March 11, 1969 K. M. GROETSCHEL 3,431,738

ROOF SUPPORTING SYSTEMS FOR MINE WORKINGS

Filed June 6, 1967 Sheet 1 of 3

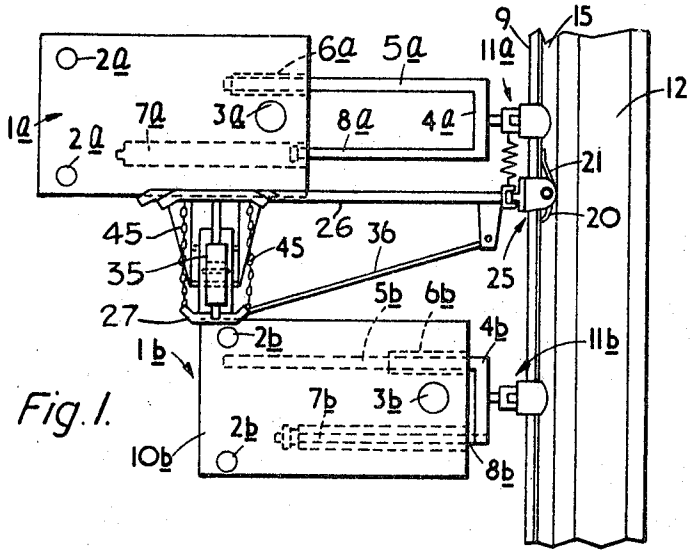


Fig. 1.

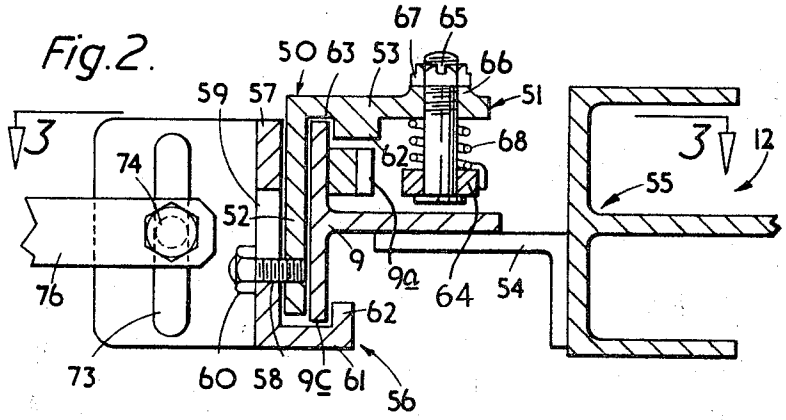


Fig. 2.

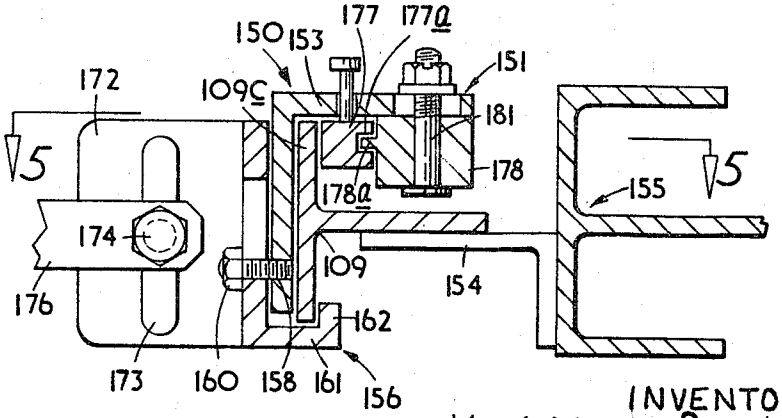


Fig. 4.

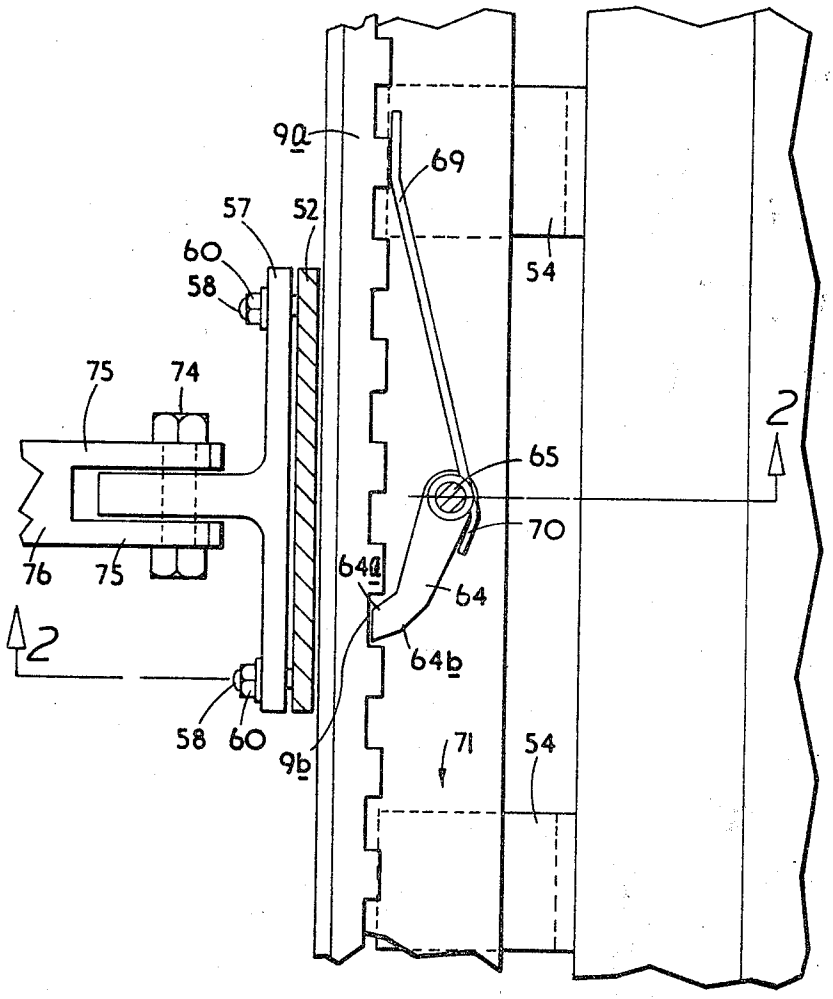
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ROOF SUPPORTING SYSTEMS FOR MINE WORKINGS

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Fig. 3.



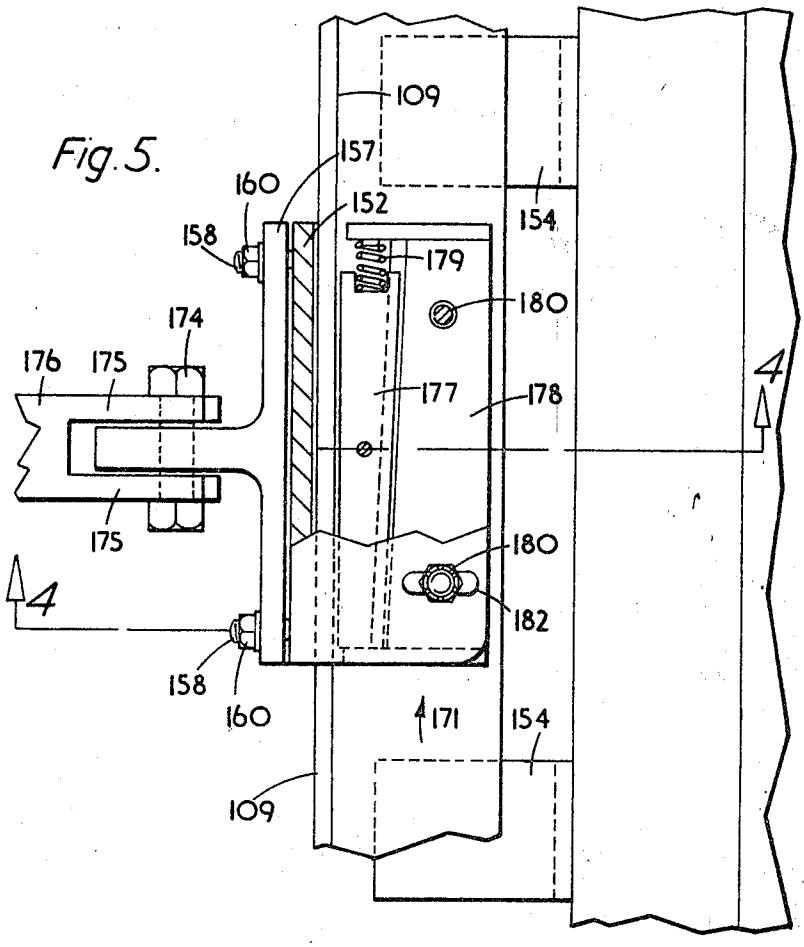
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ROOF SUPPORTING SYSTEMS FOR MINE WORKINGS

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Fig. 5.



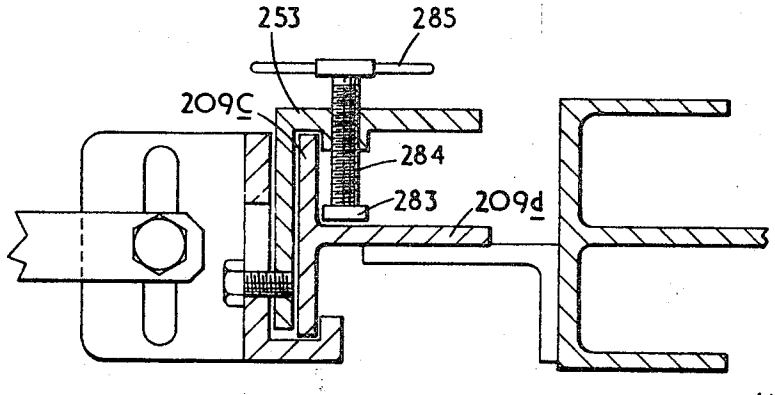


Fig. 6.

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3,431,738

ROOF SUPPORTING SYSTEMS FOR MINE WORKINGS

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U.S. Cl. 61—45 10 Claims
Int. Cl. E21d 23/04

ABSTRACT OF THE DISCLOSURE

This invention relates to a roof supporting system which includes a plurality of laterally spaced self-advancing roof supports each having a base, a plurality of power-operated props thereon and a roof engaging superstructure carried by the props, and guiding devices disposed between successive ones of the roof supports and engaging same by laterally presented guide faces of effective length to control the direction of advancement of the supports in contact therewith, a laterally extending anchorage member disposed in advance of the supports and guiding devices, and connecting each of the guiding devices and optionally the supports to the anchorage member, such connection means having a body affording a laterally extending guide passageway through which the anchorage member extends, and retaining means acting between the anchorage member and the body and comprising pawl and ratchet means, friction gripping means or a manually releasable clamping means arranged to provide for free movement of the anchorage member in a lateral direction being that in which the floor of the mine working slopes downwardly while preventing movement of the guiding devices and any supports connected to the anchorage member in the same direction.

BACKGROUND OF THE INVENTION

Field of the invention

This invention is concerned with roof supporting systems for supporting the roofs of mine workings and including self-advancing roof supports herein referred to as being of the kind specified, and each comprising a base, a plurality of power-operated props thereon, a roof-engaging superstructure carried by the props at their upper ends, and traction means for advancing the support.

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 direection from one end 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 copending application 419,647 and now U.S. Patent No. 3,362,169 I disclosed a guiding device for use between laterally spaced self-advancing roof supports, such device being in the form of a unit which is structurally separate from the roof supports themselves and comprising laterally spaced side members for engagement with opposed side faces of the roof supports, one at least of such side members affording a guide face of effective length sufficient to control the direction of advancement of that one of said supports in contact therewith, and power operated bracing means extending between the side members and serving to control their lateral separation and inclination.

Also it was disclosed in my copending application aforesaid that such guiding devices, and in certain cases the roof supports themselves, were preferably connected with a laterally extending anchorage member (which may be constituted by a conveyor extending along the coal face or by a cable (as therein defined) mounted on, or attached to, the conveyor, or having means for fixing it independently to the floor.

This arrangement was intended to maintain the forward end of each guiding device and roof support when so connected to the anchorage member in a predetermined lateral position.

When, however, the slope of the mine working in a direction longitudinally of the coal face is steep the conveyor itself, and hence any cable attached thereto, becomes displaced by downward sliding along the coal face.

Advancement of the conveyor section by section is ordinarily effected by employment of traction means embodied in the roof supports normally in the form of hydraulic rams, such rams being extended to push an associated section of the conveyor forwardly towards the coal face whilst the props of the support in question are extended so that the superstructure is in load-bearing relation to the roof and the support is thereby maintained in a fixed position between the roof and the floor of the mine working. Where, however, the slope along the coal face is steep the forces tending to cause displacement or drift of the conveyor downwardly along the coal face are large and the forward ends of the supports and the guiding devices are sometimes dragged with the conveyor in a downward direction, despite the roof load exerted on the superstructures of the supports.

Such downward displacement or drift of the conveyor is ordinarily confined to the times when it is undergoing advancement and at these times the roof supports themselves and the intervening guiding devices would be securely held against downward sliding along the coal face were it not for the dragging action of the conveyor or cable attached thereto.

The object of the present invention is to avoid this disadvantage.

SUMMARY OF THE INVENTION

According to the present invention a supporting system comprising a plurality of laterally spaced roof supports of the kind specified and guiding devices disposed between successive ones of these supports and engaging same by means of laterally presented guide faces of effective length to control the direction of advancement of the supports in contact therewith, is characterised in that the guiding devices and those of the supports which are connected to a laterally extending anchorage member are so connected through the intermediary of a connecting means comprising a body connected, or adapted for connection, to the roof support or guiding device as the case may be and formed or constructed to afford a laterally extending guide passageway through which the anchorage member extends, and retaining means acting between the anchor-

age member and the body for preventing movement of the body along the anchorage member in one direction (the downward direction of inclination of the floor), such retaining means permitting of movement of the anchorage member, or being releasable to permit of such movement in the same direction during periods when the anchorage member is undergoing advancement towards the coal face.

BRIEF SUMMARY OF THE DRAWINGS

The invention will now be described by way of example with reference to the accompanying drawings wherein:

FIGURE 1 is a plan view showing a roof supporting system incorporating roof supports of the kind specified and intervening guiding device connected to an anchorage member on a conveyor extending along a coal face by connecting means in accordance with the invention.

FIGURE 2 is a fragmentary plan view in cross section on the line **2—2** of FIGURE 3 on an enlarged scale showing one embodiment of the connecting means which may be employed in the roof supporting system of FIGURE 1.

FIGURE 3 is a view in end elevation of the embodiment of connecting means shown in FIGURE 2 in cross section on the line **3—3** of FIGURE 2.

FIGURE 4 is a fragmentary plan view in cross section on the line **4—4** of FIGURE 5 on an enlarged scale of the second embodiment of the connecting means which may be employed in the roof supporting system of FIGURE 1.

FIGURE 5 is a view in end elevation of the embodiment shown in FIGURE 4 and in cross section on the line **5—5** of FIGURE 4.

FIGURE 6 is a view on an enlarged scale in end elevation and in cross section of a third embodiment of connecting means which may be employed in the roof supporting system of FIGURE 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The laterally spaced roof supports of the roof supporting system illustrated in FIGURE 1 are indicated generally at **1***a*, **1***b*. Since these may be identical only one of them, namely **1***b*, is described and reference numerals with the suffix *a* to denote parts corresponding to those described for the support **1***b* are applied to the support **1***a*.

The support **1***b* comprises a base **10***b* on which are supported rear hydraulic props **2***b* and a forward hydraulic prop **3***b*. The base **10***b* includes a forwardly projectable **4***b* carried by a guide bar **5***b* sliding in a guide structure **6***b* in the base **10***b*. The part **4***b* can be projected forwardly by means of a double-acting piston and cylinder unit **7***b* forming the traction means of the support and energized by hydraulic fluid under pressure. The piston rod **8***b* of this piston and cylinder unit is connected to the part **4***b*.

Means may be provided for controlling the direction in which the part **4***b* is projected relatively to a longitudinal reference axis of the base **10***b*. Such means are not illustrated but may be as disclosed in my copending applications 322,606 and 392,002.

Each roof support includes a superstructure (not illustraed) carried by the props at their upper ends and engaging the roof.

Between successive supports is provided a guiding device which may be constructed as more fully disclosed in my copending application 419,647. For convenience it is herein stated that such guiding device comprises two laterally spaced guide members **26** and **27**. The side member **26** has a length which ordinarily will be approximately equal to the length of the side face of the base for the roof support **1***a* with which it is in contact during use. The side member **27** may, as illustrated, be shorter in length and is typically about ¼ to ⅙ of the length of the side face of the roof support with which it is in contact.

Extending between the side members **26** and **27** is a power-operated bracing means for resisting inward movement of the side members towards each other. Such bracing means comprises a piston and cylinder unit **35** adapted to be energised by hydraulic fluid under pressure. The bracing means further comprises a stay structure in the form of a stay bar **36** connected between the forward end of the side member **27** and the lug near the forward end of the side member **26**.

The piston and cylinder unit **35** may be double-acting.

To limit maximum separation between the side members, a stop means, preferably adjustable, is provided and this is in the form of two lengths of chain **45** connected respectively between opposite ends of the side member **27** and corresponding longitudinally spaced connection points on the side **26**. Adjustment of the effective length of the chain connected between the side members may be effected by providing on one of the side members anchor means extending releasably through links of the chain, such anchor means comprising a removable pin extending between the limbs of a U-shaped lug on the side member concerned.

The supports **1***a* and **1***b* are connected at their forward ends to a laterally extending anchorage member **9** by connecting means indicated generally for the two supports at **11***a* and **11***b* and for the guiding device **25**.

The anchorage member may comprise a rack bar secured to the conveyor **12** or alternatively it could be in the form of a cable, which expression is to be deemed to include a rope composed of metal or other strands, or a chain. Whatever the form of the anchorage member it is preferred that it should be secured to the conveyor. The latter comprises a plurality of sections articulately connected with each other at adjacent ends in such a manner to permit the conveyor to be advanced in a direction at right angles a section at a time towards the coal face, for this purpose a ram such as **7***b* being pressurised to project the part, such as **4***b*, while the roof support concerned is under load between the floor and the roof of the mine working of its hydraulic props **2***b* and **3***b*. The anchorage member should thus be of a form which permits of snaking movement of the conveyor towards the coal face. Such movement is readily accommodated when the anchorage member is a cable since this is flexible. If the anchorage member is in the form of a rack bar, as illustrated, it is preferably composed of sections articulately connected to each other.

One embodiment of connection means **11***a*, **11***b* and **25** which may be employed to effect connection between units of the roof supporting system and the anchorage member, such units being the roof supports and the guiding device, is illustrated in more detail in FIGURES 2 and 3 to which reference is now made.

Such connection means comprises a body **50** which includes an upper body member **51** of angle section having a vertical plate **52** lying in face-to-face relation with the rearwardly presented face of the anchorage member **9** while the top plate **53** extends over the upper edge of the anchorage member **9**.

The anchorage member **9** is formed conveniently of a length of T-section girder with the stem of the T arranged horizontally and attached by brackets such as **53** to a side member **54** of the conveyor **12**. For simplicity, attachment elements which secure the bracket **54** to the side member **55** and to the anchorage member **9** are omitted from the drawings.

The body **50** further comprises a lower body member **56** having a vertical plate **57** arranged in face-to-face relation on the rearward side of the vertical plate **52** and secured thereto by screw threaded studs **58** projecting from the plate **52** through vertical slots **59** in the plate **57**, such studs being equipped with clamping nuts **60**.

The lower body member includes a bottom plate **61** formed at its forward free edge with an upturned flange **62**.

Collectively the upper and lower body members embrace the vertical flange **9***c* of the T-section anchorage member and may be assembled therewith by temporarily slackening the nuts **60** to allow the upper body member to be raised during the assembly operation to pass over the vertical flange **9***c*.

It will be noted that the top plate **53** of the upper body member includes a rib **62** which, in combination with the vertical plate **52**, defines a groove **63** in which the upper margin of the vertical flange **9***c* of the anchorage member is received. The body is thus interlockingly engaged with the anchor member along the direction of advancement of the supports and guiding devices.

Collectively the upper and lower body members thus afford a guide passageway the dimensions of which are are such as to permit of free sliding of the body as a whole along the anchorage member.

The anchorage member carries a rack bar **9***a* secured in any convenient manner, for example by welding or by fastening elements not shown, to the forwardly presented face of the vertical flange **9***c* of the anchorage member above the horizontal stem thereof. Cooperating with the rack is a pawl element **64** pivotally mounted on a pin **65** the upper end of which is screw threaded to engage in an internally threaded boss **66** integral with the top plate **53** of the upper body member and carrying a lock nut **67** at the upper side of the latter.

Also mounted on the pin **65** is a torsion spring **68** one long arm **69** of which engages the vertical flange **9***c* of the anchorage member **9** above the rack bar **9***a* and another short arm **70** of which presses against the pawl element **64** to urge same into contact with the toothed face of the rack bar.

It will be noted that the configuration of the pawl element is such that it will permit of movement of the rack bar in the direction of the arrow **71** by virtue of the acute angled relationship between the face **64***a* at one side of the pawl element and the base of each recess in the toothed face of the rack bar, whereas the oppositely presented face **64***b* of the pawl element has an obtuse angled relationship and hence abuts the adjacent end face of the recess **9***b* positively to prevent movement of the body of the connecting means in the direction of the arrow **71**.

The lower body member **56** is provided with an attachment plate **72** in a vertical plane and having a slot **73** through which extends a bolt **74** secured between the limbs **75** of an attachment portion **76** on the associated guiding device or on an appropriate part of a roof support, such as **4***a* or **4***b*, according to whether the connection means is utilised to effect connection between the anchorage member and a guiding device or a roof support respectively.

It will further be evident that if it is required to permit of movement of the anchorage member (and conveyor) in a direction opposite to that indicated by the arrow **71** it is possible for the pawl element **64** to be reversed so that it would engage the rack bar on the side of the pin **65** opposite to that shown in FIGURE 3, the torsion spring also being similarly reversed in position.

In the embodiment illustrated in FIGURES 4 and 5 component parts corresponding to those already described with reference to FIGURES 2 and 3 are designated by like numerals of reference with the prefix 100, and the preceding description is to be deemed to apply thereto.

In this embodiment, instead of employing a rack bar and cooperative pawl element, restraint against movement of the guiding device or the roof support, as the case may be, relative to the anchorage member **109** is effected by a friction gripping element **177** in the form of a movable wedge cooperating with a fixed wedge **178** secured to the top plate **153** of the upper body member. The movable wedge has a groove **177***a* in which a rib **178** of the fixed wedge engages to hold the former in assembled relation with the latter when the connection means is removed from the anchorage member **109**.

The movable wedge **177** is urged by a coiled compression spring **179** in a direction to establish frictional engagement with the vertical flange **109***c* of the anchorage member **109**.

The anchorage member **109** in this embodiment is permitted to move in the direction of the arrow **171**. Such movement tends to reduce the contact pressure between the movable wedge **177** and the flange **109***c* by virtue of the oblique relation between the mutually contacting faces of the fixed and movable wedge and the flange **109***c*, the movable wedge being moved somewhat against the opposing force of the coiled compression spring **179**.

On the other hand any tendency for the guiding device or the roof support connected to the body of the connecting means to move in the direction of the arrow **171** is resisted by increasing contact pressure between the movable wedge **177** and the flange **109***c*.

Initial adjustment of the positional relationship of the two wedges and the flange can be effected by temporarily slackening securing nuts **180** on bolts **181** which extend through the fixed wedge **178** and pass through slots **182** in the top plate **153** of the upper body member.

In the embodiment illustrated in FIGURE 6 components corresponding to those already described with reference to FIGURES 2 and 3 are designated by like reference numerals with the prefix 200.

In this embodiment the stem **209***d* of the anchorage member **209** is engaged by a screw operated clamping element **283**. This clamping element is carried at the lower end of a screw rod **284** extending through an internally screw threaded boss in the top plate **253** and operable by means of a handle **285**.

With this form of connection means the clamping element **283** is normally tightened on to the stem of the T-section anchorage member to prevent all relative movement between the anchorage member and the guiding device or the roof support connected thereto.

When the conveyor is about to be advanced, however, the operator releases the clamping element **283** by appropriate rotation of the screw rod **284**.

What is claimed is:

1. In a mine roof supporting system for use in proximity to a long wall face of a mine working and comprising a plurality of units including laterally spaced roof supports and guiding devices disposed between successive ones of these supports, and engaging same by means of laterally presented guide faces of effective length to control the direction of advancement of the supports in contact therewith toward said face, and an anchorage member extending longitudinally of said face in advance of said units, the improvement comprising connecting means for connecting at least some of said units to said anchorage member, such connecting means each having:

(a) a body defining a guide passageway extending longitudinally of said anchorage member and through which said anchorage member extends, said body and said anchorage member being engaged interlockingly with each other in a direction transverse to the length of the anchorage member;

(b) retaining means on said body cooperative with said anchorage member while said body remains in said interlocking engagement therewith for preventing relative movement between said body and said anchorage member longitudinally of the latter in one direction therealong, while allowing said relative movement in the reverse direction.

2. The improvement according to claim **1** wherein:

(a) the anchorage member includes a rack element having a toothed face extending longitudinally of the anchorage member;

(b) the retaining means comprises a pawl element cooperatively engaging the toothed face of the rack element;

(c) means are provided to urge the pawl element into

cooperative engagement with the toothed face of the rack element.

3. The improvement according to claim 1 wherein:

(a) the body comprises body members movable relatively to each other between an operative position embracing the anchorage member and establishing said interlocking relationship, and a releasing position in which the guide passageway defined by the body members collectively is enlarged to permit of assembly of the body with the anchorage member,

(b) securing means are provided to hold the body members in said operative position.

4. The improvement claimed in claim 1 wherein:

(a) the retaining means comprises a friction gripping element movably mounted relative to the body between an operative gripping position and a releasing position with respect thereto,

(b) said anchorage member and said friction gripping element having mutually contacting faces extending in a direction generally lengthwise of that in which said gripping element is movable relative to said body,

(c) movement of said anchorage member in said reverse direction frictionally moves said gripping element towards its releasing position,

(d) movement of said body in said one direction frictionally moves said gripping element towards its operative position.

5. The improvement claimed in claim 4 wherein:

(a) said gripping element is a movable wedge mounted on said body for movement longitudinally of said anchorage member,

(b) a fixed wedge is provided on said body having a face extending obliquely relatively to an opposed face of said anchorage member,

(c) the movable wedge is mounted between said obliquely extending face and said opposed face.

6. The improvement according to claim 4 wherein means are provided for yieldably urging said friction gripping element towards its operative position.

7. In a mine roof supporting system comprising a plurality of laterally spaced roof supports, guiding devices disposed between successive ones of these supports, and engaging same by means of laterally presented guide faces of effective length to control the direction of advancement of the supports in contact therewith, and a laterally extending anchorage member in advance of the supports and guiding devices, the improvement comprising connecting means for connecting at least the guiding devices to the anchorage member, such connecting means having:

(a) a body defining a guide passageway extending longitudinally of said anchorage member and through which said anchorage member extends, said body and said anchorage member being engaged interlockingly with each other in a direction transverse to the length of the anchorage member;

(b) retaining means on said body comprising an element thereon movable towards and away from an opposed face on said anchorage member;

(c) manually operable screw mechanism on said body operatively connected with said element to move same between an operative position engaged with said opposed face on said anchorage member to hold said body against movement relatively to said anchorage member therealong, and a released position freeing said body for movement relatively to said anchorage member therealong.

8. A mine roof supporting system for use in proximity to a long wall face of a mine working comprising:

(a) an elongated anchorage member extending longitudinally of said face;

(b) a plurality of units of said system spaced apart laterally of each other in a direction longitudinally of said face;

(c) a plurality of connecting means respectively connecting said units to said anchorage member and each including

(1) a body defining a guide passageway extending longitudinally of said face and through which sad anchorage member extends, said body and said anchorage member being engaged interlockingly with each other in a direction transverse to the length of the anchorage member;

(2) retaining means on said body cooperative with said anchorage member to prevent relative movement between said anchorage member and said connecting means in one direction along said anchorage member while allowing relative movement therealong in the reverse direction.

9. A mine roof supporting system according to claim 8 wherein:

(a) said units comprise roof supports each including:

(1) a base;

(2) a plurality of props on said base;

(3) a roof-engaging superstructure carried by said props;

(4) a pressure fluid piston and cylinder unit for advancing said support in a direction towards said anchorage member;

(b) respective ones of said connection means are operatively connected between said piston and cylinder unit and said anchorage member.

10. A mine roof supporting system according to claim 8 wherein:

(a) said units comprise roof supports and further comprise guiding devices disposed between laterally successive ones of said roof supports;

(b) respective ones of said connection means are operatively connected between said guiding devices and said anchorage member.

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JACOB SHAPIRO, *Primary Examiner.*

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