ABSTRACT: Mine roof support means comprising a hydraulic roof support having side guide means adapted to be rendered operative and inoperative by hydraulic jacks under control of timing control means, so that in use with similar adjacent support, the side guide means is rendered operative for guiding one of the supports relative to the other when one of the supports is in roof supporting condition hydraulically and is acting as an anchorage support, and the other support is in nonroof supporting condition and is hydraulically being displaced relative to the anchorage support.
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MINE ROOF-SUPPORTING MEANS

CROSS-REFERENCES TO RELATED APPLICATIONS

Reference is made to British Pat. application No. 52,034/68 Nov. 2, 1968, W. E. & F. Dobson Limited, from which priority is claimed.

This invention is for improvements in or relating to mine roof support means comprising an extensible and contractable support adjustable between an extended roof supporting condition and a contracted condition in which it is advanceable from a rear to a forward position relative to an adjacent support.

When a row of such supports is used in an inclined seam there is a general tendency, when the supports are released from the roof and are being advanced, for some slippage of the supports down the seam, i.e. in relation to a conveyor, but it is preferable for the different advanced positions of each support to be straight forward. In one method of achieving this, the supports have been interconnected by wire ropes or chains which during part of the advance movements allow some slippage but thereafter restore the supports to their original positions in relation to the conveyor. A disadvantage of this method is that in very steep seams the slackness of the ropes or chains necessitated by the advance movements of the supports, might allow slippage of supports which cannot be tolerated. In another method the supports are arranged to lean one on another, and taper slides or runners between successive supports are provided for easing the relative advance movements. Although tipping of supports in a steep seam is avoided by this method, there occurs a time when the whole row of supports tends to become ironbound with the disadvantage of resisting the supports' advance movements.

An object of the invention is to provide mine roof support means in such improved manner as to avoid the said disadvantages.

The invention provides mine roof support means comprising a support adapted to be brought into roof-supporting and nonroof-supporting conditions, and side guide means mounted on the support and adapted for being rendered operative and inoperative when required. The support means conveniently includes control means for controlling the side guide means to become operative and inoperative when required. Conveniently also the support means includes an adjacent support adapted to be brought into roof-supporting and nonroof-supporting conditions, and said control means is adapted for controlling the side guide means to become operative and act as a guide between the two supports when one of them is in nonroof-supporting condition and is being displaced relative to the other support in roof-supporting condition and acting as an anchorage. The side guide means conveniently comprises a guide member and a piston and cylinder device adapted for rendering the guide member operative and inoperative. The support means conveniently includes main hydraulic means for operating each support, auxiliary hydraulic means for operating the side guide means, and a sequence control device for controlling operation of the auxiliary hydraulic means in suitable operational relationship with operation of the main hydraulic means. Conveniently also the side guide member is a guide bar carried by a plurality of hydraulic jacks to extend horizontally at a location at the side of a rear part of the support and at a height substantially midway of the extended height of the support. There is also conveniently a rubber sealing on the opposite side of the support at a position for sliding contact therewith of a side guide plate of an adjacent support. In one arrangement the support frame has vertical sideplates, and there are two spaced hydraulic jacks mounted in one of the sideplates and carrying the side guide bar. The main hydraulic means includes a main control valve operable from the main hydraulic means which displaces the side guide means into its projected position prior to operation of the main hydraulic means to release the support from the roof; the latter operation is followed, under control of the main control valve, by advance of the support and resetting of it to the roof, and the auxiliary hydraulic means is next operated, by predetermined built up pressure in resetting the support to the roof, to then contact the side guide member from the main predetermined roof-supporting pressure in the support has been attained. The main control valve may embody handle-controlled disc valves, or it may be pilot fluid controlled or solenoid controlled from adjacent supports or from a remote location, so that a plurality of the supports can be operated in required sequential manner. The sequence control device conveniently comprises a valve block, a valve controlled right angle throughway passage for connection between the main control valve and the support, and a valve-controlled transverse throughway passage for connection between the main control valve and the hydraulic jacks for the side guide member.

The foregoing and other features of the invention set out in the appended claims are incorporated in the construction which will now be described, as a specific embodiment with reference to the accompanying drawings in which:

FIG. 1 is a general rear view of an inclined mining seam having a row of roof supports.

FIG. 2 is a plan view of the roof supports.

FIG. 3 is a similar view to FIG. 2 at a second stage.

FIG. 4 is a similar view to FIG. 2 at a third stage.

FIG. 5 is a similar view to FIG. 2 at a fourth stage.

FIG. 6 is a similar view to FIG. 2 at a fifth stage.

FIG. 7 is a part perspective and part sectional view of one of the supports and control valve means therefor.

FIG. 8 is a similar view to FIG. 3 with the valve means at a different stage.

FIG. 9 is a similar view to FIG. 3 with the valve means at a further different stage.

Referring to FIG. 1, the inclined mining seam 1 is comparatively steep and it will be seen that there is provided in the seam a row of roof supports. All the supports are identical and hereinafter where the context so permits, particular reference to one support 2 will apply equally to each other support, like parts being given like reference numerals raised to first and second degrees. The support 2, which is of extensible, contractable and stepwise advanceable kind, is so disposed that when not extended to the roof it could, in the absence of special means provided, either slip down the seam or tip over.

In order to prevent this, a frame 3 of the support 2 has a sideplate 4 on which are mounted two spaced hydraulic jacks, 5, 6, FIG. 2, carrying a side guide bar 7. These jacks 5, 6 carry the side guide bar 7 to extend longitudinally of the support 2 at the side of a rear part of the support and at a height of, FIG. 1, substantially midway of the height of the extended support. The support 2 also has an opposite side frame plate 8.

By the use of main and auxiliary hydraulic means, to be hereinafter fully described, and starting with the support 2 in the rear roof-supporting position, FIG. 2, and with the side guide bar 7 retracted, as shown, the next operation of the support 2 is to be released from the roof. However before this happens, the two hydraulic jacks, 5, 6 are extended so that the guide bar 7 then bears against the frame 8' of the support 2', FIG. 3. This is followed by the support 2 being released from the roof, and, while maintaining the side guide bar 7 bearing against the plate 8', the support 2 is advanced, FIG. 4, to its forward position, FIG. 5. The next operation of the support 2 is to be reset to the roof, and when a required roof-supporting pressure has been attained, the side guide bar 7 is retracted, FIG. 6, by the two hydraulic jacks 5, 6 to its original position in which there is no contact with the plate 8' of the support 2'. Consequently the support cannot become ironbound, and throughout the stage when the support is released from the roof and until the required roof-supporting pressure is attained, the side guide bar 7 is in bearing or sliding engagement with the adjacent support, so that the support is prevented from slipping down the seam. Since the side guide bar 7 is disposed substantially midway of the height of the extended support, the support is also prevented from tipping over. Since all the supports are identical, these conditions apply equally well to each of the supports.
For the purpose of further particularly describing the invention it will be assumed that each support has a plurality of hydraulic props, FIG. 7, said frame 3, an advancing hydraulic jack 5, 6, said guide bar 7.

Such a support will usually have a main control valve 11 which is usually controlled by two handles, one which rotates a disc valve 12 for extending and retracting the hydraulic props 9, and the other of which rotates a disc valve 13 for extending and controlling the advancing hydraulic jack 10 which is for connection to a conveyor FIG. 2.

If desired that part 15 of the valve 11 which embodies the disc valves 12, 13 together with the handles, can be removed and replaced by alternative control means for pilot fluid control or solenoid valve control, from adjacent supports or from a remote location, in a desired sequential manner, substantially as disclosed in our Pat. No. (application No. 39088/65) to which reference is directed for full details.

Briefly with regard to the handle operation, and after the conveyor 14 has been advanced to its new position the support is released from the roof a few inches by moving one of the handles to rotate the valve disc 12 and to depress a dead man's handle button 16 usually employed in the valve. This provides for pressure fluid to pass from the feed 18, FIG. 9 through a valve 19 opened by the button 16 and through a disc 20 in the disc valve 12 to a line L1 which leads to the annulus ends of the hydraulic props 9 for their release from the roof. This release can be halted by moving the valve handle to a neutral position, FIG. 7, where the disc valve 12 cuts off the feed to the hydraulic props. The support is then advanced by moving the other handle valve to rotate the disc valve 13 into a position FIG. 7 where pressure fluid feed 18 is admitted through a duct 21 in the disc valve 13 to the annulus end of the advancing hydraulic jack 10. When the support has been fully advanced, the first handle is again moved to rotate the disc valve 12 to the position of FIG. 8 where pressure fluid from the feed 18 then passes a valve 22 opened by a dead man's handle button 17 and passes through the duct 20 in the disc valve 12 to admit fluid to the piston ends of the hydraulic props 8, thereby to reset the support to the roof, it being understood that the control valve also provides for return of fluid from either end of the props and advancing hydraulic jack when the other end is under fluid pressure.

For use in steep seams, as hereinafter described with reference to FIGS. 1 to 6, the control valve 11 has associated with it a sequence control valve 23, FIGS. 7 to 9. This valve has a throughway passage 24 controlled by a spring pressed conical valve 25, 25a, and a transverse passage 26 controlled by a nonreturn ball valve 27 controlled by a piston 28. The passage 24 is connected by the aforesaid line L1 to the control valve 11, the other end of the passage 24 is connected by line L2 to the annulus end of the hydraulic jacks 9, one end of the transverse passage 26 is connected by line L3 to the control valve 11 and is also connected by line L4 to the annulus ends of the hydraulic jacks 5, 6, and the other end of the transverse passage 26 is connected by line L5 to the piston ends of the hydraulic jacks 5, 6. The line L2 is also connected by a return line L6 to the control valve 11.

In use of this sequence valve, when the disc valve 12 is turned to the position of FIG. 9 for release of the support from the roof, and the button 16 is pressed, pressure fluid passes from the line L1 to the passage 24 in the sequence valve 23. This pressure fluid will pass the nonreturn ball valve 27 and via line L5 to the piston ends of the hydraulic jacks 5, 6. This will extend these two jacks thereby pushing the guide bar 7 into contact with the frame plate 8 of the next support, FIG. 3. Pressure will build up in the passage 24 governed by the conical seated valve 25 and its spring 25a.

When a desired stimulating pressure is attained, for example of the order of 750 p.s.i., the conical valve 25 will be opened by the pressure fluid passing through the passage 24 and transverse passage 26 in the control valve 11 and via line L2 to the line L6 whereby a piston 29 of the main control valve is operated to open a nonreturn ball valve 30 whereby the piston ends of the hydraulic props 9 are opened to a return passage 31 of the main control valve. Pressure fluid in the line L2 will also pass to the annulus ends of the hydraulic props 9 which will consequently contract to release the support from the roof. Pressure may fall in the passage 24 of the sequence valve but pressure will be held in the hydraulic jacks 5, 6 by virtue of the nonreturn ball valve 27.

This condition will remain while the support is advanced as before described, and the condition will continue while the valve handle is moved to rotate the disc valve 13 to the neutral position of FIG. 7 and the other handle is moved to rotate the disc valve 12 to the position of FIG. 8, for resetting of the support to the roof, during which pressure fluid passes from the feed to the piston ends of the hydraulic props. During this time fluid from the annulus ends of the hydraulic props 9 will be displaced via the line L2 to the passage 24 of the sequence valve 23. This pressure fluid will open the conical valve 25 and pass to exhaust via the line L1 and the return line 31 of the valve 11. However pressure will still be held between the nonreturn ball valve 27 and the hydraulic jacks 5, 6, so that the support continues to be stabilized by the guide bar 7 while the support is being reset to the roof.

The pressure fluid passing to the piston ends of the hydraulic props 9 is also fed to the annulus ends of the hydraulic jacks 5, 6 via the lines L3 and L4, but the hydraulic jacks 5, 6 will remain extended until a desired pressure is built up in the hydraulic props 9, sufficient to hold the support positively thrust against the roof, by virtue of the fact that the ball valve 27 temporarily prevents return fluid to fluid from the piston ends of the hydraulic jacks 5, 6. When however a desired roof-supporting pressure, for example of the order of 750 p.s.i., is attained, this acts on the piston 28 thereby to open the ball valve 27 so that fluid can then pass from the piston ends of the hydraulic jacks 5, 6 and the pressure acting on the annulus ends of the hydraulic jacks 5, 6 will contract them whereby the guide bar 7 is retracted into its original position leaving a space between it and the next support.

What is claimed is:

1. A self-advancing hydraulic mine longwall and roof support system in combination with a conveyor, comprising a plurality of interconnected and laterally spaced self-advancing piston and cylinder roof support assemblies, each having a sideway piston and cylinder lateral side guiding devices carried by said piston and cylinder roof support assemblies, hydraulic spacing devices including a main hydraulic means between each of two adjacent roof-support assemblies and consisting of two cylinder-piston units at two spaced points on the sidewalks of one roof support assembly, auxiliary hydraulic means for operating said side guide devices acting in lengthwise direction of the longwall face, a slide rail attached to the pistons and bearing against the facing sidewalk of the adjacent roof support assembly, main control valve means in said main hydraulic means operably associated with said piston and cylinder roof support assemblies for controlling the advancement and resetting of each roof support assembly in respect of their setting, release and advancement, a sequence control valve in said auxiliary hydraulic means comprising a valve block and a right angle communicating throughway passage for operative connection between the main hydraulic means, said main control valve means and said support assemblies, a valve controlling said throughway passage, said main control valve means and said piston and cylinder guiding devices having a communicating passage with a piston-operable valve for flow of pressure fluid from the main control valve means, when in return position to extend said piston and cylinder guiding devices, an automatic valve in said passage operable by built up pressure to admit pressure fluid to the main control valve means for causing release of the support assembly, a nonreturn valve for maintaining pressure on the piston and cylinder guiding device while the support is hydraulically advanced and is the lifting means wherein the lifting mean be said nonreturn valve under predetermined setting pressure to cause retraction of the piston and cylinder guiding devices. 2. A mine longwall and roof support system as in claim 1, characterized in that the extended length of the piston and
cylinder assemblies of the spacing support assemblies includes hydraulic control limiting means for selectively varying the lengths of stroke of said piston and cylinder assemblies.