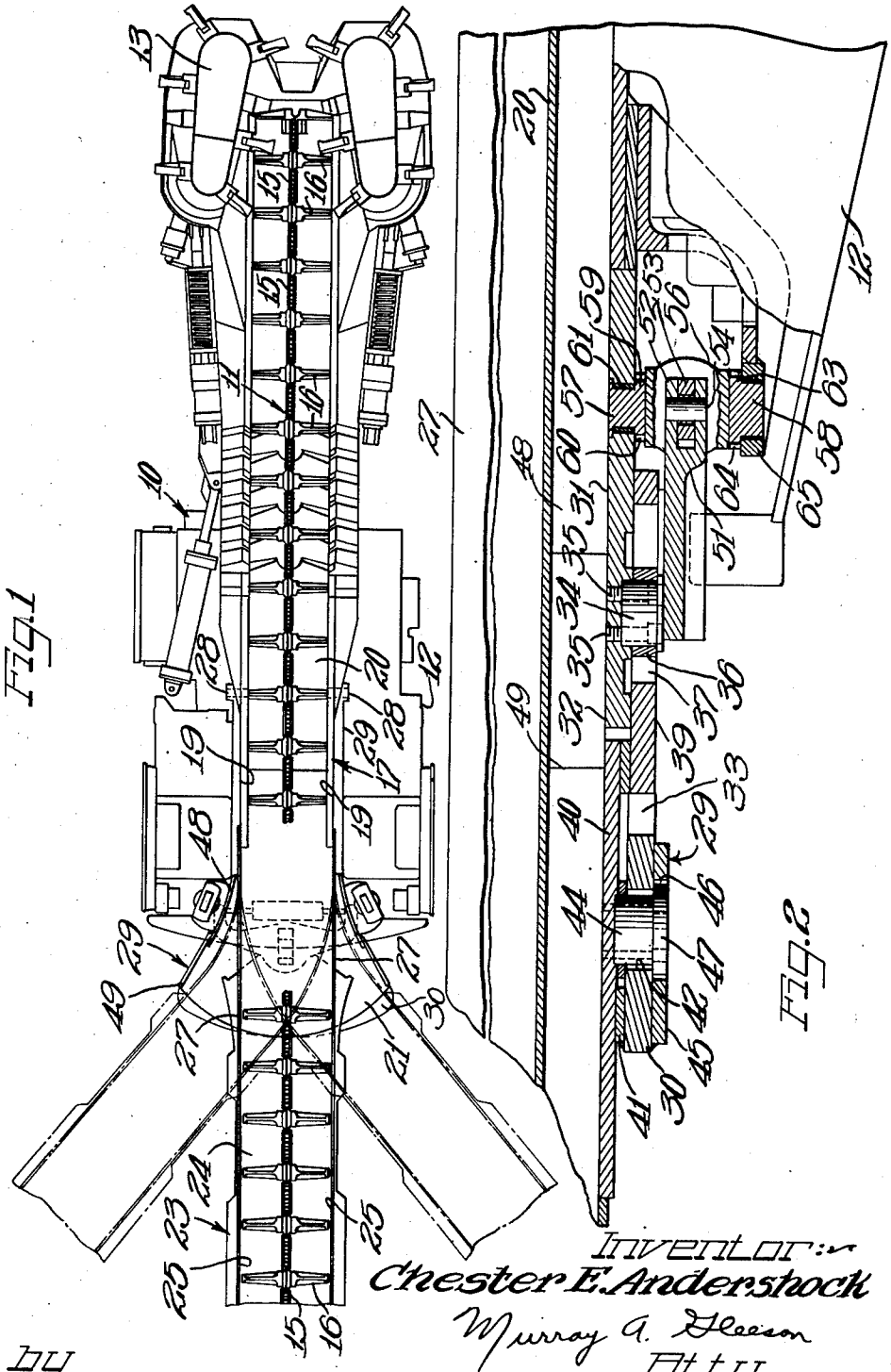


Fig. 1

Fig. 2

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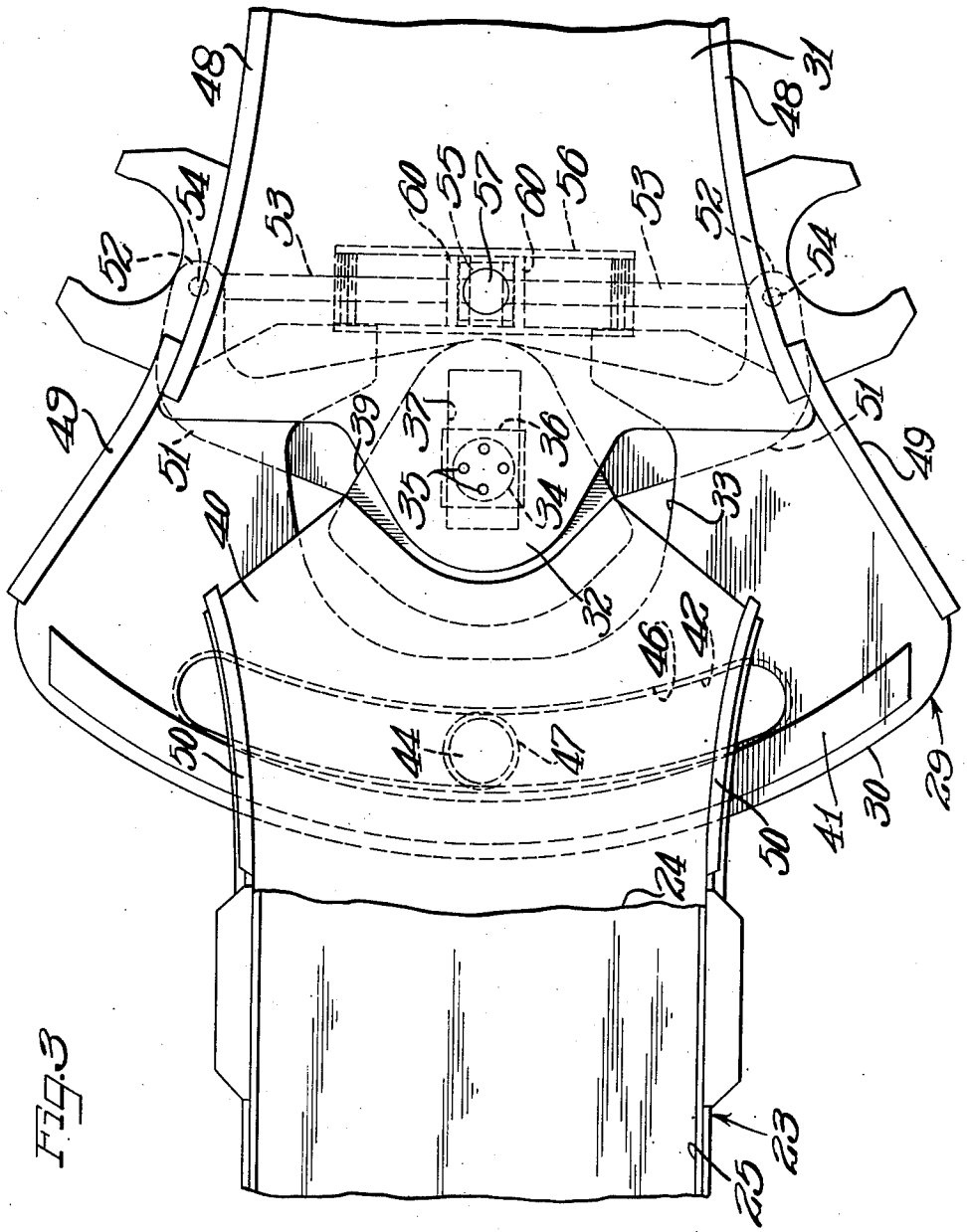


Fig. 3

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Filed Aug. 14, 1951 3 Sheets-Sheet 3

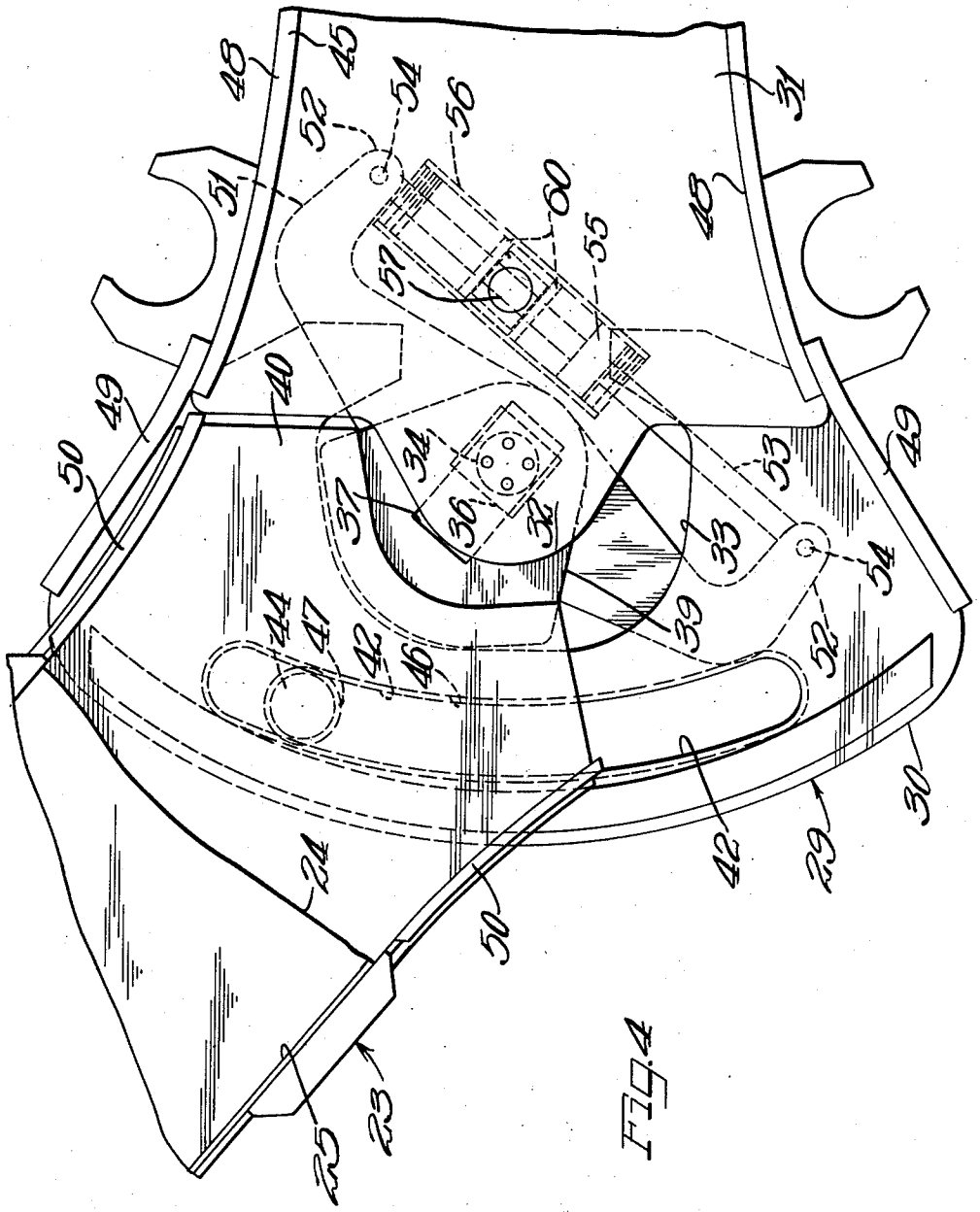


Fig. 4

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ARTICULATED CONVEYER WITH SWIVELING MEANS

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Application August 14, 1951, Serial No. 241,871

13 Claims. (Cl. 198—109)

1

This invention relates to improvements in articulated conveyor structures and more particularly relates to an improved articulated conveyor structure and lateral swinging means therefor, particularly adapted for face loading machines operating in confined spaces underground.

A principal object of my invention is to provide a novel form of articulated conveyor structure having a simplified swinging means therefor arranged with a view toward utmost simplicity and compactness in construction and operation.

A further object of my invention is to provide a novel and improved form of articulated conveyor structure, particularly adapted for loading machines operating in confined spaces underground and including an improved swinging mechanism for the laterally movable portion of the conveyor contained beneath the conveyor structure and within the lateral limits thereof.

A further and more detailed object of my invention is to provide a novel and improved form of articulated conveyor structure in which a single cylinder and piston located beneath the conveyor structure and within the lateral limits thereof forms the means to change the position of the swinging part of the conveyor at will.

A still further object of my invention is to provide a novel and improved form of articulated conveyor structure particularly adapted for loading machines operating in confined spaces underground utilizing a center strand endless chain and flights having means for maintaining the path of travel of the chain of a uniform length in all positions of articulation of the conveyor and utilizing a cylinder slidably movable about a transverse axis and pivoted for movement about a vertical axis coincident with the longitudinal axis of the conveyor and so located with respect to the movable pivot of the laterally movable part of the conveyor that there will be a minimum amount of displacement of said cylinder with respect to its axis of pivotal movement in all positions of articulation of the conveyor.

A still further object of my invention is to provide a novel and improved swinging means for a laterally swingable trough section of an articulated conveyor including a cylinder movable about a vertical axis and a piston rod extensible from opposite ends thereof and so connected with the swingable portion of the conveyor as to maintain the loads on the piston rod under tension during swinging of the conveyor.

These and other objects of my invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

Figure 1 is a plan view of a loading machine having an articulated conveyor and lateral swinging means therefor, constructed in accordance with my invention, embodied therein;

2

Figure 2 is a fragmentary longitudinal sectional view taken through the point of articulation of the rear part of the conveyor, with the conveyor chain and flights broken away, in order to show certain details of my invention;

Figure 3 is an enlarged partial diagrammatic plan view at the point of articulation of the conveyor, with the material carrying pans of the conveyor broken away in order to show the means for extending or retracting the laterally movable part of the conveyor as it moves toward or from the longitudinal center line thereof;

Figure 4 is a view somewhat similar to Figure 3 but showing the articulated or laterally swinging part of the conveyor in one extreme position of articulation.

In Figure 1 of the drawings, a mobile loading machine 10 of a type commonly used to load coal at the working face of a mine underground is shown as having a continuous articulated conveyor 11 extending along the top of a main frame 12 thereof and beyond the forward and rear ends thereof. A gathering mechanism 13 is shown as extending in advance of the forward end of the conveyor 11 and along opposite sides thereof for picking up loose coal from the ground and loading it onto said conveyor. Said gathering mechanism and loading machine 10 are of a well-known form and may be like that shown and described in Patent No. 2,388,385 which issued to Frank Cartlidge November 6, 1945, so need not herein be shown or described in further detail.

The conveyor 11 is shown as being a center strand laterally flexible endless chain and flight conveyor including a plurality of strands of chain 15, 15 pivotally connected at their ends to flights 16, 16 for movement with respect thereto about vertical axes. Said chain is guided along the conveyor on the ends of said flights, engaging the side walls of the trough sections of the conveyor. As herein shown, the front part of the conveyor 11 is laterally swingable to enable the gathering mechanism 13 to be positioned laterally with respect to the main frame 10 to pick up loose material from the ground from opposite sides thereof, as in the aforementioned Cartlidge Patent No. 2,388,385. This part of the conveyor is no part of my present invention so need not herein be shown or described further.

The rear part of the conveyor includes a stationary trough section 17 extending along the top of the main frame 12 of the loading machine and having a pair of laterally spaced side walls 19, 19 and a bottom plate 20 along which the chain 15 and flights travel. The bottom plate 20 is spaced above the return run of the conveyor and has a widened generally fan-shaped rear end portion 21. The rear end portion 21 has an arcuate rear end conforming to the path of movement of a laterally swingable tail-section 23 of the conveyor

and slidably engaged by the forward end of a bottom plate 24 thereof (Figure 1).

The bottom plate 20 and the laterally swingable tail section 23 of the conveyor overhang the rear end of the main frame 12 for discharging the gathered coal into mine cars and the like. Said tail section, as herein shown, includes a pair of laterally spaced side walls 25, 25 extending upwardly and downwardly from the bottom plate 24 and suitably secured thereto. Flexible side walls 27, 27 are suitably guided for slidable movement along the side walls 25, 25 and abut the top surface of the bottom plate 24. The flexible side walls extend across the support plate 20 and slide laterally therealong during lateral movement of the tail section 23 and are secured at their forward ends to the side walls 19, 19 of the stationary trough section to form a continuous laterally flexible trough to the discharge end of the conveyor in all positions of articulation thereof, as in the aforementioned Patent No. 2,388,385.

The tail section 23 is slidably supported on a supporting frame structure 29 having a support plate 30 flaring at its rear end to a generally fan-like form similar in form to the bottom plate 20 and laterally flaring rear end portion 21 thereof. The frame structure 29 has the bottom plate 20 suitably supported thereon in vertically spaced relation with respect to the plate 30 and may be transversely pivoted to the main frame 12 of the conveyor on trunnions 28, 28 to afford a means to vertically adjust the tail section of the conveyor. The plate 30 is herein shown as underlapping a bottom plate 31 forming a support for the return of the conveyor and as extending rearwardly therefrom. The plate 31 has a rearwardly projecting central portion 32 in the general form of an ear extending over a forwardly opening recess 33 in the support plate 30 but terminating in advance of the forwardly facing rear wall thereof. A pivot pin 34 is secured to the bottom of the projection 32 as by machine screws 35, 35 and depends therefrom. The pivot pin 34 is shown as having a block 36 pivotally mounted thereon which forms a slidable guide for a bottom plate 40 of the tail section of the conveyor. The block 36 extends within a rectilinear slot 37 formed in a forwardly projecting tongue 39 of the bottom plate 40. The tongue 39 is secured to the bottom of the bottom plate 40 and extends forwardly therefrom within the recess 33 of the support plate 30 and slidably engages the bottom of the ear 32. The bottom plate 40 forms a support for the return run of the conveyor and the material carrying plate 24 thereof. The plate 40 is also laterally movable along the plate 30 on a bearing strip 41 extending across the top of the plate 30, and the level of the top surface of said plate 40 is on the same level as the level of the top plate 31.

The plate 30 is shown as having an arcuate slot 42 extending thereacross for a portion of the width thereof. A pin 44 secured to and depending from the bottom of the plate 40 extends downwardly through the slot 42 and is slidably guided therein. A plate 45 is shown as being secured to and extending along the bottom of the rear portion of the plate 30 and as having a slot 46 extending therealong in registry with the slot 42, but wider than said slot. A follower 47 on the lower end of the pin 44, which may be the head of said pin, is slidably guided along slot 46.

The slots 46 and 42 are so formed as to form a cam with the pin 44 and follower 47 to extend the laterally swingable tail section 23 of the conveyor as it moves past the longitudinal center line of the machine in one direction or another, and to retractibly move said tail section as it approaches the longitudinal center line of the machine, to maintain a uniform tension on the chain 15 as its path of travel is shortened as it passes to either side of the longitudinal center line of the machine. During this extensible or retractible movement of the tail section 23 effected by the follower 47 moving along the guide slot 46, the block 36 pivoted on the pin 34 will also form a movable pivot for the tongue 39 and plate 40 and control movement of said plate during articulation of the conveyor.

The plates 31 and 30 are shown as having outwardly flaring side walls 48, 48 and 49, 49, respectively, extending along opposite sides of the respective of said plates and forming a support for the bottom plate 20 on the frame structure 29. The plates 49, 49, besides serving to support the bottom plate 20, also serve to limit lateral swinging movement of the tail section 23 of the conveyor. The plates 48, 48 also serve to guide the return run of the chain to travel to the longitudinal center of the conveyor and therealong over the main frame 12 as the tail section 23 is in one laterally extended position or another.

The plate 40 has outwardly flaring side walls 50, 50 extending along opposite sides thereof and upwardly to the bottom of plate 20 and having slidable engagement with the bottom thereof. Said side walls also extend to the bottom of the bottom plate 24 of the tail section 23 rearwardly of the bottom plate 20 and may form a support for said bottom plate 24 and may also guide the return run of the conveyor to the side walls 48, 48.

The mechanism for laterally swinging the tail section of the conveyor to either side of the longitudinal center line of the machine at the will of the operator includes a yoke 51. Said yoke is shown in Figure 2 as abutting the bottom of the tongue 39 and as being suitably secured thereto, as by welding. The yoke 51 has two forwardly projecting arms 52, 52 spaced equally on opposite sides of the center line of the tongue 39, to which are connected opposite ends of a piston rod 53 by means of pins 54, 54. The connection between said pins and piston rod may be a relatively loose connection to place the portion of the piston rod 53 swinging the tail section of the conveyor under tension and to release the opposite end portion of said piston rod from compression stresses.

The piston rod 53 extends in opposite directions from a centrally disposed piston 55 movable within a fluid pressure cylinder 56. While a single piston rod is herein shown as extending in opposite directions from the piston 55, it is obvious that two piston rods may be provided in place of the single piston rod.

The cylinder 56 may be of any well known form of double-acting fluid pressure cylinder with fluid inlet ports at each end thereof to admit fluid to either end of said cylinder and at the same time release it from the opposite end thereof under the control of suitable valve means (not shown). The valve means may be of any well known form and will not herein be shown or described since it forms no part of the present invention.

The cylinder 56 is herein shown as being mounted on the frame structure 29 for pivotal movement about a vertical axis intersecting the transverse axis of said cylinder and for limited slidable movement along its transverse axis on trunnion pins 57 and 58 extending upwardly and downwardly from said cylinder. The trunnion pin 57 is herein shown as being formed integrally

with and extending upwardly from a block 59 slidably guided between a pair of spaced guide ribs 60, 60 extending upwardly from the outer wall of said cylinder and transversely thereacross. The trunnion pin 57 is journaled on the bottom plate 31 in a bearing 61 for movement about a vertical axis intersecting the longitudinal axis of the conveyor 11.

The trunnion pin 58 is likewise formed integrally with a block 63. Said pin extends downwardly from the block 63 and the cylinder 56 and is slidably guided between a pair of guide ribs 64, 64 depending from the bottom of the cylinder 56 and extending transversely thereacross. The depending trunnion pin 58 is journaled coaxially with the pin 57 in a bracket 65 spaced beneath the plate 31 and secured thereon in advance of the cylinder 56 as by welding. The trunnion pins 57 and 58 are thus pivoted to a stationary part of the conveyor frame for movement about a vertical axis intersecting the longitudinal axis of the frame and mount the cylinder 56 for pivotal movement with respect to said frame about said vertical axis, and also allow rectilinear movement of the cylinder along the blocks 59 and 63 in a direction transverse of said cylinder to compensate for the spacing of the pin 34 from the true pivotal axis of the tail section 23 and thus to accommodate said cylinder for any longitudinal movement of the tail section 23 with respect to the support frame 31 as said tail section is laterally moved along the support plates 30 and 31.

It should here be noted with reference to Figures 3 and 4 that while the tail section 23 is extensibly and retractibly moved as it passes toward or from a longitudinal center line of the conveyor, said tail section in reality pivots about an imaginary axis along the stationary part of the conveyor forwardly of the axis of the pivot pin 34, and the axis of pivotal movement of the cylinder 56 with respect to the sliding pivot for said tail section may be located in such position that there will be a minimum amount of displacement of the blocks 59 and 63 relative to the cylinder 56 during lateral swinging movement of the tail section 23.

It will further be noted that when fluid under pressure is admitted to one end of the cylinder 56 to swing the tail section of the conveyor, the piston rod 53 will be under tension and the swivel blocks 59 and 63 will take the swinging load along the respective ribs 60 and 64 forming the transverse guide for said swivel blocks.

It may also be seen that fluid under pressure is admitted to the same end of the cylinder 56 as it is desired to swing the tail section 23 of the conveyor, and that as fluid under pressure enters one end of the cylinder 56, the piston 55 will exhaust an equal amount of fluid from the opposite end of said cylinder through the control valve means therefor, and the fluid exhausted from said cylinder will serve as a check against sudden impact loads.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. An articulated conveyor comprising two spaced trough sections, one of which is laterally movable with respect to the other, a stationary plate extending from one of said trough sections and supporting the other of said trough sections for lateral swinging movement with respect thereto, and means for laterally swinging said

movable trough section comprising a member pivoted for movement about a vertical axis in alignment with the center line of said stationary trough section and also mounted for lateral slidable movement with respect to said vertical axis, a second member carried thereby for slidable movement with respect thereto and extending from opposite ends thereof, and operative connections between opposite ends of said second member and said movable trough section.

2. An articulated conveyor comprising two longitudinally spaced trough sections, one of which is laterally swingable with respect to the other, a support plate extending from the stationary of said trough sections and supporting the movable of said trough sections for movement about a pivot movable along the longitudinal axis of said stationary trough section and disposed in advance of the forward end of the movable of said trough sections, a cylinder extending beneath the stationary of said trough sections in advance of said movable pivot, a piston within said cylinder, a piston rod extensible from opposite ends of said piston and cylinder and having relatively loose connection with said movable trough section at its opposite ends, and transversely slidable pivot means mounting said cylinder beneath the bottom of said stationary trough section for pivotal movement with respect thereto.

3. An articulated conveyor comprising two longitudinally spaced trough sections, one of which is laterally swingable with respect to the other, a support plate for the stationary of said trough sections and having the movable of said trough sections supported thereon, a longitudinally sliding pivot pivotally connecting the movable of said trough sections with said support plate, a transversely disposed sliding guiding connection between the movable of said trough sections and said support plate, extending the movable of said trough sections upon movement to either side of the longitudinal center line of the stationary of said trough sections, a power member on the opposite side of said moving pivot from said movable trough sections, means for pivotally mounting said power member for movement about a vertical axis disposed intermediate its ends and for movement transversely of said vertical axis, and a member extensible from the opposite ends of said power member and having pivotal connection with said movable trough section at its ends at points spaced laterally of the longitudinal axis thereof for laterally swinging the same.

4. An articulated conveyor comprising a trough structure having an endless chain and flights guided for movement therealong from one end thereof to the other, said trough structure including a stationary trough section, a laterally swingable trough section spaced therefrom, and flexible side walls connecting said trough sections together to form a continuous trough from one end of the conveyor to the other in all positions of articulation of the conveyor, and means for laterally swinging said laterally swingable trough section comprising a cylinder extending transversely of said trough sections and having a piston movable therein and a piston rod extensible from opposite ends thereof, means mounting said cylinder on the bottom of the stationary of said trough sections for movement about a vertical axis, a yoke extending from said swingable trough section and relatively loose connections between opposite ends of said piston rod and said yoke at points spaced laterally and in advance of

the pivotal axis of said swingable trough section.

5. An articulated conveyor comprising a trough structure having an endless chain and flights guided for movement therealong, said trough structure including a stationary trough section and a laterally swingable trough section spaced therefrom and mounted for swinging movement about a movable pivot, flexible side walls connecting said trough sections together to form a continuous trough from one end of the conveyor to the other, and means for laterally swinging said swingable trough section comprising a cylinder extending transversely of said swingable trough section and disposed therebeneath in advance thereof, means pivotally mounting said cylinder for pivotal movement about a vertical axis intersecting the longitudinal axis of said stationary trough section and for limited movement transversely of said vertical axis, a piston in said cylinder, a piston rod extending from opposite ends of said piston and extensible from said cylinder, and an operative connection between the opposite ends of said piston rod and said swingable trough section at points spaced laterally from and in advance of the movable pivot thereof.

6. An articulated conveyor comprising a trough structure having an endless chain and flights guided for movement therealong from one end thereof to the other, said trough structure including a stationary trough section and a longitudinally spaced laterally swingable trough section with flexible side walls connecting said trough sections together to form a continuous trough from one end of the conveyor to the other, and means for swinging said swingable trough section comprising a cylinder extending transversely of and disposed beneath said stationary trough section, two vertically spaced blocks pivoted for movement about a vertical axis intersecting the longitudinal axis of said stationary trough section, a slidable connection between said blocks and said cylinder mounting said cylinder for pivotal movement and for slidable movement in a direction transverse to the longitudinal axis thereof, a piston in said cylinder and a piston rod extensible from opposite ends of said cylinder and having operative connection at its ends with said swingable trough section.

7. An articulated conveyor comprising two spaced aligned trough sections, one of which is laterally swingable with respect to the other, an endless chain and flights guided for movement therealong between the side walls thereof, and flexible side walls connecting said trough sections together and guiding said chain on said flights for movement past the axis of articulation thereof, a support plate extending rearwardly from the stationary of said trough sections and forming a support for the movable of said trough sections, a longitudinally slidable pivot connecting the movable of said trough sections with said support plate, a sliding guiding connection between the movable of said trough sections and said support plate, extensibly and retractibly moving said movable trough section as it passes toward and from the longitudinal center line of the stationary of said trough sections to maintain a uniform tension on the chain in all positions of articulation of the conveyor, a power member, means mounting said power member on the stationary of said trough sections on the opposite side of the axis thereof from said sliding connection for movement about a vertical axis and for slidable movement transversely of said vertical axis, a member carried by said power member for movement toward either end thereof and having pivotal connection with the movable of said trough sections at points spaced laterally from the pivotal axis thereof, for laterally swinging said movable trough section upon the application of power to said power member.

8. In an articulated conveyor structure particularly adapted for use on a low-vein face loading machine comprising a self-propelled main frame having a conveyor at the forward end thereof extending upwardly from a position adjacent the ground to a position adjacent the top of said main frame and along the top thereof and beyond the rear end thereof, and having a laterally movable discharge end, a support frame structure for said discharge end and a pivotal and slidable connection for said movable discharge end on said support frame structure, the improvements comprising means for laterally swinging the discharge end of said conveyor disposed beneath said conveyor and within the lateral limits of said support frame structure including a cylinder mounted on said support frame structure for movement about a vertical axis disposed intermediate its ends and forwardly of said movable pivot and for movement transversely of said vertical axis, a piston in said cylinder, a piston rod extending in opposite directions from said piston and extensible from opposite ends of said cylinder and having operative connection with said laterally movable discharge end of said conveyor at its opposite ends at laterally spaced points disposed forwardly of the pivotal axis thereof, to swing said discharge end in the direction of application of pressure to said piston and maintain said piston rod under tension in either direction of movement of said laterally swingable discharge end portion of said conveyor.

9. In a low-vein face loading machine, including a self-propelled main frame, an elevating conveyor extending from in advance of the forward end of said main frame along the top thereof and having a laterally movable discharge end portion overhanging the rear end of said main frame, a support frame structure on said main frame forming a support for said discharge end of said conveyor, a longitudinally slidable pivotal connection between said laterally swingable end of said conveyor and said support frame structure, a transverse guiding connection between said support frame structure and the laterally swingable discharge end of said conveyor, extensibly moving said conveyor as it passes beyond the longitudinal center line of the machine and retractibly moving said conveyor as it approaches the center line of the machine, the improvements comprising power means for laterally swinging the discharge end of said conveyor disposed beneath and within the lateral limits of said support frame structure and including a cylinder, a slidable pivotal mounting for said cylinder on said support frame structure disposed intermediate the ends of said cylinder and mounting said cylinder for pivotal movement about a vertical axis and for slidable movement about an axis extending transversely thereof, a piston within said cylinder, a piston rod extending from opposite ends of said piston and beyond opposite ends of said cylinder, a yoke extending forwardly from said laterally swingable portion of said conveyor in advance of the pivotal axis thereof, and a relatively loose connection between opposite ends of said piston rod and said

yoke, to swing said laterally swingable discharge end of said conveyor in the direction of application of pressure to said piston, and maintain said piston rod under tension in either direction of swinging movement of said discharge end of said conveyor.

10. In an articulated conveyor, a support frame having a widened rear end portion, a conveyor trough extending along said support frame for a portion of the length thereof, a second support frame mounted on said first support frame for lateral swinging movement with respect thereto, a conveyor trough supported by said support frame and extending beyond the rear end of said first support frame and having lateral slidable movement therealong, flexible side walls connecting said troughs together, an endless chain and flight conveyor movable along said troughs, means mounting said second support frame for lateral movement along said first support frame about a movable pivot and for extending or retracting said second support frame as it moves away or toward the longitudinal axis of said first support frame, to maintain a uniform tension on the conveyor, and means for laterally swinging said second support frame and the trough thereon comprising a cylinder pivoted for movement about a vertical axis in advance of the movable pivot of said laterally flexible trough, a piston within said cylinder, a piston rod extending from opposite ends of said piston for extensible movement from opposite ends of said cylinder, a yoke extending forwardly from said second support in advance of the movable pivot thereof, and relatively loose connections between opposite ends of said piston rod and said yoke.

11. In an articulated conveyor structure, a support frame having a widened rear end portion, a conveyor trough extending along said support frame for a portion of the length thereof, a second support frame mounted on said first support frame for laterally swingable movement with respect thereto and extending rearwardly therefrom, a conveyor trough extending along said second support frame beyond the rear end thereof, and endless chain and flight conveyor movable along said troughs, and flexible side walls connecting said troughs together, a guide extending longitudinally along one of said support frames, adjacent the forward end thereof, a slide pivotally mounted on the other of said support frames and movable along said guide, a lateral guide extending transversely of one of said support frames rearwardly of said first-mentioned guide and a follower on the other of said support frames movable along said lateral guide, said lateral guide being of such a shape as to extend or retract said movable support frame as it moves from or toward the longitudinal axis of said stationary support frame, and maintain a uniform tension on said conveyor, a cylinder disposed in advance of said guide and beneath the stationary frame of said support member, a vertical pivotal connection between said cylinder and the stationary of said support frames, a piston within said cylinder, a piston rod extending from opposite ends of said piston and said cylinder, a yoke extending forwardly from the movable of said support frames, and operative connections between opposite ends of said piston rod and said yoke for laterally swinging the movable of said support frames and said laterally swingable trough section in the direction of application of fluid pressure to said piston.

12. In an articulated conveyor structure, a support frame having a widened rear end portion, a conveyor trough extending along said support frame for a portion of the length thereof, a second support frame mounted on said first support frame for lateral swingable movement with respect thereto and extending rearwardly therefrom, a conveyor trough extending along said second support frame beyond the rear end thereof, an endless chain and flight conveyor movable along said troughs, and flexible side walls connecting said troughs together, a guide extending longitudinally along one of said support frames, adjacent the forward end thereof, a slide pivotally mounted on the other of said support frames and movable along said guide, a lateral guide extending transversely of one of said support frames rearwardly of said first-mentioned guide and a follower on the other of said support frames movable along said lateral guide, said lateral guide being of such a shape as to extend or retract said movable support frame as it moves from or toward the longitudinal axis of said stationary support frame, and maintain a uniform tension on said conveyor, a cylinder disposed in advance of said guide and beneath the stationary of said support frames, two vertically spaced blocks pivotally connected to the stationary of said support frames, and aligned oppositely facing transverse guides on said cylinder having slidable engagement with said blocks, a piston within said cylinder, a piston rod extending from opposite ends of said piston and said cylinder, and operative connections between opposite ends of said piston rod and the movable of said support frames.

13. In an articulated conveyor, a support frame having a widened rear end portion, a conveyor trough extending along said support frame for a portion of the length thereof, a second support frame, means pivotally mounting said second support frame on said first support frame for lateral swinging movement with respect thereto, a movable conveyor trough supported by said second support frame and slidably supported on said first support frame, means flexibly connecting the side walls of said conveyor troughs together, an endless chain and flight conveyor movable along said troughs and means for laterally swinging said second support frame and trough comprising a cylinder extending laterally of said trough sections and mounted therebeneath for pivotal movement about a vertical axis spaced from the pivot of said second support frame, a piston within said cylinder, a piston rod secured to said piston and extending from opposite ends thereof for extensible movement from opposite ends of said cylinder, a yoke on said second support, and relatively loose connections between opposite ends of said piston rod and said yoke.

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