April 8, 1969 A. VAN GELDER 3,437,011

INSTALLATION FOR CONTROLLING A PUSHING CYLINDER AT A WORKING FACE WITH POWER ADVANCED SUPPORTS

Filed Jan. 3, 1967 Sheet 1 of 3

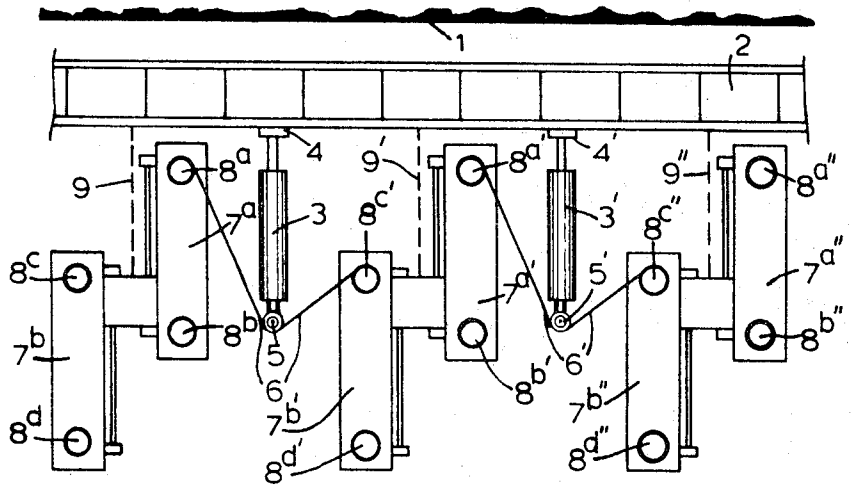


FIG.1

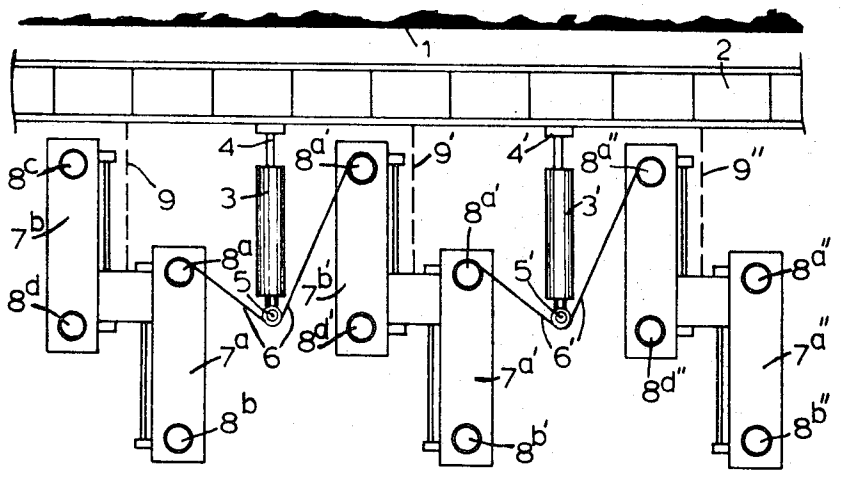


FIG.2

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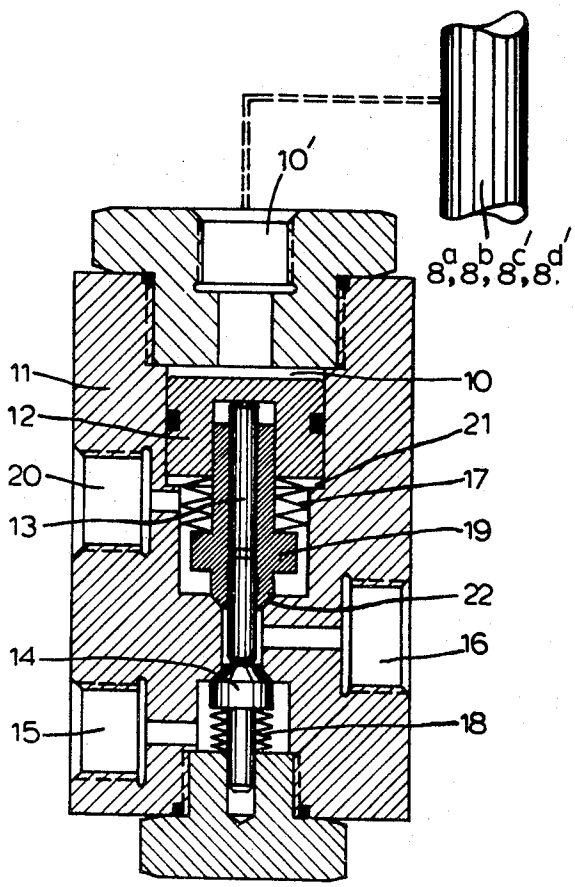


FIG.3

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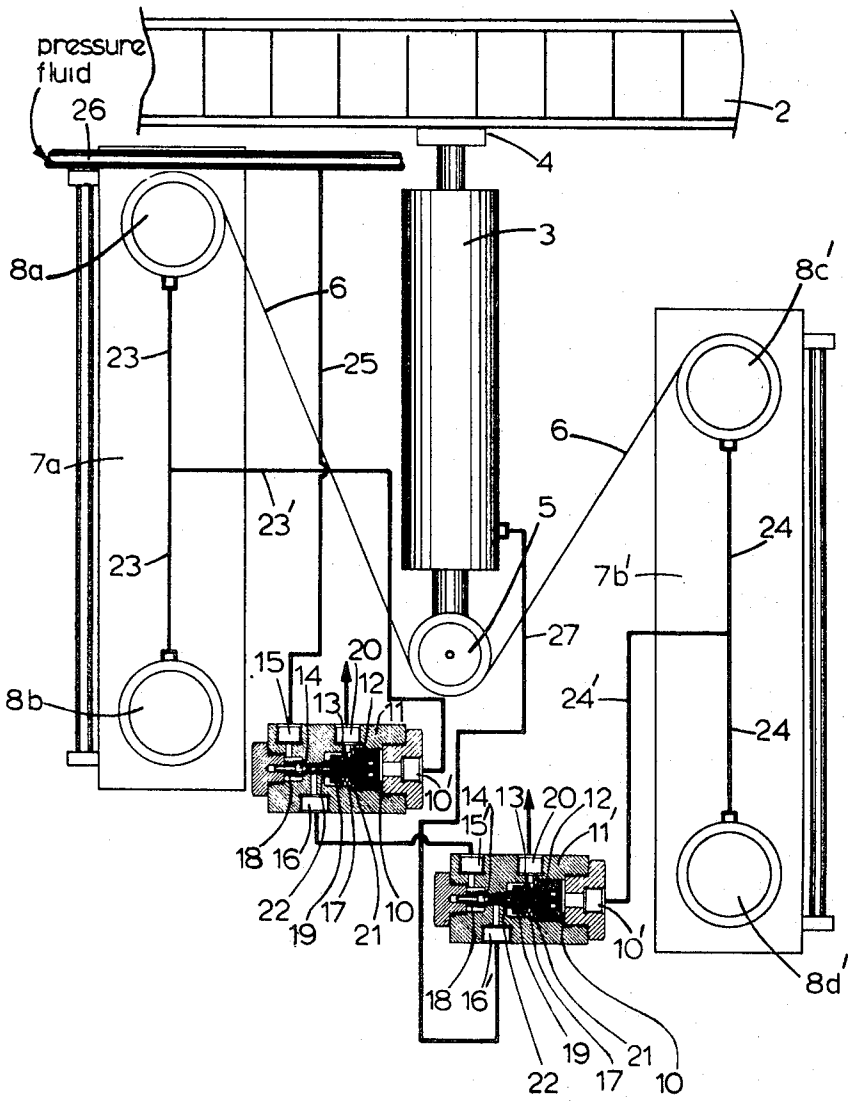


FIG.4

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INSTALLATION FOR CONTROLLING A PUSHING CYLINDER AT A WORKING FACE WITH POWER ADVANCED SUPPORTS

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4 Claims

ABSTRACT OF THE DISCLOSURE

Both the leading and trailing props of an alternately advanceable hydraulic roof support are pressurized, when sufficient material has been mined from the face to permit advancing of the mining machinery, a pushing cylinder is activated pushing the mining machinery forward an increment. To step the support forward, pressure is relieved from the trailing props and they are pushed forward by an advancing cylinder which reacts against the mining machine. A valve allows escape of back pressure from the pushing cylinder. The advanced, formerly trailing now leading props are again pressurized to complete the cycle.

The foregoing abstract, because of its brevity, should not be considered as an attempt to define or be in any way indicative of the scope of the invention disclosed in this document.

Background of the invention

If at a face equipped with a mechanical mining installation, power-advanced supports and the facilities for pushing the mining installation up to the face, the part of a power-advanced support connected to a pushing cylinder is advanced by a cylinder pertaining to the particular power advanced support, the piston rod of the pushing cylinder will be forced inwards. After the support has been advanced, this pushing cylinder can push the mining installation forward again. It is essential that during the advancement no pressure is admitted to the pushing cylinder and the hydraulic medium can flow off freely from the cylinder because the force exerted by the pushing cylinder is opposed to the force exerted by the advancing cylinder pertaining to a power-advanced support. If the two forces act simultaneously, advancement is hindered or made impossible, and it frequently happens that component parts of the installation get damaged. Further, a pushing cylinder must not exert pressure on the mining installation as long as the resulting reaction force cannot be taken up by a support, which is the case when the props of the support are not pressed against the roof or are pressed thereagainst with insufficient force. The control of a power-advanced support consequently calls for a given sequence of operations. In the case of manual control it may easily happen that one of the required manipulations is not performed or is incorrectly performed, which may result in delays and cause damage to parts of the installation.

Further, automatic displacement of power-advanced supports with which pushing cylinders cooperate in the way described in the beginning of this specification, is not at all possible so long as provision is not made for relieving the pressure from the pushing cylinders.

Summary of the invention

The present invention provides an installation which eliminates these drawbacks by providing between the feed line for the medium and the pressure compartment in the pushing cylinder, a valve which is actuated by a piston connected with the pressure compartment of the hydraulic support and by providing, between the pressure compartment in the pushing cylinder and the discharge line for the medium, a second valve which is held on its seating by a resilient element provided between said valve and the piston, the resilient element being so dimensioned, that when the piston is so placed by the medium pressure in the pressure compartment of the hydraulic support that the first valve is open, it transmits a force from the piston to the second valve just greater than the force needed for keeping said second valve closed against the pressure of the pressure medium.

According to the present invention, the feed and discharge of hydraulic medium to and from the pushing cylinder is controlled by the setting pressure of the supports. Use may be made of a shut-off device provided with an entrance and an exit valve, which device, upon attainment of the required prop pressure, can be actuated against spring pressure by a piston with a fixed end position. As this pressure is high, e.g. 250 at gauge, the exit valve and/or its seatings are apt to get damaged by the large forces exerted on said parts by the cylinder piston. This drawback is obviated in that a resilient element has been provided between the exit valve and the piston, which element is so constructed that when the props are under the required pressure, the resilient element transmits a force to the exit valve just larger than the force needed for blocking the pressure medium of the pushing cylinder. If the prop pressure decreases, or is relieved altogether, the entrance action of the piston displacement, and the force exerted on the exit valve by the spring pressure decreases so much that the valve can be easily opened by the backflow of medium produced by the inward travel of the piston.

Brief description of the drawing

FIGURE 1 shows a fragmentary top plan view of a mining face equipped with power-advanced supports and pushing cylinders;

FIGURE 2 is a view similar to FIGURE 1 showing the same face with the power supports in the advanced position;

FIGURE 3 is a longitudinal cross-sectional view of a valve according to the present invention; and

FIGURE 4 is a top plan view similar to FIGURE 1 showing the arrangement of the valves of FIGURE 3 in a mining installation.

The environment of the invention

In a face gallery, partly shown in FIGURE 1, a mining installation, which includes a conveyor **2**, is installed at a long-wall face **1**. The conveyor is pushed up to the face **1** by means of pushing cylinders **3**, **3'** etc. On one end (**4**, **4'** etc.) the pushing cylinders are rigidly connected for example by means of a piston rod, to the conveyor **2**, the other end **5**, **5'** being in rolling contact with ropes **6**, **6'** etc., the ends of which are fixed to base plates **7***a* and **7***b'*, respectively. Each of these base plates, which may be composed of coupled parts, forms part of a power-advanced support; base plate **7***a* constitutes a pair with base plate **7***b*, and base plate **7***b'* forms a pair with base

plate 7a'. Each of the base plates bears hydraulic props, base plate 7a bears the props 8a and 8b, base plate 7b the props 8c and 8d, base plate 7a' the props 8a' and 8b' and so forth along the face, beyond the ends of FIGURE 1.

If now, upon removal of a web of mineral from the face 1 by a mining machine (not shown) conveyor 2 has been pushed forward far enough by the pushing cylinders, 3, 3' etc. and the pressure has been relieved from the props 8c and 8d, 8c' and 8d', etc., the base plates 7b, 7b' etc. can be advanced until they are in the position shown in FIGURE 2. During the advancement of the base plates e.g. by means of advancing cylinders which are mounted between the base plates 7a and 7b, 7a' and 7b' etc., and derive their force of reaction from conveyor 2, this being indicated solely by a dotted line 9, 9' etc., substantially all pressure must be relieved from the pushing cylinders 3, 3' etc., as otherwise the advancement of the base plates 7a, 7a' etc. will be hindered by the force produced via the ropes 6, 6' etc.

Description of the preferred embodiment

Relieving the pressure from the pushing cylinders can now be done automatically by means of one or several valves, as shown in FIGURE 3.

The pressure chamber of props 8a, 8b, 8c' and 8d' (refer for these to FIGURE 4) communicate, in the embodiment of FIGURE 3, via port 10' with the pressure chamber 10 of the valve, the housing 11 of which may form part of a control valve of said prop which is operable to raise and lower that prop. The pressure in chamber 10 equals the pressure of the hydraulic medium in the prop, and may amount to for instance 250 atmospheres gauge. The chamber pressure acts on a piston 12. This piston may open a valve 14 by means of a pin 13, thereby enabling pressure medium to flow to the pushing cylinder 3 via entrance port 15 and exit port 16. If now the pressure is relieved from the prop, so that the pressure on piston 12 decreases, said piston is pushed back by a spring 17, so that valve 14 can be closed by a spring 18. At the same time, the force exerted on valve 19 by spring 17 decreases so much as to enable the latter valve to be easily opened by the medium flowing back from the pushing cylinder during the advancement of the base plate. Said medium can then escape through exit port 20. The force exerted on piston 12 is so large that it may be transmitted to valve 19 only via the spring 17. The stroke of the piston is limited by a collar 21 which can take up a force of for instance 3000 kgs. while a smaller force of for instance, 300 kgs., is transmitted to valve 19 and seating 22 by the spring 17. In this case the latter force must be slightly larger than that of the counter-pressure exerted on said valve by the pressure medium of the pushing cylinder. If the piston is in the topmost position, spring 17 exerts a slight force. Spring 17 is preferably designed as a stack of cup springs, so that the spring pressure can be accurately adjusted to a given value, and the spring force will vary considerably upon a slight displacement of the piston. Valve 19 can be made of synthetic material.

FIGURE 4 shows a preferred arrangement. The pressure chambers in the props 8a and 8b are connected to a valve 11 by means of tubing 23 and 23', the chambers in props 8c' and 8d' being connected a second valve 11' via the tubing 24 and 24'. Feed port 15 communicates with a pressure conduit 26 via a tubing 25; exit port 16 communicates with entrance port 15' of the second valve 11'. Exit port 16' of the latter valve communicates with the output side of pushing cylinder 3 via tubing 27. So, the valves 11 and 11' are arranged in series to permit the passage of pressure medium. This passage is blocked and discharge becomes impossible, if one or several of the props 8a and 8b or 8c' and 8d' is not under pressure. The casings of valves 11 and 11' may be made integral with the setting valves for raising and lowering the props. Another possibility is to provide each prop with such a valve, four in all, for the supports shown, and to connect them in series. If the power-advanced props are set automatically in some way or other, valves 11 and 11' will operate automatically during the displacements. The installation described should be seen as being well suited to form part of an automatic power-advanced face support.

Because the invention described hereinabove can be considerably modified without departing from the principles of the invention as set forth herein, the invention should be understood as encompassing all such modifications as are within the spirit and scope of the following claims.

What is claimed is:

1. Apparatus for pushing a mineral mining machine up to a working face comprising a hydraulic pushing cylinder adapted to be connected at one end to the mineral mining machine and connected at the opposite end thereof to at least one advanceable hydraulic prop support unit having hydraulically extensible props alternateable between a more pressurized, extended condition and a less pressurized retracted condition; conduit means connected to the hydraulic pushing cylinder for communicating a hydraulic medium feed line to the hydraulic pushing cylinder; a valve mechanism interposed in said conduit means, said valve mechanism also being communicated to the hydraulic pressure acting upon said hydraulically extensible props and being constructed and arranged to allow feeding of hydraulic medium from the hydraulic medium feed line to the hydraulic pushing cylinder only when said hydraulically extensible props are in said more pressurized, extended condition and to allow discharge of hydraulic medium from the hydraulic pushing cylinder when said hydraulically extensible props are in said less pressurized, retracted condition; said valve mechanism comprising: valve housing means having a piston reciprocably received therein for limited travel, one side of said piston being communicated to the hydraulic pressure action upon said hydraulically extensible props; a first valve in said housing means being movable between a first condition wherein a communication path is established through the conduit means and a second condition wherein communication through said conduit means is blocked, said valve being operatively connected to the piston for movement thereby; a hydraulic medium discharge line connected to said valve housing means; a second valve in said housing means; said second valve being operatively interposed between said hydraulic pushing cylinder and said hydraulic medium discharge line; said second valve being mounted for reciprocation onto and away from means defining a seat in said valve housing means; resilient means bearing against said piston and said second valve and being so constructed and arranged that when the piston is displaced sufficiently to open the first valve, said resilient means transmits a force from the piston to the second valve just greater than that needed for maintaining the second valve closed respecting said seat against the pressure of the hydraulic medium within the hydraulic pushing cylinder.

2. The apparatus of claim 1 wherein the resilient means comprises a stack of cup springs.

3. The apparatus of claim 1 further comprising a second advanceable hydraulic prop support unit having hydraulically extensible props alternatable between a more pressurized, extended condition and a less pressurized, retracted condition; a second valve mechanism interposed in said conduit means between the first-mentioned valve mechanism and the hydraulic pushing cylinder, said second valve mechanism also being communicated to the hydraulic pressure acting upon the hydraulically extensible props of said second advanceable hydraulic prop support unit and being constructed and arranged to allow feeding of hydraulic medium from the conduit means upstream of the second valve mechanism to the hydraulic pushing cylinder only when the hydraulically extensible props of said second advanceable hydraulic prop support unit are in said more pressurized, extended condition and

to allow discharge of hydraulic medium from the hydraulic pushing cylinder when said hydraulically extensible props of said second advanceable hydraulic prop support unit are in said less pressurized retracted condition.

4. The apparatus of claim 1 wherein said advanceable hydraulic prop support unit includes thereon a valve for admitting and exhausting hydraulic medium to at least one of said hydraulically extensible props, the last-mentioned valve being incorporated in a common valve housing means with said valve mechanism.

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U.S. Cl. X.R.

91—446, 448; 137—596.18, 627.5