ABSTRACT OF THE DISCLOSURE

A self-advancing mine roof support comprises, as an integral structure, outer units and an interjacent unit located between said outer units. Each outer unit comprises two base members arranged one behind the other and pivotally linked together. At least one pressure-fluid extensible prop is mounted on each of said base members and a roof-engaging structure is supported on the upper parts of said props. The interjacent unit comprises a base member and at least one pressure-fluid extensible prop mounted on said base member and a roof-engaging member supported on the upper part of said prop. Transverse members connect the outer units together and space them apart to receive the interjacent unit which is slidably guided between said outer units. The support includes pressure-fluid ram means operatively connected between the outer units and the interjacent unit of the support and adapts alternately to advance the interjacent unit and the outer units with respect to one another. The support may also include ram means for advancing a coal face conveyor.

This invention is for improvements in or relating to mine roof and like supports.

The invention is more particularly, although not exclusively, concerned with a support or chock designed primarily for use in high seam working in longwall mining and where a condition known as "back slip" is encountered. The expression "back slip" means a joint in a coal seam which is inclined away from the observer from floor to roof. It would be a "face slip" from the opposite direction. The structure of the coal in such conditions is such that a forward support should be advanced immediately a cut has been taken and yet leave a rear strong waste edge support in position for a longer period. An object of the present invention is to provide a support which is admirably suited to meet this requirement.

According to the present invention there is provided a self-advancing mine roof support comprising three laterally disposed support units each having at least one base member and at least one roof-supporting canopy spaced by a plurality of hydraulically extensible props, the roof-supporting canopy of the intermediate support unit having a length not substantially greater than that of the canopies of the outer support units, and pressure-fluid ram means connected to said units for displacing the base member of the intermediate support unit longitudinally with respect to the base members of the two outer units whereby the roof-supporting canopy of the intermediate support unit may be advanced immediately over a fresh cut in the coal face while the roof-supporting canopies of the outer support units remain in rearward roof-supporting condition.

According to a further feature of the invention there is provided a self-advancing mine roof support comprising outer elements or units and an intermediate element or unit located between said outer elements, each outer support element comprising two base members arranged one behind the other and articulated or pivotally linked together, at least one pressure-fluid extensible prop on each of said base members and a roof-engaging structure supported on the upper parts of said props, and the intermediate element comprising a base member and at least one pressure-fluid extensible prop on said base member and a roof-engaging member supported on the upper part of said prop, and pressure-fluid ram means operatively connected between the outer elements and the intermediate element of the support for alternately advancing the intermediate element and the outer elements with respect to one another.

In one preferred embodiment of the invention the pressure-fluid ram means comprises at least one and preferably two hydraulic rams having opposed pistons, one piston or pair of pistons being designed exclusively for pushing over the conveyor or other piece of apparatus and being movable quite independently of any of the support elements.

Generally, the construction will be such that the support as a whole is alternately lengthened and shortened as cutting of the coal at the coal face proceeds.

One particular embodiment of the invention will now be described, by way of example, with reference to the accompanying semi-diagrammatic drawings in which:

FIGURE 1 is a sectional elevation on the line I--I of FIGURE 2.

FIGURE 2 is a plan view and shows the condition of the support immediately before a cut is made at the coal face.

FIGURE 3 is a plan view with the roof-bar structure of the support removed and shows the condition of the support immediately after the cut has been made at the coal face, and

FIGURE 4 is a view similar to FIGURE 1 but showing the intermediate support unit in its advanced position.

The support shown on the drawings comprises outer support elements 10 and 11 which in effect constitute one unit and an intermediate support element 12.

Each outer support element comprises a base 13 in which is mounted, in the usual way, two hydraulically extensible legs or props 14 and 15. The props 14 and 15 support at their upper parts a roof-bar 16. Each outer support element also includes a further and forwardly located base 17 flexibly connected or articulated to the rearwardly located base 13 by a substantially rigid link 18 and hinge pins 19 and 20. The flexibility in the base structures, provided by the links 18 and hinge pins 19 and 20, is to take care of man-made floor irregularities, e.g. steps left by the coal-cutting machine, whereas the arrangement according to the invention to overcome the problem of back slip deals with conditions brought about by geological faults.

Hingedly connected to each roof-bar 16 by a pin and vertical slot arrangement, as indicated at 21, is a roof-bar extension 22 which rests on the upper part of a hydraulically extensible leg or prop 23 mounted in the base 17.
When the props are released from between floor and roof for advancement and re-setting they are spring-biased into a slightly canted position, towards the coal face, by means of spring devices 23a. This allows for sprung subsequent reverse tilting of the props, when re-set, due to roof movement.

The intermediate support unit comprises a base 24 on which is mounted, in the usual way, two hydraulically extensible legs or props 25 which support on their upper parts a forwardly extended or part cantilever roof-bar 26. Two of the intermediate supporting members 27 which slidably engage the base of the neighbouring outer support elements 10 and 11 so as to provide a guiding arrangement for the relative movement between the outer support elements and the intermediate support element. The members 27 may be flexible and resilient, e.g. in the form of leaf-springs.

Attached to the intermediate support unit on opposite sides of the base thereof are the cylinders 28 of two double-acting hydraulic ram devices constructed substantially as disclosed in the pending application of Archelaus Allen, Ser. No. 127,979, now Patent No. 3,186,178.

Each ram device has a pair of opposed pistons, the piston rods of which are indicated at 29 and 30. The piston rods 30 are coupled to the rear portions of the other support elements, by a pin and vertical slot arrangement, as indicated at 31, whilst the forwardly located piston rods 30 work freely through holes or vertically elongated slots in guide members 32 mounted on the forward base members 17, of the outer support elements. At their outer ends the piston rods 30 are provided with a clevis device 34a secured to the conveyor C.

Each ram device has means for selectively introducing pressure-filled into its cylinder at opposite ends thereof and between its opposed pistons.

The outer support elements 10 and 11 are strapped together by transverse members 33 and 34 at the back and front respectively.

Extension and retraction of the hydraulic legs or props and operation of the ram devices 28 is controlled by a conventional pressure-fluid circuit and hand valve means having the necessary positions to raise and lower the props and advance the base members in a proper and required sequence.

Immediately before a cut has been made at the coal face, in the vicinity of a support, the support elements occupy the position shown in FIGURES 1 and 2. Immediately a cut has been made the hand valve means required above is operated so that the props are retracted, the hydraulic ram devices 28 are operated to advance the intermediate support unit 12 to the position shown in FIGURE 3 and the props 25 are re-set, the outer support elements 10 and 11 remaining in position so as to maintain a strong waste edge support. After the intermediate support unit has been advanced and re-set, as just described, the hand valve is operated so that the pistons 30 of the hydraulic ram devices 28 are advanced so as to push over the conveyor C to which said rams are connected in the usual way by the clevis devices 30a. Finally, the hand valve is operated so that the props 15 and 23 are retracted, the hydraulic ram devices 28 are operated so that, through the piston rods 29, the outer support units are advanced and the props 15 and 23 are then re-set. The support structure is then in the condition shown in FIGURES 1 and 2 ready for the next cut to be made. It will be appreciated, as just described, that for advancing the support elements the hydraulically extensible legs or props are temporarily retracted, by the positioning of the valve, so as to release the support elements from between floor and roof.

It is noted from FIGURE 2 that the position of the forward leg 25 of the intermediate support element and the position of the piston rods 30 is such that there is no obstruction to the immediate advance of the intermediate support element under the newly exposed roof.

Heretofore, where "back slip" conditions (i.e. a pronounced system of joints in coal of stratified mineral structure) occur at the bedding surface at an angle of 35° to 75° away from the observer from floor to roof have been encountered, a support system comprising conventional five-leg or six-leg chocks has been operated by advancing every other chock as an initial stage and then advancing the remaining chocks as a final stage. This has the disadvantage that the supports are too widely spaced to give an effective control at the face and waste edge because in such conditions the supported roof tends to slide away from the face supported area and in turn creates heavy chock loading. With the arrangement according to the present invention which utilizes a support within a support arrangement, the centre section or element is advanced whilst the members on either side remain set to the roof, after which the two outer members or elements are advanced whilst the central member or element is set to the roof. Thus, at no time is the roof supported at a greater distance than from the centre section of one chock or support to the outer member of the adjacent chock or support. This results in a high degree of control at the waste edge. Similarly, the greatest distance of support at the face is from the centre of one chock or support to the centre of the adjacent support.

A support according to the present invention is extremely stable by virtue of the fact that all support elements are interconnected. The construction shown on the drawings offers excellent travelling track for men working on the coal face. It will be noted from FIGURE 3 that the conveyor D may, in the mode of operation, not result in any material obstruction of the travelling track between the line of props 14, 25, 14 and the line of props 23, 25, 23.

The roof-bars 22 and/or 26 may be provided with retractable and extensible extension roof-bar members.

I claim:

1. A self-advancing mine roof support comprising as an integral structure, outer units and an interjacent unit located between said outer units, each outer unit comprising two base members arranged one behind the other and flexibly linked together, at least one pressure-fluid extensible prop on each of said base members and a roof-engaging structure supported on the upper parts of said props and the interjacent unit comprising a base member, at least one pressure-fluid extensible prop on said base member and a roof-engaging member supported on the upper part of said prop, at least one transverse member connecting the outer units together and spacing them apart to receive the interjacent unit, guide means on the interjacent unit which slidably engage guide means on the outer units, and pressure-fluid ram means operatively connected between the outer units and the interjacent unit of the support for alternately advancing the interjacent unit and the outer units with respect to one another.

2. A mine roof support as claimed in claim 1 wherein the pressure-fluid ram means comprises two hydraulic rams each having a cylinder, opposed pistons in said cylinder and means for selectively introducing pressure-fluid into the cylinder at opposite ends thereof and between the opposed pistons, said cylinder and one of said pistons being operatively connected between one of the outer support units and the interjacent unit for alternately advancing the interjacent unit and the outer support units with respect to one another and the other of said opposed pistons being operable independently of any of the support units and serving to push a conveyor towards a mineral face.

3. A mine roof support as claimed in claim 1 wherein the guide means on the interjacent unit are flexible and resilient.
4. A mine roof support as claimed in claim 1 wherein each outer support unit has three pressure-fluid extensible props arranged in line one behind the other and the interjacent unit has two pressure-fluid extensible props arranged in line one behind the other so that when the interjacent unit is advanced with respect to the outer units the props of the interjacent unit are substantially in lateral alignment with props of the outer units to form an operator path through and across the three units.

References Cited

UNITED STATES PATENTS
2,803,444 8/1957 Potts --------------- 299-33 X
3,120,105 2/1964 Kibble et al. ---------- 61-45.2

FOREIGN PATENTS
916,164 8/1954 Germany.

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