Fig. 18

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ROOF SUPPORTS FOR MINE WORKINGS

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ABSTRACT OF THE DISCLOSURE

This invention relates to a roof support for a mine working which includes a top structure and a bottom structure each sub-divided into an inner part and an outer part, the inner part being laterally with each other with the inner part in each case able to move angularly relatively to the outer part in a plane parallel to the floor and roof, the top structure being carried by hydraulic props mounted on the bottom structure, and the angular relation between the inner part and the outer part of the bottom structure or both structures being determined by guide devices engaged between the inner and outer parts at longitudinally spaced positions. One of such guide devices is adjustable and preferably comprises a power-operated laterally shiftable element mounted on the inner part and having faces contacting opposed laterally presented faces of the outer part of the structure.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to roof supports primarily for use in underground mine workings of the kind comprising a bottom structure for resting on the floor, a top structure for engaging and supporting the roof, a plurality of power-operated extensible props extending between the top and bottom structures, and traction means for advancing the support. Such supports are hereinafter referred to as being of the kind specified.

Self-advancing roof supports of the kind specified are ordinarily employed in a system of coal-mining known as "long wall mining" wherein a plurality of the supports are disposed at positions spaced apart laterally from each other along the length of the coal face, and a conveyor and coal-getting machinery is advanced periodically towards newly exposed portions of the coal face as coal is extracted therefrom by movement of the coal-getting machinery along the coal face, the traction means of the supports being operated to move the supports in succession towards the coal face.

In many mines the floor (and roof) of the mine working is inclined to the horizontal in a direction from one of the coal face towards the other, and there is often a tendency for an individual roof support to be displaced out of its proper laterally spaced relationship with the adjacent roof supports on each side of it, or for the whole of a group of successive roof supports to slide in the downward direction in which the floor of the mine working slopes.

One of the objects of the present invention is to ensure that individual roof supports can be advanced in the required direction towards the coal face without becoming displaced downwardly in a direction in which the floor of the mine working slopes laterally.

Description of the prior art

In my prior Patent No. 3,320,751 I have described and claimed a self-advancing roof support comprising a plurality of power-operated extensible props mounted on a base, and a roof engaging superstructure carried by the props, the support including a part which can be projected forwardly relatively to the remaining part by power-operated traction means, and including guide means for determining the direction of such projection relatively to a horizontal longitudinally extending reference axis of the support, such guide means having co-operative parts disposed respectively on said forwardly projectable part and on said remaining part of the support and defining mutually determined paths diverging respectively to the left and to the right with respect to the reference axis, the guide means and traction means being operable to project said part selectively along a path parallel to the reference axis or along one or the other of said divergent paths.

In the specific embodiments advanced in my prior patent the base of the support comprised a rearward base element and a forward base element (the latter forming the forwardly projectable part mentioned in the preceding paragraph) and the guide means comprised laterally displaceable slides situated at left and right of spaced positions on the rear base element and having apertures receiving a longitudinally extending guide plate fixedly connected to the forward base element so that, by appropriately adjusting the position of the slides, the path of movement along which the forward base element could be advanced was determined.

My co-pending application 690,856 filed Dec. 15, 1967 divided from my application 392,002 now issued as United States Letters Patent 3,571,901 relates to roof supports primarily for use in underground mine workings and is concerned with a roof support comprising a base, a plurality of power-operated extensible props carried thereon, a roof engaging superstructure, and traction means for advancing the support. I have described therein and claimed such a self-advancing roof support wherein the superstructure comprises two parts which are interleaved with each other but have mutual clearance laterally of the direction of advancement, and one of which projects forwardly of the other upon its advancement by the traction means, and wherein the lateral position and path of advancement of the forwardly projecting part relatively to a reference axis extending medially and longitudinally of the support is determined within the limits afforded by said mutual clearance by guide means disposed at the level of the superstructure, such guide means being adjustable to vary the angular relationship in a plane parallel to the roof between said path and said reference axis.

In the specific embodiment disclosed in my co-pending application 690,856 the guide means disposed at the level of the superstructure comprised a single guide member in the form of a cradle or trough which lay between lateral boundaries of a channel afforded by a rear part of the superstructure, such cradle or trough slidably receiving the rear portion of the fore part of the superstructure and itself being angularly movable about a substantial vertical axis by means of a pin connecting the trough or cradle to a horizontally angularly movable crosshead disposed in the base of the support.

Further, my co-pending application 701,138 filed Jan. 6, 1968 divided from my application 544,145 now issued as United States Letters Patent 3,399,927 is concerned with a roof support primarily for use in underground mine workings and comprising a base, a plurality of power-operated extensible props carried thereon, a roof-engaging superstructure, and a traction means for advancing the support. In this application I have described and claimed such a support wherein the superstructure comprised two parts which are interleaved with each other but had mutual clearance laterally of the direction of advancement and which were adapted to be alternately projected forwardly of the other upon its being advanced...
by the traction means, one of these parts of the superstructure being so supported from its associated prop or props so as to be capable of angular movement in a plane parallel to the floor of the working within the limits afforded by said mutual clearances, and wherein the angular position and path of advancement of each part of the superstructure relative to a horizontal, longitudinally extending, reference axis of the support was determined by guide means disposed at the level of the superstructure and comprising at least one adjustable guide element situated for positioning spaced longitudinally of the superstructure from the axis about which said angular movement may take place.

In the specific embodiment disclosed the axis about which said angular movement can take place was defined by one of the props carried by the base, and the guide element included plungers extending laterally outwardly from the inner part of the superstructure for engagement with the laterally inwardly presented face of outer faces of the superstructure, such plungers being urged outwardly by spring means or held positively in adjusted positions by clamping means, or displaced laterally by hydraulic piston and cylinder units to effect angular movement of the inner part of the superstructure about said axis.

Whilst all these foregoing arrangements provided in each case a substantial measure of improvement as to the construction for advancing guidance and steering, there were more especially in mine workings wherein the floor (and roof) slope laterally of the support, that is to say in the direction of the length of the coal face when mining is conducted in accordance with the method of long wall coal mining currently in use, conditions can arise in which these arrangements do not provide control as to the direction of advancement to the extent necessary to ensure that each roof support remains, over an extended period of use, in its proper position in a row of such supports extending along the coal face.

The object of the present invention is to provide improved means for guiding and steering the support along a path of advancement.

SUMMARY OF THE INVENTION

According to the present invention a support for supporting the roof of a mine working comprises a bottom structure for resting on the floor, a top structure for engaging and supporting the roof, a plurality of power-operated extensible props extending between said top and bottom structures, traction means for advancing said support, and includes the improvement wherein at least one of said structures includes longitudinally extending parts each having at least two longitudinally spaced seatings engaged by respective ones of said props, said parts are disposed in interleaved relation with each other in a direction laterally of the support, said parts are laterally spaced from each other to define inter-part clearance spaces providing the capability of relative angular movement between said parts in a plane generally parallel to said floor and roof, guide means are provided for controlling the relative angular positions of said parts in said plane, said guide means including a first guide device operatively engaged between said parts at a first position therealong, a second guide device operatively engaged between said parts at a second position therealong spaced longitudinally from said first position, at least one of said guide devices including means enabling the relative angular positions of said parts to be adjusted.

Embodiments of the invention will now be described with reference to the accompanying drawings wherein:

FIGURES 1 to 4 are diagrammatic views of one of the structures of a roof support of the kind specified provided with guide devices in accordance with the invention:

FIGURE 5 is a view in side elevation and in cross-section on the line 5—5 of FIGURE 7 of a first embodiment of roof support in accordance with the invention;

FIGURE 6 is a plan view of the first embodiment in cross-section on the line 6—6 of FIGURE 5;

FIGURE 6A is a fragmentary view in side elevation and in cross-section on the line 6A—6A of FIGURE 6 showing the provision of one of the stabilising elements on a side member of the bottom structure for stabilising the inner part of the bottom structure and props and top structure carried thereby against lateral deflection;

FIGURE 7 is a view in end elevation of the first embodiment on the line 7—7 of FIGURE 5;

FIGURE 7A is a fragmentary view in rear elevation showing the bottom structure of the first embodiment and in particular the laterally disposed transversely slidably plate incorporated in the adjustable guiding device at the rear end;

FIGURE 8 is a plan view of a second embodiment of a roof support of the kind specified in accordance with the invention, the top structure being omitted;

FIGURE 9 is a view in side elevation of the second embodiment;

FIGURE 10 is a view in end elevation and in cross-section on the line 10—10 of FIGURE 9;

FIGURE 11 is a plan view of a third embodiment of roof support of the kind specified in accordance with the invention, the top structure being omitted;

FIGURE 12 is a fragmentary plan view on an enlarged scale of one of the guide devices incorporated in the embodiment of FIGURE 11 but shown reversed left to right relative to the showing of FIGURE 11;

FIGURE 13 is a fragmentary view in side elevation of the guide device shown in FIGURE 12;

FIGURE 14 is a fragmentary view in end elevation and in cross-section on the line 14—14 of FIGURE 11;

FIGURE 15 is a view in end elevation and partly in vertical cross-section of a fourth embodiment of roof support of the kind specified in accordance with the invention generally similar to the third embodiment but incorporating longitudinally spaced guide devices in the top structure as well as in the bottom structure;

FIGURE 16 is a view in side elevation of a fifth embodiment of roof support of the kind specified in accordance with the invention incorporating two adjustable guide devices in both the bottom structure and the top structure;

FIGURE 17 is a diagrammatic view in plan, and partly in vertical cross-section, of one arrangement of adjustable guide device which may be incorporated in any of the foregoing embodiments of roof support;

FIGURE 18 is a view in side elevation of a sixth embodiment of roof support of the kind specified in accordance with the invention partly in vertical cross-section;

FIGURE 19 is a plan view of the sixth embodiment, the top structure being removed;

FIGURE 20 is a plan view of a seventh embodiment, the top structure of the support being removed and the adjustable guide device incorporating a longitudinally movable element shown in its extended position; and

FIGURE 21 is a view similar to FIGURE 20 with the longitudinally movable element in its retracted position in consequence of the outer base element having been advanced.

Referring firstly to the diagrammatic drawings FIGURES 1 to 4, these illustrate in principle various alternative forms of guiding means which may be adopted within the scope of the invention.

Each of FIGURES 1 to 4 illustrates the application of guiding means to either the bottom structure or the top structure of a roof support of the kind specified. In each case the structure includes interleaved parts, one of which, herein called the outer part, is designated A and the other of which, herein called the inner part, is designated B, the latter having clearance space between its outer side faces and the inwardly presented side faces of the outer part A. The two side members of the outer
part A are connected to each other at opposite ends in a rigid manner and either part A or B is capable of angular movement in a plane parallel to the floor or roof of the working for the purpose of controlling the direction of advancement, is indicated by the arrow C.

Since each part of the structure A or B is overlapped longitudinally with the other such part, by virtue of the interleaved relationship, and each is associated with at least two longitudinally spaced props, angular movement of the part A can be effected reliably even under bad conditions of a roof and floor, that is to say when either of these is uneven or soft, due to the fact that whilst the angular movement takes place the inner part B is firmly secured by pressurisation of its associated props. Furthermore, the axis about which angular movement takes place is situated either in the region of the fixed guide elements W or between the two adjustable guide devices K, and the laterally directed forces of reaction applied against the fixed part B are lower than is the case where the two parts of the structure, which are required to be moved angularly relatively to each other, are offset longitudinally from each other.

The arrangement shown in FIGURE 1 may be used generally in the same manner as those illustrated in FIGURES 2 to 4, except that the part B will be subjected to some angular movement during its advancement in any case where the laterally shiftable element of the adjustable guide device K is set otherwise than in its initial position.

Referring now to the first embodiment of the support shown in FIGURES 5 to 7, this comprises a bottom structure which includes an outer base element formed of side members 10 each formed conveniently of two laterally spaced roof bars 11 of box-section secured to top and bottom plates 12 and 13 by welding, the top plates having secured thereto upstanding socket-like chambers 14 at the rearward end of the support and 15 at the forward end of the support. Chambers at corresponding ends are rigidly connected with each other by cross members 16 and 17, of which the former is a hollow upwardly extending fabricated structure forming a flushing shield for preventing or reducing the risk of loose material moving forwardly between the members 14 onto the base of the support from the rearward end of the latter. The members 16 and 17 may be welded to the chambers 14 and 15 respectively.

The outer base element, although rigid in the sense that the side members 10 are fixedly connected in each case to the cross members 16 and 17, does permit of some torsional and bending deflection within the range of its inherent elasticity so as to allow it to continue functioning under floor conditions, in particular uneveness in the floor. The rigidity, however, is sufficient to ensure proper operation of the guide devices and traction means as hereininafter described.

The bottom structure further includes an inner element 18 which is a fabricated structure of laterally spaced, upwardly extending, plates, there being two such outer plates 19 and two such inner plates 20 welded to top and bottom plates 21 and 22 to form two laterally spaced, approximately box-section, girders spanned at their rearward and forward ends by socket-like chambers 23 and 24, the bases of which are welded to the top plates 21.

The top structure comprises an outer part which includes side members 25 each formed of a pair of laterally spaced roof bars 26 of box-section, the vertical webs of which are somewhat inset from their upper and lower horizontal webs to provide flanges connected by plates 27 and 28. The side members 25 are rigidly connected with each other adjacent the rearward end of the support and at a position above the forward end of the bottom structure by cross members 29 and 30, the central portions of which are cranked or offset downwardly below the side members 25 to define in conjunction therewith a channel or passageway 31.
The top structure further comprises an inner part 32 similar in construction to the side members 25 and situated in this channel. The outer part and inner part of the top structure may be of the same, or approximately the same, length as seen particularly in FIGURE 5. In use the extent of forward projection of both the inner and outer parts of the top structure is such as to enable it to project forwardly to support the roof of a mine working over a conveyor 33 extending along the coal face. The long wall working and pin 44 being set so as to form a discharge outlet 44a of sufficient width to communicate with the interiors of both of the box-section girders which form the side members of the outer base element to facilitate discharge of loose material from the interior of each of these members as hereinafter mentioned. The top structure is provided with a slot 44a in its upper margin centrally in which the rearward end of lever 50 engages to enable such lever to shift the plate to the position required.

At its forward end the lever is associated with a retaining means comprising a plate 52 spanning the inner base element and secured at its opposite ends to the top plates 21, such plate having a plurality of apertures for the reception of pins. As shown two such apertures are provided one on each side of the central position of the lever 50 for reception of pins 53 to hold the lever in its medial position.

Upon displacement of the lever to one side or the other, one of these pins would also engage the inner edge face of the lever and would hence serve as a locking means to retain the lever in such position.

It will, of course, be understood that at least one of the pins 53 requires to be removed preparatory to operation of the guide device by the piston and cylinder assembly 47, 48 through the intermediary of the lever 50.

The piston and cylinder assembly may incorporate a single piston with piston rods projecting from opposite sides thereof and from each end of the cylinder as shown, or it may include two pistons one on each projecting piston rod 47, and a valve system may be provided for supplying fluid to the cylinder so that the pistons are always moved in the same direction relative to the cylinder.

It will be noted that frictional forces in a direction longitudinally of the support and applied to the plate 44, in consequence of the engagement of its ends with the opposed inwardly presented side faces of the side members 10 of the outer base element, are borne entirely by the plate and the transverse guideway 45. The piston and cylinder assembly 47, 48 is isolated from these forces by the intermediary mechanism, that is to say the lever 50, and hence is not exposed to distortion or damage, even if loose floor or roof material should enter the clearance spaces 38 and cause a temporary obstruction.

For the clearance of such material the inner base element is formed with ways for the discharge of such material rearwardly of the support, and for this purpose each of the outer side plates 19 of the chambers of the inner base element is formed with an opening 54 adjacent to, but forwardly of, the plate 44 so that loose material can pass into the interiors of the chambers, which latter are open at their rearward ends.

As already mentioned the lower margin of the plate 44 is cut away to form an outlet 44c from the chambers for the discharge of the loose material.

The inner base element is operatively connected with the outer base element by a single hydraulic traction ram 55 having its cylinder 56 disposed between the side chambers of the inner base element and pivotally connected at 57 to a bracket on a rear plate of the inner base element. The piston rod 58 projects forwardly and is pivotally connected to a bracket 59 extending downwardly from, and secured to, the transverse member 17 at the forward end of the outer base element.

It will be noted that with this arrangement the traction ram is fully protected by virtue of its disposition within the inner base element when the latter is in its advanced position. It is at this stage when falls of roof material are rather more likely to take place. Further, the absence of any part of the ram projecting rearwardly from the inner base element minimises obstruction to the clearance of any loose material collecting in this region.
It will be noted that the length of the inner base element is approximately half the length of the outer base element and the former is capable of advancement by a distance which is slightly less than half the length of the outer base element. When so advanced the rear props 36 will occupy a position just in the rear of the initial position occupied by the forward prop 37. The element and props and its associated part of the top structure, during advancement of the relatively heaved outer base element have moved into a position between the two props 35 at the forward end of the outer base element.

In order to guard against the possibility of undesired rearward shift of the inner base element, together with its props and associated part of the top structure, during advancement of the relatively heaved outer base element and props and its associated part of the top structure, tie means are provided to connect the inner base element to the conveyor 33. Such tie means comprise anchorage rods 60 which are slideable in the interiors of the chambers of the inner base element and at their forward ends are connected to each other by a cross member 61 having a bracket 62 inter-engaged with the conveyor. It will be noted that the bracket 62 affords a transverse guided pathway in which a T section rail 64 on the conveyor is received so that translatory movement of the bracket along this guide rail is not possible. At the anchorage rods 60 are provided with stop means in the form of downwardly cranked end portion 65. Alternatively collars or laterally projecting bolts or pins could be secured on these ends of the anchorage rods. The stop means co-operate with stop blocks (not shown) secured internally in each of the chambers adjacent to the forward end thereof positively to prevent withdrawal of the anchorage rods.

When the support is used in mine workings which present a slope laterally of the support, there is the possibility of the props 34 and 37 of the inner base element and the inner part of the top structure carried by these props becoming displaced towards the lower side of the working, such displacement being in the form of tilt so far as the props are concerned and translatory displacement with a slight degree of tilt so far as the inner part of the top structure is concerned. This could result in reduction in width of the clearance space between the inner part of the top structure and the side member of the outer part of the top structure on the lower side of the working, or in extreme cases contact between the inner part and this member thereby obstructing the establishment of any desired angular relation between the inner base element necessary to enable the support to be steered up the slope to correct any downward drift of the support as a whole.

To avoid or minimise this condition means are provided to counteract lateral tilt, if any, of the props 34 and 37. These means comprise a pair of deflector elements in the form of wedges 70 presenting vertical contact faces 71 which lie in planes oblique to the medial, longitudinally extending, reference axis 66 and have their rearward and outer extremities situated laterally outwardly of the forward path of movement of the adjacent side face of the chamber 24 at the forward end of the inner base element and their forward and inner extremities situated inwardly of this path so as to be engaged with the forward vertical corners of the chamber 24 intermediate these extremities during a terminal stage of the advancement step of the prop system 74 and 75 of the two brackets respectively are secured to each other by a clamping bolt 76. The clamping bolt may pass through a slot 77 extending in a direction laterally of the support through the limb 74 to permit the lateral position of the associated wedge 70 to be adjusted if required. Securement in any laterally adjusted position may be improved by the formation on the contacting faces of the limbs 74 and 75 of co-operative interfitting serrations 78 extending longitudinally of the support.

It will be understood that it is not essential in all cases to utilise two deflector elements. One only on the lower side of the inner base element may suffice. Further, instead of providing for adjustment of the lateral position, wedge elements have different dimensions to provide for selective lateral positioning of the contact faces in a range of lateral positions may be employed if desired.

It is contemplated that deflector elements would be employed when the lateral slope of the mine working is such that a vertical line drawn from the combined centre of gravity of the props 34 and 37 and the inner part of the top structure carried thereby falls outside the lower side of the inner base element. Two deflector elements would normally be employed for floors in which the slope changes randomly from one direction to the other or for very soft floors where the support as a whole may tilt laterally in one direction or the other randomly.

The props 36 and 37 carried by the inner base element, or at least one of them, may be of larger effective diameter than the props 34 and 35 carried by the outer base element in order to ensure that the inner base element, its props, and inner part of the top structure will be established in firm roof supporting relation and can act as an abutment from which the requisite force can be exerted by the traction ram to advance the outer base element, its props and outer part of the top structure without rearward slipping of the inner base element. This may be contrived by providing a booster unit of larger effective diameter in which one or both of the props 36 and 37 are seated at their lower ends. Such booster element may be as described and claimed in Patent No. 3,145,964. Alternatively or in addition hydraulic interlock means may be provided in the supply system operatively connecting the props 36 and 37 and the traction ram 55 with the pump to ensure that the last mentioned cannot be energised to advance the outer base element until the props 36, 37 are fully set or pressurised.

The operation of the support shown in FIGURES 5 to 7 is as follows.

Initially, preparatory to passage of the coal-getting machine along the coal face, the relatively moveable parts of the support, hereinafter to be described, the inner part and the outer part, occupy the positions shown in FIGURES 5 and 6. As soon as the coal-getting machine has passed the support the newly exposed portion of the roof, resulting from removal of a layer of coal from the face, requires to be supported and such support is effected by advancement of the inner part of the support by appropriate pressurisation of the traction ram 55.

If at this stage it is necessary to effect correction of the lateral position of the support as a whole, due to a lateral slope of the mine working and previous downward drift of the support, two alternative procedures are possible.

Preparatory to advancement of the inner part the props 34 and 35 may be depressurised to release the outer parts 25 of the superstructure from load-bearing relation with the roof, the pin 53 on the higher side of the working is withdrawn and the piston and cylinder assembly 47, 48 pressurised to move the forward end of the lever 50 towards the higher side of the working and the rearward end of the lever and the plate 44 to the lower side of the working. The inner part of the support forms an abutment or anchorage and the lateral shift of the plate 44 will then move the outer part of the support axially, so that the guide path defined by the inwardly presented sides of the side members 10 then face obliquely up the slope of the mine working.

The props 34 and 35 are then pressurised and the props 36 and 37 are depressurised.
The piston and cylinder assembly 47, 48 is repressurised to bring the lever back to the medial position shown and the removed pin 53 reinserted. The traction ram is then appropriately pressurised to advance the inner part of the cylinder, as already described. As soon as the coal-getting machine has moved sufficiently along the conveyor (which is ordinarily formed of sections connected articulately to each other) to permit the particular section opposite the support concerned to be advanced towards the coal face, such advancement is carried out. For this purpose certain of the supports, for example one in every four along the row, is provided with a conveyor shifting hydraulic rams 90 which may conveniently be mounted on a bracket 91 on the outer base element at the outer side of one of the side members 10. The bracket 91 may have apertures 92 in the form of slots in which laterally projecting pins 93 from the ram extend to provide for freedom for the ram to pivot about the horizontal axis afforded by the pins 93. These latter may also have appreciable clearance with the support frame 92, thereby allowing freedom for some angular movement of the ram 90 in a horizontal plane.

After advancement of the conveyor section concerned the outer part of the support is advanced, at which time the props 36 and 37 of the inner part are depressurised, the props 34 and 35 of the outer part are depressurised and the traction ram 55 pressurised to draw up the cylinder 56 forwardly with respect to the piston rod 58. Due to the oblique upward inclination of the guide path defined by the inwardly presented sides of the side members 10, both advancement of the inner part of the support and the outer part of the support will have taken place to some extent up the slope of the mine working. Advancement in this direction may be continued through as many cycles of advance as is necessary to correct any downward drift.

As a possible alternative, advancement of the inner part of the support may take place preparatory to any operation of the adjustable guide device 41, that is to say with the guide path parallel to the reference axis 66 extending medially and longitudinally of the support. This avoids the necessity of any depressurisation of the props 34, 35 before advancement of the inner part of the support.

Angular movement of the outer part of the support is then effected with the inner part in its advanced position in the manner already described, except that in this case the props 34 and 35 of the outer part are depressurised that is towards the lower side of the working, whilst advancement of the outer unit is effected, so that the latter travels along an oblique upwardly extending path. In this case the removed pin 53 could be replaced to engage the inner edge of the forward end of the lever 50 and so avoid the necessity for continued pressurisation of the piston and the cylinder assembly 47, 48 during advancement of the outer part of the support.

When sufficient corrective movement in a direction up the slope of the mine working has been effected to compensate for the haphazard advance of the adjustable guide device 41 can be operated to move the outer part of the support angularly back into parallel relation with the reference axis 66.

If, however, it is found in any particular site that there is a systematic drift down the slope of the working, all advancement may be effected along a path which inclines obliquely in an upward direction with respect to the slope of the mine working just sufficiently to compensate for the downward slippage.

In certain cases where the downward slope of the mine working is not sufficiently severe to cause slippage of the base elements, it may nevertheless be sufficient to result in downward lateral displacement of the inner part 32 of the top structure so that the clearance space 39 at the lower side of this part is reduced or contact is actually made at this side between the inner part 32 and the outer part 25 situated at the lower side of the working.

To compensate for this effect, if it occurs, the adjustable guide device 41 may be operated preparatory to advancement of the inner part of the superstructure and when the props 36 and 37 are depressurised to move the inner base element angularly in such direction as will compensate for the lateral displacement of the forward end of the inner part 32 of the top structure. The inner base element is then advanced in a direction parallel to the reference axis 66 but in an oblique attitude with respect thereto.

In comparison with the forms of guide means disclosed in my prior patents and co-pending applications previously mentioned, the present invention has the following advantages.

1. The two parts of the support, and in particular the two base elements, are so designed that the inner base element is wholly overlapped longitudinally at all times by the outer base element. Consequently guidance of one base element by the other can be effected without the necessity for resisting a turning moment increased intrinsically by the forward disposition of one base element relatively to the other.

2. The arrangement of the base elements permits very early advancement of a part of the top structure, namely that associated with the inner base element, to provide for the exposure of a newly exposed portion of the roof, and concurrently occurs or sets up the requisite guidance path to compensate for any downward drift of the support as a whole due to a lateral slope on the mine working.

3. In the specific form of the first embodiment the actuating piston and cylinder assembly for the adjustable guide device is effectively isolated from frictional and other forces which could impose undesirable lateral stresses on the piston rods of such assembly.

4. Effective guiding is attained by the use of only one adjustable guide device of simple and reliable design capable of being locked in any of its adjusted positions and hence rendered effective independently of the actuating piston and cylinder assembly.

5. The support affords two laterally extending manways between the top structure and bottom structure, as indicated at 80 and 81. The manway 81 is maintained at its full dimension longitudinally of the support at any stage of advancement of the inner base element between its rearward and forward limits of travel.

Referring now to the second embodiment illustrated in FIGS. 44 and 45, the base elements already described are designated by like numerals of reference with the prefix 1 and the preceding description is to be deemed to apply thereto.

In this embodiment the traction means comprises two hydraulic traction rams 155 whereof the piston rods 158 are pivotally connected at their forward ends by pins 159a to brackets 159 fixed to, and projecting laterally from, the forward ends of the side members 110 of the outer base element.

The cylinders 156 of the traction rams are pivotally connected about vertical pins 155a to a laterally shiftable element in the form of a bar 144 of an adjustable guide device 141. For this purpose the cylinders 156 have secured thereto upwardly extending blocks 156a carrying pins 156b for engagement through openings at the ends of the bar 144.

The bar 144 is elidable in a transverse guideway 145 on the inner base element formed between the rearward face 145a of chamber 124, and guide blocks 145b on the side chambers of the inner base element.

Transverse movement of the bar 144 is effected by a lever 150 pivotally mounted on a pin 151 and capable of being locked in any of a number of positions by means of pins or bolts such as 153 extending through the lever and engaging in a selected one of openings 153a in a cross plate 152 secured between the side chambers of the inner base element.
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13

The shorter forward arm of the lever has a slot 150a through which engages an upstanding pin 144a on the cross bar 144.

The lever may be operated manually to effect lateral movement of the cross bar 144, although a power energized actuating device such as a piston and cylinder assembly could be provided if desired.

Operation of the adjustable guide device 141 involving lateral shift of the bar 144 effects relative angular movement between the inner part of the support, namely the inner base element, associated props, and inner part of the top structure on the one hand, and outer part of the support base element, associated props, and outer part of the top structure on the other hand, such angular movement being determined and controlled by the adjustable guide device 141 and a fixed guide device 140.

The general manner of operation of the second embodiment of the support is as already described with respect to the first embodiment. In this case, however, it will be noted from the chain line positions of the rectangular structure comprising the cross bar 144, rams 155, bracket 159, and cross member 177 associated with the latter than the one of thrust of the rams against the brackets is oblique to the reference axis 166. Consequently having set the inner and outer base elements in a particular angular relationship by means of the lever 150, the thrust of the rams tends to maintain this relationship.

In an adjustable guide device 341 provided, as indicated at 209, at the outer side of one of the side members of the outer base element, such ram being mounted at its rearward end upon a bracket 208 projecting laterally from the side member concerned. The ram 209 may, as already indicated in the case of the first embodiment, be provided only on a fractional number of supports in a row, for example on very fourth support.

The manner of operation of the third embodiment is generally as already described with reference to the first embodiment. The displacement of the outer base element angularly is illustrated by the chain lines shown in FIGURE 11.

Referring now to the fourth embodiment illustrated in FIGURE 15, parts corresponding to those already described in the first embodiment are designated by like numerals of reference with the prefix 3, and the preceding description is to be deemed to apply.

In this embodiment both the bottom structure and the top structure are provided with longitudinally spaced guide devices, one of which is fixed and the other adjustable. The fixed guide device may include fixed guide elements (not shown but similar to the guide elements 242) these extending laterally from the rear end of both the inner base element and the inner parts of the top structure.

14

At a position immediately in the rear of the prop chamber 324 the inner base element is provided with an adjustable guide device 341 which is in conformity with that of the second embodiment and for this reason is not further described.

At a position vertically, or approximately vertically, above this adjustable guide device the top structure is provided with an adjustable guide device 341n.

This is of the same form as the device 341 except that the plate 344 has its ends 344b projecting upward into the clearance spaces 339 between the inner and outer parts of the top structure.

The manner of operation of this embodiment is as already described with reference to the first embodiment except that the adjustable guide device 341 would be operated concurrently, and in the same manner, as the adjustable guide device 341 operative between the inner and outer base elements.

Further, it will be noted that the resultant angular movement of one part of the top structure relative to the other is effected by direct operation of the upper guide devices, namely the fixed guide device and the adjustable guide device 341, and does not involve the establishment of any pivotal axis by means of a prop head, so that the angular movement is not dependent upon the lateral stability of the props.

It will further be noted that the extent of upward projection of the end portions 344b of the upper laterally shiftable plate 344 is sufficient to ensure that these remain in vertically overlapped relation with the opposed inwardly presented side faces of the outer parts 325 of the top structure when one of the parts of the top structure is lowered relatively to the other to bring it out of engagement with the roof. Further, the outer side faces of the end portions 344b are of curved convex form, as seen in FIGURE 15, to avoid any obstruction to relative movement between these end portions and the outer parts of the top structure in the vertical direction, despite the presence of inwardly projecting flanges on the side members of the outer part of the top structure.

Referring now to the fifth embodiment illustrated in FIGURE 16, parts corresponding to those already described with reference to the first embodiment are designated by like numerals of reference with the prefix 4 and the preceding description is to be deemed to apply.

In this embodiment both the bottom structure and the top structure are provided with two longitudinally spaced adjustable guide devices. Those of the bottom structure are indicated generally at 441c and 441d and

76

75

A hydraulic ram for advancing the conveyor may be
those of the top structure are indicated generally at 441e and 441f.

The form of these devices may be as already described in respect of the third and fourth embodiments, according to whether they are incorporated in the bottom structure of top structure.

The provision of two adjustable guide devices increases the angle through which relative angular movement can be effected between the inner and outer parts of the structure concerned for a given clearance space between the members.

The manner of operation of the fifth embodiment is generally as already described in respect of the first embodiment, except that the laterally shiftable element in the guide device 441c would be displaced in a direction opposite to that in which the laterally shiftable element of the guide device 441d is displaced when effecting relative angular movement between the inner and outer base elements. The laterally shiftable element of the guide device 441e would be displaced in the same direction as that of 441c and the laterally shiftable element of the guide device 441f would be displaced in the same direction as that of the guide device 441d.

Referring to FIGURE 17, there is shown therein an alternative form of piston and cylinder assembly for actuating the laterally shiftable element of any of the foregoing adjustable guide devices.

In the embodiment the cylinder 548 is sub-divided internally by a web 548a to provide two separate cylinders 548b in which operate separate pistons 547a carried on respective piston rods 547 projecting from opposite ends of the cylinder. The piston rods 547 may act upon a common laterally shiftable element 544, the cylinder 548 being rigidly in the inner part of the structure B and the ends of the element 544 engaging the inwardly presented side faces of the side members of the outer part of the structure A.

Cylinder spaces to the left-hand sides of the pistons are connected to each other by a pipe 570, and cylinder spaces to the right-hand sides of the pistons are connected to each other by a pipe 571.

Selectively, by a valve means 572, fluid under pressure can be supplied from an inlet 573 connected to a source of hydraulic fluid under pressure to either pipe 570 or pipe 571.

One of the advantages of this arrangement is that for a given hydraulic pressure and cylinder diameter, the force exerted on the laterally shiftable element is materially increased (approximately double) in comparison with that obtainable by the use of a single piston on a common piston rod projecting from both ends of the cylinder. Alternatively, for a given force the diameter of the cylinder can be reduced resulting in an extremely compact unit.

The laterally shiftable element 544 can be guided in a guideway 545 extending laterally in the inner part B so that the piston and cylinder assembly is effectively isolated from frictional forces attendant upon relative longitudinal sliding movement between the laterally shiftable element 544 and the upper part A of the structure.

Referring now to the sixth embodiment of the invention illustrated in FIGURES 18 and 19, parts corresponding to those already described in the first embodiment are designated by like numerals of reference with the prefix 7 and the preceding description is to be deemed to apply thereto.

In this embodiment the inner base element is provided with an adjustable guide device 741 at its forward end. Such guide device comprises a longitudinally movable element 782 having laterally spaced guide rods 783 slidably in guideways afforded by the inner base element 718. Such guideways are of a sufficient width to permit of the guide rods being set parallel to the reference axis 766 or selectively to the left or to the right thereof, which last mentioned condition is shown in FIGURE 20. The longitudinally movable element 782 includes a cross member 784 connecting the guide rods at their forward ends and at this position includes centralising means in the form of cam elements 785 presenting contact faces 786 arranged obliquely to the reference axis 766 and the respective paths of advancement of the forward inner corners 710a of the side members 710 of the outer base element.

At its forward end the longitudinally movable element 782 is also provided with means in the form of a bracket 787 enabling it to be connected to the outer base element as a conveyor 733. The conveyor is provided with a rib 788 formed with a plurality of holes 789 through any one of which selectively a coupling pin provided on the bracket 787 can be passed.

At its rearward end the inner base element 718 has a fixed guide device 740 in the form of a transverse plate 742, at opposite ends of which engage the inwardly presented side faces of the members 710 to control the rela-
tive lateral positions of the inner and outer base elements at the rearward end of the former.

If it is desired to effect advancement of the support in a direction upwardly of a laterally inclining slope, for example to the lower side of FIGURE 20, the element 782 is uncoupled from the conveyor whilst it is in a retracted position and is then advanced either manually or by one or more traction rams to the projected position shown and moved angularly to diverge to the requisite sides of the reference axis 766 and thereafter recoupled to the conveyor at a position offset laterally therealong from the former position at which it was coupled.

Operation of the traction means then advances the outer base element to the position illustrated in FIGURE 21, the inner base element remaining in its initial position. Co-operation between the cam elements 785 and the corners 710a in the terminal stage of the advancement step of the outer base element determines the lateral position of the forward end of the outer base element, whilst the rearward end of the outer base element has its lateral position determined by the guide plate 742. Consequently the outer base element is displaced angularly relative to the inner base element in a direction inclining obliquely up the lateral slope of the mine workings. Subsequent advance of the inner base element is thus effected along this oblique upwardly inclining path as defined by the inwardly presented side faces of the side members 710.

In all of the foregoing constructions where reference is made to the formation of parts of the bottom structure and top structure by welding together components of smaller size, such components may, of course, be secured by other means such as bolts or other suitable fastening elements. This facilitates manufacture in respect of those components which require to undergo heat treatment and also facilitates storage and transport of the component parts of the support.

What I claim then is:

1. In a support for supporting the roof of a mine working comprising:
   (a) a bottom structure for resting on the floor,
   (b) a top structure for engaging and supporting the roof,
   (c) a plurality of power operated extensible props extending between said top and bottom structures,
   (d) traction means for advancing said support,
   the improvement wherein:
   (e) both said bottom structure and said top structure each include longitudinally extending parts, such parts each having at least two longitudinally spaced side members; and
   (f) in said bottom structure and in said top structure said longitudinally extending parts are disposed in interleaved relation with each other laterally of said support,
   (g) in both said bottom structure and in said top structure said laterally interleaved parts are laterally spaced from each other to define an inter-part clearance space providing capability of relative angular movement between said parts in a plane generally parallel to said floor and roof,
   (h) guide means are provided for controlling the relative angular positions of said parts in said plane, and said guide means includes in both said bottom structure and said top structure
   (i) a first guide device operatively engaged between said parts of the structure concerned at a first position therealong,
   (ii) a second guide device operatively engaged between said parts of the structure concerned at a second position therealong spaced longitudinally from said first position,
   (f) at least one of said guide devices in each longitudinally spaced pair thereof includes means enabling the relative angular positions of said parts of the structure concerned to be adjusted.

2. A support according to claim 1 wherein said guide devices of said top structure are disposed at least approximately in vertical alignment with the corresponding guide devices respectively of said bottom structure.

3. A support according to claim 1 wherein:
   (a) said bottom and top structures each includes as one of its parts an outer base element having laterally spaced side members connected to each other and defining a longitudinally extending gap between them, and includes as the other of its parts an inner element disposed in said gap,
   (b) said outer part of said top structure is supported by at least two of said said elements and part laterally from each other, and at least a further one of said props spaced longitudinally from said two, all of these props being carried by said outer element of said bottom structure,
   (c) said inner part of said top structure is supported by at least two longitudinally spaced props carried by said inner element of said bottom structure.

4. In a support for supporting the roof of a mine working comprising:
   (a) a bottom structure for resting on the floor,
   (b) a top structure for engaging and supporting the roof,
   (c) a plurality of power operated extensible props extending between said top and bottom structures,
   (d) traction means for advancing said support,
   the improvement wherein:
   (e) said bottom structure includes as one of its parts an outer base element having laterally spaced side members connected to each other and defining a longitudinally extending gap between them, and includes as the other of its parts an inner base element disposed in said gap, so as to be in interleaved relation with said outer base element and having lateral clearance with respect to the side members of the outer base element providing capability of relative angular movement between said outer and inner base elements in a plane generally parallel to said floor and roof,
   (f) each of said base elements has at least two longitudinally spaced seatings carrying respective ones of the props serving to support a respective part of the top structure,
   (g) said parts of said top structure are laterally interleaved with each other and are spaced laterally to provide an inter-part clearance space providing capability of relative angular movement between said parts of said top structure in said plane,
   (h) guide means are provided for controlling the relative angular positions of said parts in said plane, said guide means including:
   (i) a first guide device mounted to engage operatively between the inner base element and the outer base element adjacent to the forward end of the inner base element,
   (ii) a second guide device mounted to engage operatively between the inner base element and the outer base element adjacent to the rear end of the inner base element,
   (i) at least one of said guide devices includes means enabling the relative angular positions of said parts to be adjusted.

5. A support according to claim 4 wherein:
   (a) one of said guide devices includes a fixed guide element defining a fulcrum about which relative angular movement of said parts can take place,
   (b) the other of said guide devices, which includes said means for enabling the relative angular positions of said parts to be adjusted, includes as a component of said means a laterally shiftable guide element mounted on one of said parts of said support and engag-
3,490,243

6. A support according to claim 5 wherein:
(a) said laterally shiftable guide element includes a central portion spanning the part of said structure on which it is carried,
(b) said central portion is situated at a level relative to said part of said structure on which it is carried, spacing it vertically from the surface of the mine working engaged by such part,
(c) said laterally shiftable guide element includes end portions connected to said central portion at opposite ends thereof, respectively, and extending in at least approximately vertical directions therefrom into said inter-part clearance spaces between said part of said structure spanned by said central portion and the other of said parts of said structure.

7. A support according to claim 4 wherein:
(a) one of said guide devices includes a fixed guide element defining a fulcrum about which relative angular movement of said parts can take place,
(b) the other of said guide devices, which includes said means for enabling the relative angular positions of said parts to be adjusted, includes as a component of said means a laterally shiftable guide element mounted on one of said parts of said structure and engaging at least one laterally presented face on the other of said parts of said structure,
(c) guide means are provided extending laterally of said part of said structure on which said laterally shiftable guide element is mounted and defining a laterally extending guideway for translatory movement of said laterally shiftable guide element,
(d) fluid pressure operated piston and cylinder means are provided for effecting movement of said laterally shiftable guide element along said guideway,
(e) means are provided operatively connecting said piston and cylinder assembly with said guide element while isolating said piston and cylinder assembly from frictional or the like loads applied to said laterally shiftable guide element in consequence of its engagement with said other part of said structure during relative longitudinal movement between the parts of said structure.

8. A support according to claim 7 wherein said piston and cylinder assembly is operatively connected with said laterally shiftable guide element through a lever.

9. A support according to claim 4 wherein one of said guide devices includes a fixed guide element defining a fulcrum about which relative angular movement of said parts can take place, the other of said guide devices, which includes said means for enabling the relative angular positions of said parts to be adjusted, includes as a component of said means a laterally shiftable guide element mounted on one of said parts of said structure and engaging at least one laterally presented face on the other of said parts of said structure, said laterally shiftable guide element is operatively associated with retaining means for releasably holding said element at least in a medial position with respect to its range of movement.

10. A support according to claim 9 wherein in operative association with said laterally shiftable guide element is provided a biasing means for urging said element towards a medial position in its range of movement.

11. A support according to claim 4 wherein:
(a) said bottom structure includes as one of its parts an inner base element having upstanding lateral walls defining the inner boundaries of inter-part clearance spaces between said outer base element and said inner base element,
(b) said outer base element has side members defining the outer boundaries of said inter-part clearance spaces,
(c) at least said walls of said inner base element have openings communicating with an interior space in said inner base element,
(d) said inner base element has an outlet at its rearward end communicating with said interior space for discharge of loose material therefrom entering said base element through said openings.

12. A support according to claim 4 wherein:
(a) said guide means are provided for effecting said inner base element to an anchor member situated forwardly of said support, such tie means preventing movement of said inner base element in a rearward direction relative to said anchor member during advancement by said traction means of said outer base element.

13. A support according to claim 12 wherein:
(a) said tie means comprise at least one rod having means at its forward end for connection to said anchor member, said rod being engageably slidably with said inner base element,
(b) stop means on said rod adjacent to its rearward end for limiting longitudinal separation between said inner base element and said anchor member substantially to that value of separation which exists when both said inner base element and said anchor member are in their nonadvanced positions.

14. A support according to claim 4 wherein:
(a) one of said guide devices includes a fixed guide element defining a fulcrum about which relative angular movement of said parts can take place,
(b) the other of said guide devices, which includes said means for enabling the relative angular positions of said parts to be adjusted, includes as a component of said means a laterally shiftable guide element mounted on one of said parts of said structure and engaging at least one laterally presented face on the other of said parts of said structure,
(c) said laterally shiftable guide element comprises a cross member extending transversely of said structure between said parts of which said guide devices are operatively engaged,
(d) said central portion of said cross member being connected to an inner one of said parts of said structure by said other part of said structure for lateral adjustment of the position of said inner part of said structure relative to said cross member,
(e) said traction means comprises traction rams disposed respectively at the outer sides of the outer one of said parts of said structure and acting between respective ends of said cross member and said outer part of said structure whereby said cross member serves both to transmit longitudinal movement to said inner part of said structure and to determine the angular position of said inner part of said structure relative to said outer part of said structure.

15. A support according to claim 4 wherein:
(a) said inner base element through said props carried thereby supports an inner part of said top structure,
(b) said outer base element through said props carried thereby supports an outer part of said top structure,
(c) said deflector means comprises a deflector element on one of said base elements presenting a contact surface for en-
21. A support according to claim 15 wherein said deflector means includes means for effecting adjustment of the extent of lateral deflection applied to the inner base element to counteract lateral tilt, if any, of the props carried by such base element.

18. A support according to claim 4 wherein:
(a) the means included in one of said guide devices for enabling the relative angular positions of said parts to be adjusted comprises a longitudinally movable element on one of said parts;
(b) said longitudinally movable element is so mounted on said part as to be movable along a path of advancement relatively to said part which is parallel to or diverges selectively to the left or right of a longitudinally extending medial reference axis of said support;
(c) said longitudinally movable element is provided with means for retaining it after advancement in said parallel or selected divergent relation to said reference axis;
(d) said longitudinally movable element is provided with means co-operating with the other part of said structure upon advancement of the latter to determine the angular relationship between the said parts of said structure between which the said guide devices are operatively engaged.

19. A support according to claim 18 wherein:
(a) said bottom structure comprises an outer base element including laterally spaced side members connected to each other at opposite ends and defining a gap therebetween, and an inner base element disposed in said gap and having lateral clearance with respect to the inwardly presented side faces of the side members of the outer base element;
(b) said traction means are operatively connected between said outer base element and said inner base element for moving the latter longitudinally of the gap;
(c) said longitudinally movable element is mounted on said inner base element and is movable relatively thereto between a retracted position in which it projects for only a short distance beyond the forward end of the outer base element and an extended position in which it projects beyond said forward end by a greater amount;
(d) means are provided adjacent to the forward end of said longitudinally movable element for connecting same to an anchor member, positioned forwardly of said support and extending transversely thereof, at any of a plurality of positions spaced apart along such anchor member to retain said longitudinally movable element at its forward end in a predetermined position in a direction laterally of said support upon movement of said longitudinally movable element to its extended position;
(e) said longitudinally movable element further including centralising means situated adjacent to its forward end for co-operating with said outer base element upon advancement of the latter by said traction means to bring said outer base element into predetermined positional relationship in a direction laterally of said support at the forward end of the outer base element;
(f) said other guide device being operatively engaged between said outer and inner base elements adjacent to the rearward end of the latter to maintain the inner base element in predetermined positional relationship with the outer base element in a direction laterally of the support thereby in combination with said centralising means to control the angular relationship between said inner base element and said outer base element after advancement of the latter.

20. In a support for supporting the roof of a mine working comprising:
(a) a bottom structure for resting on the floor,
(b) a top structure for engaging and supporting the roof,
(c) a plurality of power operated extensible props extending between said top and bottom structures,
(d) traction means for advancing said support,
the improvement wherein:
(e) at least said bottom structure includes longitudinally extending parts disposed in interleaved relation with each other in a direction laterally of the support,
(f) said parts are operatively connected with each other by said traction means for respective advancement thereby in successive steps,
(g) said parts are spaced laterally from each other to define an inter-part clearance space providing capability of limited movement of one of said parts relatively to the other in a direction transversely of said support,
(h) centralising means are provided for constraining said parts to predetermined relative lateral positions over a terminal portion of one of said advancement steps, while maintaining said capability of said limited movement over the preceding portion of said step.

21. A support according to claim 20 wherein:
(a) said bottom structure includes as one of its parts an outer base element having laterally spaced side members rigidly connected to each other and defining a longitudinally extending gap between them and includes as the other of its parts an inner base element disposed in said gap,
(b) guide means are provided for controlling the relative transverse position of said inner base element in said gap comprising:
(i) a guide device at a first position along said support,
(ii) said centralising means at a second position along said support spaced longitudinally from said first position, said centralising means including a centering element on one of said base elements cooperating with the other of said base elements during said terminal portion or said advancement step while being spaced from said other base element during the remainder of said advancement step.

22. A support according to claim 21 wherein:
(a) said first guide device including means defining a fulcrum for relative angular movement between said base elements in a plane generally parallel to said floor and roof,
(b) said centering element includes a contact face extending obliquely to a longitudinal reference axis of said support to cooperate camwise with said other base element during said terminal portion of said advancement step.

23. A support according to claim 22 wherein said centralising means includes two centering elements having respective contact faces which are oblique to said reference axis and collectively define a convergent entry for receiving said others of said base elements to bring same to a predetermined lateral position relative to said reference axis at said second position at which said centralising means is disposed.

24. In a support for supporting the roof of a mine working comprising:
(a) a bottom structure for resting on the floor,
(b) a top structure for engaging and supporting the roof,
(c) a plurality of power operated extensible props extending between said top and bottom structures,
(d) traction means for advancing said support, the improvement wherein:

(e) both said bottom and said top structures each include longitudinally extending parts which are interlaced laterally with each other,

(f) said parts at least of said bottom structure are operatively connected with each other by said traction means for respective advancement thereby in successive steps,

(g) said parts of said top structure are spaced laterally from each other to define an inter-part clearance space providing capability of limited movement of one of said parts of said top structure relative to the other of said parts thereof in a direction transversely of said support,

(h) deflector means are provided on said bottom structure upwardly of said floor for at least partially correcting lateral tilt of one of said parts of said support relative to the other of said parts over a terminal portion of one of said advancement steps, while maintaining said capability of said limited movement over the preceding portion of said step.

25. A support according to claim 24 wherein:

(a) said bottom and top structures each includes as one of its parts an outer element having laterally spaced side members connected to each other and defining a longitudinally extending gap between them, and includes as the other of its parts an inner element disposed in said gap,

(b) said outer part of said top structure is supported by at least two of said props spaced apart laterally from each other, and at least a further one of said props spaced longitudinally from said two, all of these props being carried by said outer element of said bottom structure,

(c) said inner part of said top structure is supported by at least two longitudinally spaced props carried by said inner element of said bottom structure,

(d) said deflector means includes a deflector element on one of said elements of said bottom structure having a laterally presented contact face co-operative with said other of said elements thereof at a position spaced upwardly from floor engaging faces of said elements to effect relative lateral movement of said other base element in a direction to counteract lateral tilt,

(e) guide means operative at a level below said deflector element for controlling the lateral position of said other element relative to the said first element of said bottom structure during said terminal stage of advancement.

26. A support according to claim 25 wherein:

(a) said deflector element has a contact face extending obliquely to a longitudinal reference axis of said support,

(b) said other element of said bottom structure has a contactable portion which in operation of said traction means is moved along a path intersecting with said contact face when said part of said support including the inner element of said top and bottom structures is tilted laterally from a normal upright position,

(c) said contact face and said contactable portion are spaced apart from each other over stages of said advancement step other than said terminal stage.

27. A support according to claim 24 wherein the deflector means includes means for adjusting the extent of correction of the lateral tilt.

28. A support according to claim 25 wherein said deflector element is mounted on said one of said elements by a mounting structure incorporating relatively movable parts providing for positional adjustment of said deflector element in a direction transversely of a longitudinally extending reference axis of said support, and means for securing said relatively movable parts in each of a plurality of positions of relative adjustment in said direction.

29. In a support for supporting the roof of a mine workings comprising:

(a) a bottom structure for resting on the floor,

(b) a top structure for engaging and supporting the roof,

(c) a plurality of power operated extensible props extending between said top and bottom structure,

(d) traction means for advancing said support, the improvement wherein:

(e) said bottom structure includes longitudinally extending parts disposed in interleaved relation with each other laterally of the support,

(f) one of said bottom structure parts is shorter than the other, longer, part thereof and is movable by said traction means from a rearward position to a forward position relatively to said longer part within the length of said longer part,

(g) said top structure includes longitudinally extending parts disposed in interleaved relation with each other laterally of the support,

(h) a first one of said parts of said top structure is supported by longitudinally spaced ones of said props carried by said longer part of said bottom structure,

(i) a second one of said parts of said top structure is supported by longitudinally spaced ones of said props carried by said shorter part of said bottom structure,

(j) both said first and said second parts of said top structure are of a length to project forwardly beyond said longer part of said bottom structure with said shorter part of said bottom structure in said rearward position,

(k) said second part of said top structure is of a length to project forwardly of said first part of said top structure with said shorter part of said bottom structure in its forward position.

30. A support according to claim 29 wherein:

(a) said longer part of said bottom structure is an outer part having laterally spaced side members connected to each other and defining a longitudinally extending gap,

(b) said shorter part of said bottom structure is disposed in, and movable along, said gap,

(c) said second part of said top structure is an outer part having laterally spaced side members connected to each other by cross members and defining a longitudinal passageway or channel,

(d) said first part of said top structure is disposed in said passageway or channel.

31. A support according to claim 30 wherein said cross members of said outer part of said top structure include at least one situated at the forward end of said outer part which is cranked or offset downwardly below said side members in between the latter.

32. A support according to claim 29 wherein:

(a) said parts of said top structure are spaced laterally from each other to define an interpart clearance space providing capability of limited movement of one of said parts of said top structure relative to the other of said parts thereof in a direction transversely of said support,

(b) deflector means are provided on said bottom structure upwardly of said floor for at least partially correcting lateral tilt of one of said parts of said support relative to the other of said parts over a terminal portion of one of said advancement steps, while maintaining said capability of said limited movement over the preceding portion of said step.

33. A support according to claim 30 wherein:

(a) said parts of said top structure are spaced laterally from each other to define an inter-part clearance space providing capability of limited movement of one of said parts of said top structure relative to the
other of said parts thereof in a direction transversely of said support,
(b) deflector means are provided on said bottom structure upwardly of said floor for at least partially correcting lateral tilt of one of said parts of said support relative to the other of said parts over a terminal portion of one of said advancement steps, while maintaining said capability of said limited movement over the preceding portion of said stop.
(c) said deflector means includes a deflector element on one of said parts of said bottom structure co-operative with the other of said parts thereof at a position spaced upwardly from said floor to effect relative lateral movement of said other part in a direction to counteract lateral tilt.

34. A support according to claim 33 wherein said deflector element is mounted on said one part of said bottom structure at a position thereon to be spaced longitudinally from a contact face on said other part of said bottom structure when said shorter part is in said rearward position and to engage said contact face when said shorter part of said bottom structure is in said forward position.

References Cited
UNITED STATES PATENTS
3,328,966 7/1967 Crevels et al. 61—45
1,319,372 1/1963 France.
1,044,907 10/1966 Great Britain.

FOREIGN PATENTS
JACOB SHAPIRO, Primary Examiner