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Parker et al.

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[54] **MINE PROOF SUPPORT**

[75] Inventors: **James Eric Parker; Nigel Hill,** both of Cheltenham, England

[73] Assignee: **Dowty Mining Equipment Limited,** Tewkesbury, England

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[51] **Int. Cl.²** **E21D 23/04**

[58] **Field of Search** ..... 61/45 D; 299/33; 198/126

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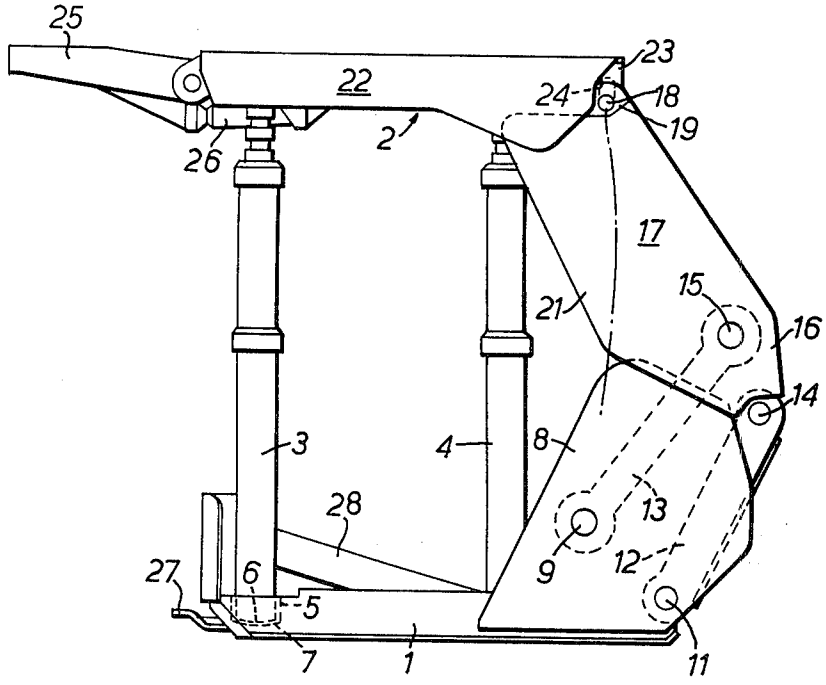
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Primary Examiner—Jacob Shapiro
Attorney, Agent, or Firm—Young & Thompson

[57] **ABSTRACT**

A roof support for use in a mine comprising, a roof-engaging canopy, a floor-engaging beam, a plurality of variable length struts extending between the floor beam and the canopy, and guide means comprising a first link pivotally connected at one position to the floor beam, a second link pivotally connected at another position to the floor beam spaced from the one position, a third link pivotally connected at spaced positions along its length to the first and second links and an extension fixedly secured to the third link and pivotally connected to the canopy, such that the centre of the pivotal connection to the canopy is limited by the links and the extension to move solely in a fixed path approximately at right angles relative to the plane of the floor beam, the pivotal connection to the canopy being arranged to permit angular tilting movement of the canopy relative to the floor beam about two axes both of which lie parallel to the plane of the canopy and to resist angular movement relative to the floor beam in the plane of the canopy.

4 Claims, 3 Drawing Figures



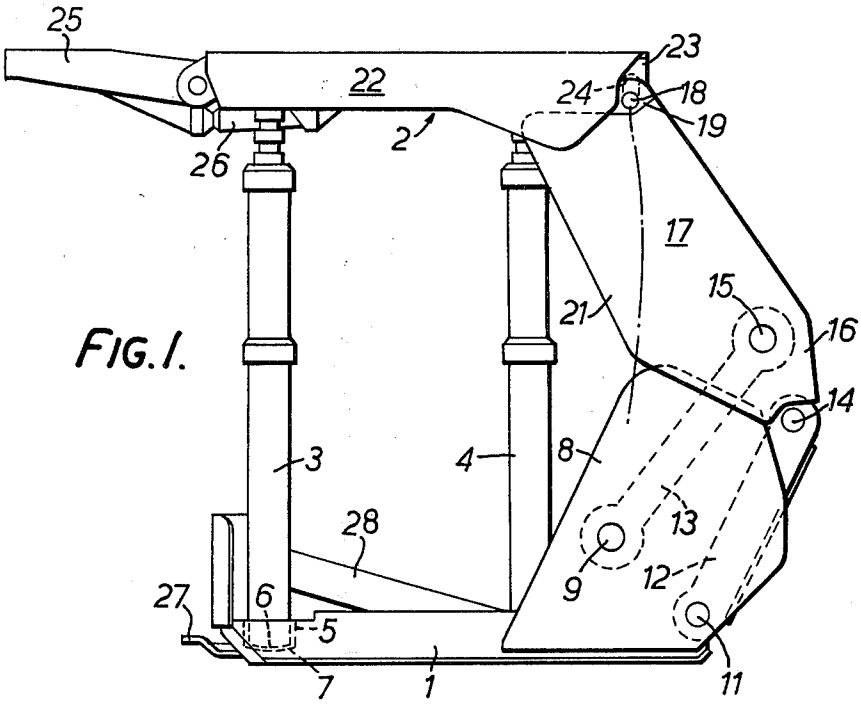


FIG. 1.

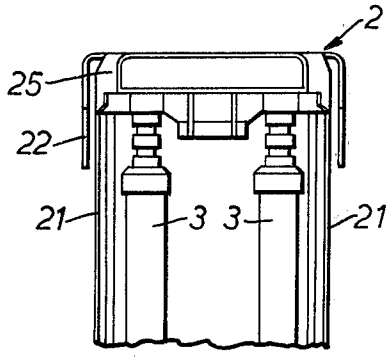


FIG. 2.

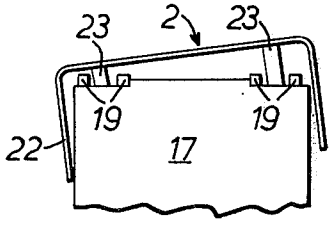


FIG. 3.

MINE PROOF SUPPORT

This invention relates to a mine roof support having a floor-engaging beam a roof-engaging canopy, and a plurality of variable length struts extending between the floor beam and the canopy. In use a large number of such supports are arranged in a line along a mineral working face in a mine and are individually advanceable towards the face. The variable length struts of each support are arranged conventionally so as to be capable of yield when the roof load acting on the canopy becomes excessive. For this purpose the struts are preferably hydraulic jacks. The conventional support has the disadvantage that lateral movement of the canopy relative to the floor beam, i.e. movement without altering the spacing between the canopy and the floor beam is resisted by limiting the permitted angular movement of the variable length struts on the floor beam so that the struts are subjected to substantial bending moment and must necessarily be constructed to resist such bending moments. It is also known to provide a lateral guide means for a roof support which acts between the floor beam and the canopy to resist lateral movement of the canopy relative to the floor beam and to remove the need to use the variable length struts to resist lateral movement of the canopy. However, in practice, it is found that a canopy supported by a lateral guide means does not have sufficient freedom of movement to accommodate itself to roof variations, and the object of the present invention is to provide a roof support having a lateral guide means in which the canopy has increased freedom to accommodate itself to roof variations.

In accordance with the present invention, a roof support for use in a mine comprises a roof-engaging canopy, a floor-engaging beam, a plurality of variable length struts extending between the floor beam and the canopy, and guide means comprising a first link pivotally connected at one position to the floor beam and a second link pivotally connected at another position to the floor beam spaced from the one position, a third link pivotally connected at spaced positions along its length to the first and second links and an extension fixedly secured to the third link and pivotally connected to the canopy such that the centre of the pivotal connection to the canopy is limited by the links and the extension to move solely in a fixed path approximately at right angles relative to the plane of the floor beam, the pivotal connection to the canopy being arranged to permit angular tilting movement of the canopy relative to the floor beam about two axes, both of which lie parallel to the plane of the canopy and to resist angular movement relative to the floor beam in the plane of the canopy.

The axes of the pivotal connection between the floor beam and the first and second links and between the third link and the first and second links may all be substantially parallel to the plane of the floor beam and parallel to one another.

Where the support is intended for advancing movement over the mine floor the links may be arranged at the rear of the support having regard to its advancing direction.

The third link may be arranged as a shield to resist entry of rubble from the rear of the support into the space between the canopy and the floor beam.

The pivotal connection between the canopy and the third link extension may comprise a plurality of slots in the canopy each substantially at right angles to the plane of the canopy, and a plurality of co-axial pins on the third link for engaging the slots, the axis of the pins being transverse to the advancing direction.

The fixed path for the centre of the pivotal connection of the third link to the canopy may be such that lowering of the variable length struts results in slight forward movement of the canopy in the advancing direction over all or a substantial part of the available range of movement of the canopy relative to the floor beam.

The variable length struts may be engaged in the floor beam and the roof beam by thrust bearings which permit angular movement.

One embodiment of the invention will now be described with reference to the accompanying drawings, in which:

FIG. **1** is a side elevation of a roof support for use in a mine,

FIG. **2** is an end elevation of the upper part of the forward end of the support, and

FIG. **3** is an end elevation of the upper part of the rear end of the support.

The support comprises a floor beam **1** for engaging the floor, a roof-engaging canopy **2** and two pairs of hydraulic jacks **3** and **4** forming variable length struts extending between the floor beam and the canopy. At the rear of the floor beam, a pair of side plates **8** are fixedly secured, the side plates being bored to provide bearings for pivot pins **9** and **11.** In between the two side plates **8** a pair of links **12** and **13** are mounted on the pins **9** and **11.** At their opposite ends, the links **12** and **13** carry respectively the pivot pins **14** and **15** which are located in spaced bores in a third link **16.** An integral extension **17** of the third link extends upwardly terminating in a plurality of co-axial pivot pins **18** secured in lugs **19.** The link **16** with its extension **17** includes side plates **21** which closely fit over the outside surfaces of the plates **8.** The side plates **21** conveniently carry the bores for pin **15.** The link **16** and its extension **17** extend the full width of the canopy **2** and form a shield against the entry of rubble from the rear of the support into the space between the floor beam and the canopy. The link **12** also extends substantially the full width of the canopy again to form a shield.

The canopy **2** is provided with downwardly extending side flanges **22** which extend on the outside surfaces of the upper end of the extension **17.** The canopy rests on the upper ends of the jacks **3** and **4** and the jacks rest on the floor beam **1** by means of thrust bearings permitting of angular movement such as that indicated at **5, 6, 7.** At its rear end the canopy **2** is provided with a pair of internal lugs **23,** each of which includes a slot **24** extending substantially at right angles to the plane of the canopy. The lugs **23** are adjacent the longitudinal edges of the canopy and are thus spaced by substantially the full width of the canopy. The pins **18** engage in the slots **24.**

The canopy at its front end carries a pivotally mounted cantilever **25** adjustably held in its operative position by means of a hydraulic piston-and-cylinder device **26** carried by the canopy **2.**

The floor beam **1** carries a relay bar **27** for connection to a conveyor located underneath the cantilever **25.** The relay bar is connected to an inclined advancing jack **28,** also mounted in the floor beam **1,** the function

of the advancing jack **28** being to advance the support relative to the relay bar **27.** The relay bar is located in position by the conveyor and the support will advance over the mine floor towards the conveyor, this direction being from right to left as seen in FIG. **1.** Thus the left-hand side of FIG. **1** is the forward end of the support and the right-hand side of FIG. **1** is the rearward end of the support.

When in use the support shown in the drawings is located in a mine in a row with many similar supports adjacent to the mineral face, the cantilever **25** being closely adjacent to the mineral face. The conveyor underneath the cantilever **25** will also be adjacent to the mineral face. As mineral is excavated from the face it will be carried away by the conveyor and from time to time the advancing jacks in the supports will advance the conveyor up to the new mineral face. Also from time to time each support will release itself from the roof and advance itself up to the conveyor.

When the jacks **3** and **4** urge the canopy to engage the roof the links **17** and **12** will form a shield against the entry of the rubble from the rear of the support. The roof will be rough and the canopy will adjust itself angularly to engage the roof as evenly as possible. For this purpose, the canopy can tilt about two different axes both of which are parallel to the plane of the canopy. The first axis is the axis of the pins **18.** When the canopy tilts about this axis, the jacks **3** and **4** will set to differing lengths. The pins **18** will rest against the lower most of the slots **24.** The other axis of adjustment is a longitudinal axis parallel to the length of the canopy in the advancing direction. Tilting about this axis will again result in the hydraulic jacks **3** and **4** setting to different lengths and the tilting effect as shown in FIG. **3** in particular is facilitated by movement of the slots **24** over the pins **18.**

By suitable design of the links **12, 13, 16** and extension **17** and by suitable location of the pivot points **9, 11, 14** and **15,** the central axis of pivot pins **18** is limited for movement relative to the roof beam solely in a path substantially at right angles to the plane of the floor beam. With the links and pivots as illustrated, the locus of movement of the central axis of pins **18** is shown by the chain dotted line in FIG. **1.** The lower part of this line is such that during downward movement of the canopy, the central axis of pins **18** and the canopy **2** will move slightly in the forward direction. For preference the links and pivot points are so arranged that downward movement of the canopy over its full range from the fully extended to the fully contracted position will result in a slight forward movement. More particularly, this feature is useful under conditions where the hydraulic jacks **3** and **4** yield under excessive roof loading, the slight forward movement then given to the canopy serving to push the roof towards the mineral face and to reduce the tendency of the roof to crack above the canopy.

The lateral guiding means formed by links **12, 13** and **16** and extension **17** will act through pins **18** which form the pivotal connection to the canopy and slots **24** to strongly locate the canopy relative to the floor beam in the advancing direction. In particular the lateral guiding means will ensure movement of the canopy with the floor beam during advance of the support and in spite of possible slight engagement of the canopy with the roof during such advance. It will further be seen that engagement of the pins **18** in the slots **24** will act to prevent any angular movement of the canopy **2** in the plane of the canopy. It will also be seen that the links **12, 13, 16, 17** will locate the canopy against any movement relative to the floor beam transversely to the advancing direction. The hydraulic jacks **3** and **4** by virtue of their pivotal connections at the floor beams and the canopy will be subjected to little or no bending moment and thus need only be constructed to act efficiently as struts.

We claim:

1. A roof support for use in a mine comprising, a roof-engaging canopy, a floor-engaging beam, a plurality of variable length struts extending between the floor beam and the canopy, and guide means comprising a first link pivotally connected at one position to the floor beam, a second link pivotally connected at another position to the floor beam spaced from the one position, a third link pivotally connected at spaced positions along its length to the first and second links and an extension fixedly secured to the third link and pivotally connected to the canopy, such that the center of the pivotal connection to the canopy is limited by the links and the extension to move solely in a fixed path approximately at right angles relative to the plane of the floor beam, the first link, the third link and its extension being arranged to extend substantially the full width of the support to form a shield and the pivotal connection to the canopy being arranged to permit angular tilting movement of the canopy relative to the floor beam about a longitudinal axis and a transverse axis both of which lie parallel to the plane of the canopy and to resist angular movement relative to the floor beam in the plane of the canopy.

2. A roof support as claimed in claim **1** wherein the axes of the pivotal connections between the floor beam and the first and second links and between the third link and the first and second links are all substantially parallel to the plane of the floor beam and parallel to one another and transverse to the length of the floor beam.

3. A mine roof support as claimed in claim **1,** wherein the pivotal connection between the canopy and the third link extension comprises a pair of slots in the canopy each substantially at right angles to the plane of the canopy and spaced apart by substantially the width of the canopy, and a pair of co-axial pins on the third link extension for engaging the slots, the axis of the pins being transverse to the length of the canopy.

4. A roof support as claimed in claim **1** wherein the fixed path for movement of the centre of the pivotal connection of the third link extension to the canopy is such that lowering of the canopy towards the floor beam results in slight forward movement of the canopy in the advancing direction over all or a substantial part of the available range of movement of the canopy towards the floor beam.

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