Dec. 9, 1969 M. FLÖTER 3,482,878

TRAVELING SUPPORT ASSEMBLY FOR A LONGWALL MINING PLOW AND CONVEYOR

Filed Oct. 31, 1967

2 Sheets-Sheet 1

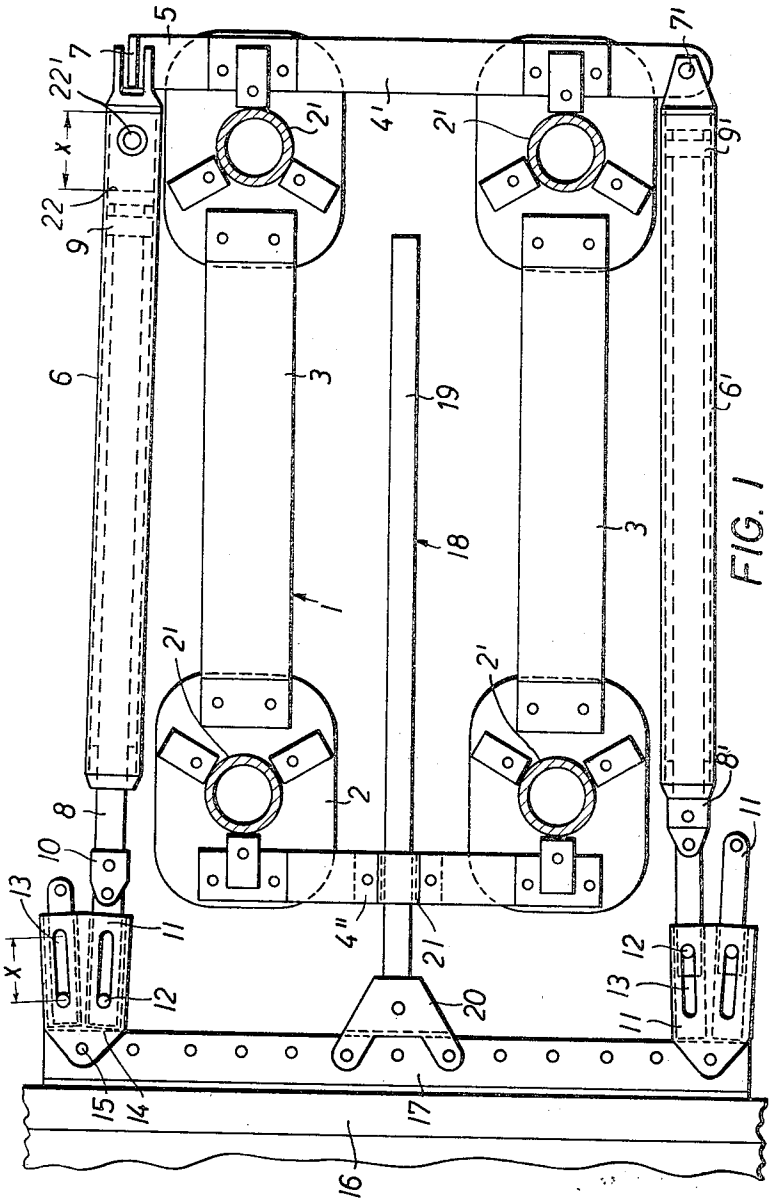



FIG. 1

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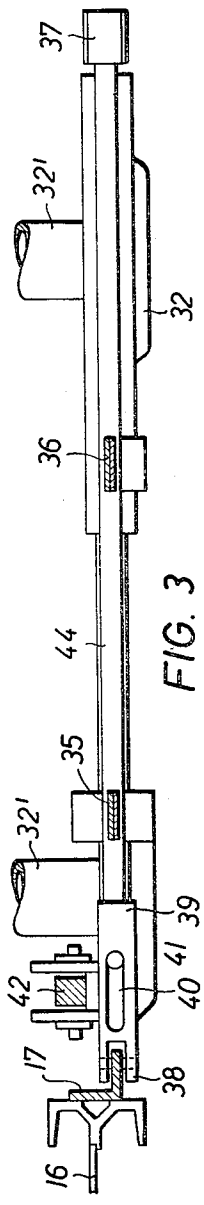



FIG. 3

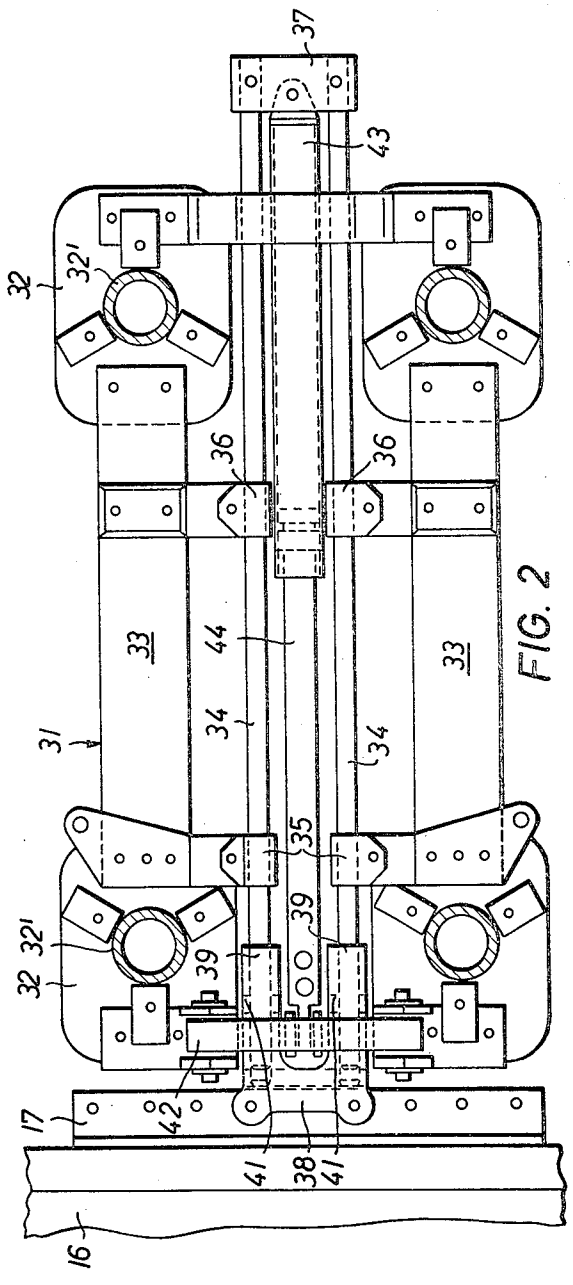



FIG. 2

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# TRAVELING SUPPORT ASSEMBLY FOR A LONGWALL MINING PLOW AND CONVEYOR

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U.S. Cl. 299—32 12 Claims

## ABSTRACT OF THE DISCLOSURE

A support assembly, such as a support trestle, used in combination with a longwall mining plow and conveyor, having a hydraulic piston arrangement coupled for moving the conveyor and support arrangement toward and away from each other through a connection which allows limited free movement, as for example a slide coupling with stops so that when the support arrangement is moved toward the conveyor the free movement is taken up and the piston of the piston cylinder arrangement must initially move in the cylinder by the amount of this free movement before acting to advance the conveyor thus ensuring a reserve space in the cylinder into which the piston can move when excess force is exerted on the conveyor by the action of the plow thus allow "breathing" by forcing fluid from the reserved space through an excess pressure relief valve.

This invention relates to an improved traveling support assembly for a longwall mining plow and conveyor. Mining equipment for longwall mining provided with a conveyor which is extended along the longwall mining face and which has a plow which is drawn back and forth to remove minerals from the mine face and deposit the same in the conveyor, is well known. In order to allow the plow or planer to remove the minerals the same must be urged against the mine face as it is drawn back and forth across the conveyor and as the mineral is removed by this action from the mine face, the conveyor must be advanced. For this purpose it is well known to utilize support assemblies, such as support trestles which are provided with prop arrangements and a piston cylinder arrangement for moving the conveyor and prop arrangement toward and away from each other in order to advance the conveyor with respect to the prop arrangement toward the mine face and for alternately advancing the prop arrangement toward the conveyor. Generally the prop arrangement is secured between the mine floor and ceiling and acts as a support for the ceiling. The piston cylinder arrangement then serves to press the conveyor away from the thus supported prop toward the pine face and to advance the conveyor. After the conveyor has advanced a certain distance generally as allowed by the piston cylinder stroke, the props are released from holding contact and the piston cylinder arrangement actuated on a reverse stroke to "walk," i.e. advance the prop arrangement toward the conveyor where the same is then again secured in place and the cycle repeated. As the coal plow is drawn back and forth across the conveyor on its mining strokes a certain yieldability or "give" of the conveyor to back away from the mine face must be provided in order to ensure against blockage of the plow which will cause chain



breakage and/or shear bolt fracture. This movement or yieldability of the conveyor away from the mine face by action of the plow in order to prevent plow blockage is known in the art and referred to as "breathing," and it is well recognized that the piston cylinder arrangements which are used to urge the conveyor toward the mine face or the other means used for this purpose must be provided with adequate yieldability when a certain maximum force is exceeded so that the conveyor can "breathe."

In certain embodiments of mining equipment of this type the piston cylinder arrangements which were used to urge the conveyor toward the mine face and advance the conveyor, i.e., the shifting cylinders, were operated with a compressible fluid such as air, so as to provide this yieldability. In other embodiments in which the shifting cylinders were hydraulic piston cylinder arrangements, excess pressure relief valves were provided so that a hydraulic fluid could be blown off or bypassed under excess of pressure exerted on the pistons allowing yieldability and the conveyor to "breathe."

In order for this to occur, however, the piston had to be sufficiently advanced in the cylinder to allow for a reverse stroke and if the piston were completely retracted in the cylinder at the end of its reverse stroke such further movement could not occur and with the piston in this position the conveyor could not breathe. In order to avoid this condition it was the general practice not to completely exploit the full stroke of the piston during the walking operation when the support assembly was advanced toward the conveyor and to leave an adequate reserve distance for the breathing. This procedure however, was subject to human error and thus did not ensure adequate security against blockage of the plow and thus damage to the machinery which could be caused therefrom.

Proposals have been made to avoid this problem by use of special constructions of the shifting cylinders or the like, but these constructions in general do not prove satisfactory due to the increased expense and/or decrease in reliability or ruggedness due to the special measures required.

One object of this invention is an improved construction for a hydraulically actuated support assembly for use with a longwall mining plow and conveyor which avoids the above mentioned disadvantages and ensures adequate "breathing" without change in the shifting cylinder construction.

This and still further objects will become apparent from the following description read in conjunction with the drawings in which:

FIG. 1 is a plan view partially in section of an embodiment in accordance with the invention,

FIG. 2 is a plan view partially in section of a further embodiment of the arrangement in accordance with the invention,

FIG. 3 is a side elevation partially in section of the embodiment shown in FIG. 2.

The support assembly to which the improvement in accordance with the invention is directed may be of any of the well known or conventional constructions used in combination with a longwall mining plow and conveyor and which has a prop arrangement such as in the form of a support trestle and a piston cylinder arrangement connected to the prop arrangement and the conveyor for moving the conveyor and prop arrangement

toward and away from each other for advancing the conveyor with respect to the prop arrangement and for alternately advancing the prop arrangement toward the conveyor. These support assemblies are sometimes referred to as "walking prop arrangements" and are not only widely known and used, but are described in the literature of the art. The piston cylinder arrangement is preferably a hydraulic piston cylinder arrangement having an excess pressure relief valve for allowing the conveyor to be forced back a limited distance toward the prop arrangement to "breathe." In accordance with the invention the piston cylinder arrangement is coupled for moving the conveyor and prop arrangement toward and away from each other through a connection which allows limited free movement in this direction. This connection allowing the limited free movement may, for example, be any sliding coupling arrangement or the like having an amount of play at least equal to the "breathing" required for the conveyor. With this limited free movement coupling when the prop arrangement is advanced toward the conveyor, i.e., as the prop arrangement is walked, this limited free movement or play is taken up. At this point if the conveyor must "breathe," it can "breathe" by this limited free movement which is now allowable in the opposite direction. As the piston of the piston cylinder arrangement is initially actuated to urge and advance the conveyor toward the mine face, this free play is initially taken up before the same can act on the conveyor. In taking up this free movement the piston of the piston cylinder arrangement moves in the cylinder ensuring a reserve space and stroke for reverse movement to allow "breathing." Thus, in connection with the hydraulic piston cylinder arrangement the piston may move into this reserve space on reverse stroke under excess force on the conveyor forcing liquid from this reserve space through the excess pressure relief valve allowing "breathing."

The improvement in accordance with the invention may, for example, be utilized in connection with multiple cylinders with the provision of such a free moving coupling being made for each cylinder.

The improvement in accordance with the invention may also be used in connection with arangements in which the shifting cylinder acts through an intermediate guidance arrangement with the sliding coupling being provided between the cylinder and this guidance arrangement. It is also possible to utilize the improvement in accordance with the invention with a prop system which is provided with an intermediate member which is rigidly connected with the conveyor and which is provided with guidance for alignment purposes.

In further development of the invention an intermediate member may also be connected angularly rigidly with the conveyor and the displaceable parts may also be angularly rigidly guided in the intermediate member, and spring bars, leaf springs or the like may be provided which serve in a manner known per se for the alignment of the support member, so that the shifting cylinder can be articulated to the free end of these leaf springs, bars or the like, and the shifting cylinder in turn again is connected with the support assembly at the conveyor end thereof.

Referring to FIG. 1 of the drawing the support assembly, except for the sliding coupling arrangement **11**, **12**, **13**, is of a basic and well known construction for a hydraulically traveling support.

The floor frame **1** of the hydraulically traveling support trestle consists of the holding or base plates **2** for the support props **2'**, the floor rails **3** connecting these and arranged in the direction of advance, and the beams **4'** and **4''** arranged transversely of the direction of advance. The rear beams **4'** are extended past both sides of the support trestle **1**, and are attached with their ends **5** through joints **7**, **7'** to the shifting cylinders **6**, **6'**. The joints **7**, **7'** are so designed that they permit angular movements of the shifting cylinders in relation to the support system in the most various planes and are preferably universal joints. The piston rods **8**, **8'** with their pistons **9**, **9'** are guided in the shifting cylinders **6**, **6'**. The piston rod ends **10** are connected to the conveyor preferably articulatedly with sliding joints **11**, the stops **12** of which are freely movable by a predetermined amount in the keyway **13**. This amount corresponds to the requisite amount of breathing of the conveyor in the passage of the coal plow. The sliding joints **11** are preferably guided in piston fashion in the casings **14**, which in turn are attached through fastening pins **15** to the special rails **17** of the conveyor **16**, which render fitting at different points possible.

To maintain alignment of the support trestle **1** with respect to the conveyor **16** an orientation element **18** in the form of a spring rod **19** is rigidly connected through the connecting flange **20** with the rail **17** of the conveyor **16**. The rod **19** is axially slidable through a guide bearing **21**. The orientation element **18** is in fact vertically displaceable, but not transversely displaceable in relation to the guide bearing **21**.

For the sake of illustration the two shifting cylinders **6** and **6'** are illustrated in different positions. The shifting cylinder **6'** has just terminated the follow-up stroke, i.e., the stroke advancing the trestle toward the conveyor. Its piston **9'** then lies practically on the end of the cylinder. The stop **12** also bears within the keyway **13** at the end of its free stroke.

The cylinder **6** is already reversed and charged by hydraulic pressure in the cylinder chamber **22** to advance the conveyor toward the mine face. The piston **9** is advanced by the amount $x$ so that the limiting element **12** bears on the other end of the keyway **13** having slide distance $x$ therein.

In both positions the plow can travel past without risk of being jammed in. While in the case of the cylinder **6'** the mechanical free stroke, through the members **11**, **12**, renders breathing of the conveyor possible, in the case of the cylinder **6** the hydraulic free stroke does this due to the fact that the hydraulic fluid can be blown off out of the chamber **22** through over-pressure valves **22'**. The sliding joints **11**, **12**, **13**, which are shown unconnected in FIG. 1 are for the attachment of adjacent support trestles of, for example, identical construction to that shown in FIG. 1.

In all other respects, construction and operation is conventional.

In the embodiment as shown in FIGS. 2 and 3, spring rods are provided for maintaining the prop arrangement in aligned position with the conveyor and the connection to the conveyor is made through these spring bars. The piston cylinder arrangement, i.e., the shifting cylinder, is connected for actuating these spring bars and the sliding connection allowing the limited free movement is between the shifting cylinder and these spring bars. In this same manner as the embodiment shown in FIG. 1, the device of FIGS. 2 and 3 has a floor frame **31** provided with the base plates **32** for the props **32'** which are connected together by the floor rails **33**. A pair of guide rails in the form of leaf springs **34** are slidably connected to the floor rails **33** by means of the sliding bearing connections **35**, **36**. These connections allow the rods **34** to slide parallel with respect to the floor rails **33**, but will not allow an angular displacement therebetween. The rear ends of the rods **34** are connected by the yoke **37**. The forward ends of the rods are connected to the rail **17** of the conveyor **16** by means of the flange **38** which is provided with the sliding sockets **39** into which the forward ends of the rods **34** slide. The limit of the sliding movement of the rods **34** in the sockets **39** is controlled by the sliding keyways **40** in the sockets and the pins **41** extending transversely through the rods **34**. A transverse yoke **42** extends across the forward end of the unit and the shifting cylinder provided with the cylinder portion proper **43** and piston portion **44** is connected between the yoke **42** and the rear yoke **37**, with the piston end **44** being connected

to the yoke 42, and the cylinder 43 being connected to the yoke 37. The piston cylinder arrangement 44, 43 is of the conventional and well known construction and is provided with an excess pressure relief valve to allow breathing of the conveyor. As the piston cylinder arrangement 43, 44 is actuated so as to draw the piston into the cylinder, the yoke 37 is pulled toward the yoke 42 forcing the rods 34 to push and advance the conveyor forward. Conversely, as the piston 44 is extended from the cylinder 43, the yokes 42, 37 are pushed apart causing the rods 34 to walk the prop arrangement toward the conveyor. Assuming a point of operation where the piston cylinder arrangement 43, 44 has completed its stroke advancing the conveyor with the piston 44 being retracted in the cylinder 43, the props 32' are released and the piston cylinder arrangement started on a reverse stroke to walk the prop arrangement toward the conveyor. As actuation of the piston cylinder arrangement causes the piston 44 to begin to extend from the cylinder 33, the action thereon between the yokes 42 and 37 causes the rods 34 to initially extend in the socket 39 until the pins 41 strike the rear end of the keyways 40. At this point the action is transmitted to the prop unit which is then walked to the position shown in FIG. 2. The props are then reset and the piston cylinder arrangement actuated in the reverse direction so as to force the piston into the cylinder. Initially before action is effected on the conveyor the free play involved in moving the pin 41 to the forward end of the keyways 40 is taken up causing the piston 44 to retract into the cylinder 43 by this amount thus leaving a reserve space of this amount in the cylinder 43 in which the piston 44 can move releasing fluid through the excess pressure relief valve and allowing "breathing," the length of the keyways 40 being determined by the "breathing" distance required. In this connection it should be noted that the movement of the piston to allow "breathing" is in the direction tending to move it out of the cylinder 43 and the excess pressure relief valve is so arranged in the conventional manner that the excess pressure can be released in this direction.

In all other respects the construction and operation of the device is conventional and well known. The piston cylinder arrangement 43 and 44 may be connected to the yoke 37 and/or the yoke 38 through a universal joint and may be vertically pivotably and rotatably mounted in order to prevent the transmission of forces which could lead to twisting of the piston cylinder arrangement, such forces being taken up by the rods 34. This construction is less trouble-prone. The point of connection between the piston 44 and the yoke 38 may in the conventional manner be vertically displaceable so, for example, the force is transmitted to mid-height of the assembly. The transverse yoke 30 may also be positioned at this height. In the case of mining thick seams where there is a substantial distance between floor and ceiling and thus long props are provided, this vertical intermediate position of the piston cylinder arrangement may be preferred.

It is also possible to provide two or more shifting cylinders, i.e., piston cylinder arrangements, one, for example, provided at the floor level as shown, and the other at the ceiling level connecting, for example, the roof girders as are conventionally provided on prop arrangements of this type.

If the rods 34 are so connected to the conveyor and so guided as to prevent movement of the conveyor in the vertical plane, then the piston cylinder arrangement 43, 44 may be vertically inclined with respect to the prop unit extending, for example, upwardly.

I claim:

1. In a support assembly used in combination with a longwall mining plow and conveyor and having a prop arrangement and a hydraulic piston-cylinder arrangement connected to the prop arrangement and the conveyor for moving the conveyor and prop arrangement toward and away from each other for advancing the conveyor with respect to the prop arrangement and for alternately advancing the prop arrangement toward the conveyor, the piston cylinder arrangement having an excess pressure relief valve for allowing the conveyor to be forced back a limited distance toward the prop arrangement to "breathe," the improvement which comprises the hydraulic piston cylinder arrangement being coupled for moving the conveyor and prop arrangement toward and away from each other through a connection allowing limited free movement whereby, when the prop arrangement is advanced toward the conveyor, this limited free movement is taken up and the piston of the piston cylinder arrangement must initially move in the cylinder by the amount of the free movement before acting to advance the conveyor ensuring a reserve space in the cylinder for movement thereinto of the piston under excess force on the conveyor to allow "breathing" by forcing fluid from the reserve space through the excess pressure relief valve, the limited free movement allowed by said connection being of sufficient length to provide a reserve space in the cylinder sufficient for said "breathing."

2. Improvement according to claim 1 in which said connection allowing limited free movement is a sliding connection having limiting stops.

3. Improvement according to claim 2 in which said sliding connection is in the form of a sliding socket having an elongated keyway, a rod member sliding in the socket and having a stop engaging the keyway.

4. Improvement according to claim 3 in which said sliding connection is in the form of two adjacent sliding connections for the attachment of piston cylinder arrangements of adjacent support assemblies.

5. Improvement according to claim 1 in which said piston cylinder arrangement is directly connected between a prop arrangement and the conveyor through said connection.

6. Improvement according to claim 5 in which said connection allowing limited free movement is a sliding connection having limiting stops.

7. Improvement according to claim 1 in which said prop arrangement is connected to the conveyor through a guided slide rod arrangement, the piston cylinder arrangement acting between the prop arrangement and the guide rod arrangement and said connection allowing limited free movement being positioned between the conveyor and the guide rod arrangement.

8. Improvement according to claim 7 in which said connection allowing limited free movement is a sliding connection having limiting stops.

9. Improvement according to claim 7 in which said guided slide rod arrangement comprises a pair of spaced-apart parallel rails connected to the conveyor through a flange provided with sockets into which the ends of the rails slide, said connection allowing limited free movement comprising slide key ways in said sockets and transverse pins connected to said rails slidably positioned in said key ways, said piston cylinder arrangement being parallelly positioned between said rails connected at the rear end thereof to said rails by means of a transverse yoke and at the forward end thereof to the prop arrangement.

10. Improvement according to claim 9 in which the forward end of said piston cylinder arrangement is connected to the prop arrangement by means of an articulated transverse yoke.

11. Improvement according to claim 10 in which said prop arrangement has sliding guide bearings connected to said rails.

12. In a hydraulically traveling support assembly such as a support trestle for a mining plow and conveyor arrangement with at least one shifting cylinder for urging and advancing the conveyor toward the mine face and for alternately walking the support assembly toward the conveyor, the improvement which comprises the shifting cylinder being coupled for moving actuation of the conveyor

through a coupling allowing limited movement of a distance substantially equal to the moving distance required for "breathing" of the conveyor.

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U.S. Cl. X.R.

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