July 23, 1968 F. J. FONTEIN 3,393,522

FACE SUPPORT

Filed Feb. 2, 1966 2 Sheets-Sheet 1

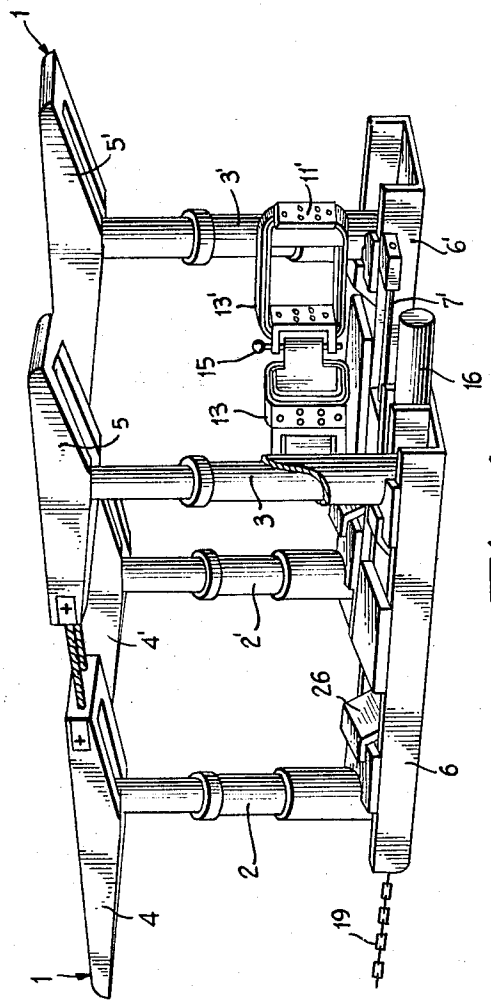

Fig. 1

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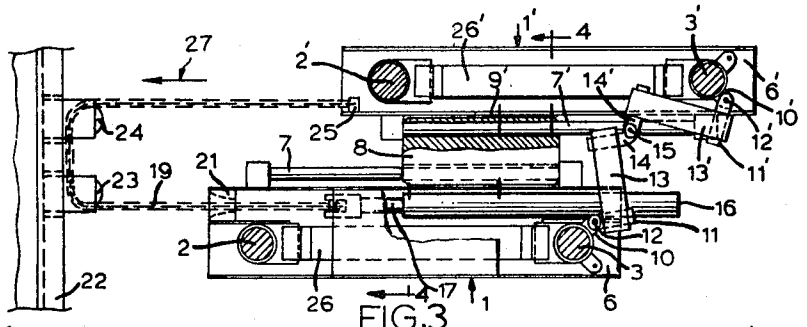

FIG.3

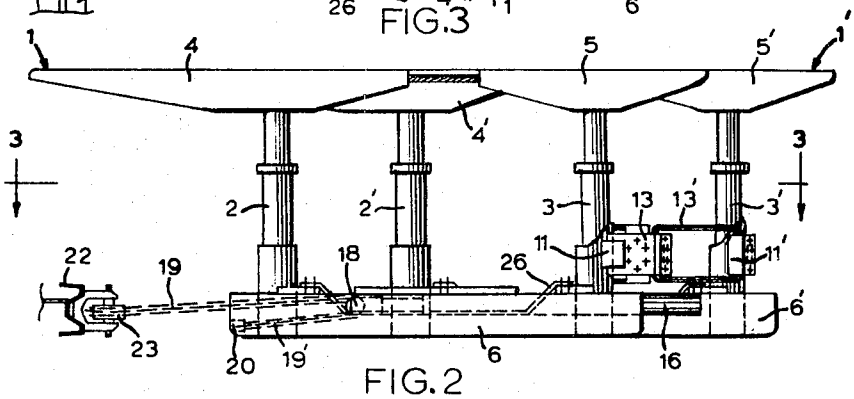

FIG.2

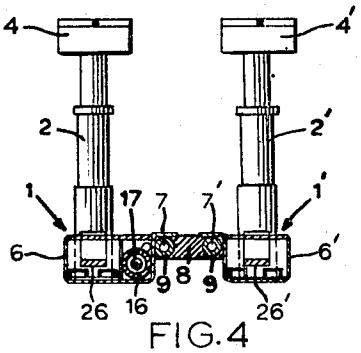

FIG.4

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3,393,522

FACE SUPPORT

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8 Claims. (Cl. 61—45)

ABSTRACT OF THE DISCLOSURE

A coal mine face support device of the type having two supporting frames which can be alternately advanced parallel to each other by means of an advancing device and a parallel guide composed of guide rails and guide members. The guide rails and the guide members cooperating therewith are constructed so that the guide members can turn with respect to the center line of the guide rails, and coupling means is provided between the pair of supporting frames which permits the usual advancing movements but which is made so rigid that a released frame is kept upright and parallel to the engaged frame irrespective of the seam inclination.

The present invention relates to a face support device for coal mines and the like consisting of two supporting frames which can be alternately advanced parallel to each other by means of an advancing device and a parallel guide composed of guide rails and guide members cooperating with these rails and more particularly to improved means for maintaining such supporting frames in proper perpendicular relation to the seam as they are advanced even when side-to-side inclinations in the seam are encountered.

Face support devices of the present type are well known. One problem presented by prior art devices of this type occurs when a side to side inclination is encountered in the seam. In a known construction, the moment which has to be exerted on a frame placed in an inclined face gallery to prevent it from leaning sidewards when it is released is absorbed by the parallel guide. As a result, this guide is subjected to large transverse forces which considerably increase the resistance that has to be overcome to advance a released frame. As there is always some play in the parallel guide, the released frame will not be exactly parallel to the clamped frame, but sightly lean towards the delivery or lower end of the face gallery. After this frame has been reset, it will retain this position. If the other frame is subsequently released and advanced, this will also lean towards the delivery end of the face gallery. As a consequence, the face support will ultimately deviate to a considerable extent from the perpendicular to the seam and an extra moment will be produced in the parallel guide as a result of this oblique position.

An object of the present invention is to provide a face support device of the type described having improved means for alleviating the above problem.

In accordance with the principles of the present invention, the guide rails and the guide members cooperating therewith are constructed so that the guide members can turn with respect to the center line of the guide rails, and coupling means is provided between the pair of supporting frames which permits the usual advancing movements but which is made so rigid that a released frame is kept upright and parallel to the engaged frame irrespective of the seam inclination. To this end, the parallel guide may consist of rods of circular cross section and sleeves cooperating therewith so that the sleeves can turn with respect to the rods. However, it is also

possible to pivotally support the ends of the guide rails so that the guide members and the guide rails can turn with respect to the center line of the rails. By preference, each supporting frame is provided with a guide rod, and the rods of these frames are connected by a runner fitted with guide sleeves.

In the construction according to the invention the moment to be exerted on a released frame to prevent it from leaning over too much in an inclined face gallery is produced not by the parallel guide, but by an improved coupling means, so that no extra transverse forces encumbering the advance of the released frame can act on the parallel guide. These forces now act on the pivot pins of the coupling means. However, at equal transverse forces, the work, calculated as the product of force and the distance covered by this force, is considerably less in the case of a hinge than in the case of a straight guide. In addition, the forces acting on the hinges can be kept small by using hinges with a great height and, consequently, a large moment arm. As a result, the resistance to be overcome when a frame is advanced is extremely small. The use of a parallel guide with a large height to keep the transverse forces acting on the guide low is objectionable, as it becomes more difficult to pass through the face gallery.

The coupling means preferably comprises strips of spring steel the ends of which are bent at right angles and are pivotally interconnected by hinges. This makes it possible to use hinges with a large height. The parts of the coupling means may be given the shape of a frame by interconnecting the bent ends of the strips. If the coupling members are deflected, the props will move parallel to themselves.

As the moment to be exerted to keep the frames normal to the seam need not be supplied by the guides in the construction of the present invention, the guide rods may be so constructed that the guide members enclose these rods with ample play. If the frames are moreover advanced by means of a pulling member extending from a point of the face conveyor to the leading sides of the frames, an aligning effect is produced on the frames when these are advanced. That is, a support remains in line with a given point of the conveyor as the coal face advances and will not shift towards the lower end of an inclined face gallery or assume an oblique position with respect to the conveyor.

When a face support of the known type has shifted towards the delivery end of the force gallery, a released frame will be forced by the guide connected to the clamped frame to move parallel to this clamped frame so that it will retain its wrong position. In the support according to the invention the released frame can move freely with respect to the clamped frame due to the ample play, and, as the frame is pulled forward from a fixed point of the conveyor, it will automatically follow the course of this point.

It is a further object of the present invention to provide a face support device of the type described having improved means for maintaining the supporting frames in proper relation to the seam as they are advanced.

These and other objects of the present invention will become more apparent during the course of the following detailed description and appended claims.

The invention may best be understood with reference to the accompanying drawings wherein an illustrative embodiment is shown.

In the drawings:

FIGURE 1 is a perspective view of a face support device embodying the principles of the present invention;

FIGURE 2 is a side elevational view of the support device;

FIGURE 3 is a sectional view taken along the line 3—3 of FIGURE 2, with certain parts broken away; and

FIGURE 4 is a sectional view taken along the line 4—4 of FIGURE 3.

Referring now more particularly to the drawings, there is shown therein a face support device including two supporting frames, **1** and **1'**, of generally conventional construction. As shown, the frames **1** and **1'** comprise two hydraulic props **2** and **3** and **2'** and **3'**, respectively, which support roof plates **4** and **5** and **4'** and **5'**, respectively, and are supported on the floor of the seam by means of base plates **6** and **6'**, respectively.

In accordance with the principles of the present invention, guide means are provided, preferably in the form of a rod or rail **7** of circular section connected to the base plate **6** of frame **1** and a similar rod **7'** connected to the frame **1'**. The rods **7** and **7'**, and consequently the frames **1** and **1'**, are spaced by a runner or guide member **8**, which is provided with sleeves **9** and **9'**, respectively, which can slide along the rods with ample play.

Coupling means is provided in accordance with the present invention in conjunction with the guide means. To this end, the props **3** and **3'** are provided with brackets **10** and **10'** to which straps **11** and **11'** are connected by means of pivot pins **12** and **12'** running parallel to the props. Fitted to these straps are springs **13** and **13'** fixed to straps **14** and **14'**, which are interconnected by a pivot shaft **15** running parallel to the props. The springs have a box-shaped longitudinal section with a relatively great height. The hinges or pivot pins **12**, **12'** and **15** are fitted to the upright sides of the springs so that the height of these hinges is great and the forces produced in the hinges to keep a released frame upright are consequently comparatively small.

A hydraulic cylinder **16** is mounted in the base plate **6** of frame **1**. The end of the piston rod **17** extending outside the cylinder is fitted with a roller **18** on which a pulling element, such as a chain or rope **19**, runs. The pulling element is fixed at one end to the leading side of base plate **6**, as at **20**, and, after passing over roller **18**, runs through a guide **21** on the leading side of the base plate **6** and then around a pair of rollers **23** and **24** mounted on the face conveyor **22**. The opposite end of the pulling element **19** is attached to the leading side of base plate **6'**, as at **25**. Since the cylinder pulls at two portions **19** and **19'** of the chain, the stroke of the cylinder need be equal only to half the step length of a frame.

In accordance with conventional practice, as the coal face advances, the conveyor is pushed forward in the direction of the arrow **27**, by conventional pushing cylinders such as are shown at **56**, **57** in FIGURE 6 of the U.S. Patent of Creuels et al. 3,328,966, and described therein, particularly at column 6, lines 6–8. During this movement, piston rod **17** is pulled out by the pulling member **19**. When the piston has finally reached its extreme position, or earlier if the advance of a support is required, the props of frame **1'** are released and pressure fluid is admitted to the cylinder **16** on the lefthand side of the piston, as shown in FIGURE 3. The piston rod then moves to the right, as shown in FIGURE 3, and pulls frame **1'** forward by means of the pulling element **19** until the piston is in its extreme righthand position, after which frame **1'** is again clamped. Due to the ample play between sleeves **9** and **9'** and the guide rods **7** and **7'**, frame **1'** can align within certain limits independently of the position of the clamped frame **1**, and since the pulling element **19** runs from roller **24** to the leading side **25** of frame **1'**, this alignment will be such that frame **1'** will always follow roller **24**. In a similar way frame **1** will always follow roller **23** when it is advanced.

When released, the props are kept from falling aside by springs **13** and **13'**, while the backward or forward inclination is prevented by springs **26** and **26'** mounted in the base plates **6** and **6'** and connected to the props **2** and **3** and **2'** and **3'**, respectively.

When a frame is advanced along a rugged floor, the guide members will not get jammed due to the ample play between the guide sleeves and rods.

If the pivoting parts **13** and **13'** are attached to the trailing sides of the hindmost props **3**, **3'** of the support and the common pivot is so mounted that it is in front of the line of connection between the hinges **12**, **12'** of the props, the passage through the face gallery will hardly be obstructed by the upright coupling members **13**, **13'**.

It thus will be seen that the objects of this invention have been fully effectively accomplished. It will be realized, however, that the foregoing specific embodiment has been shown and described only for the purpose of illustrating the principles of this invention and is subject to extensive change without departure from such principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

It is claimed:

1. A face support device for a coal mine or the like comprising: a pair of parallel supporting frames each including base means for engaging the floor of the mine; roof plate means for engaging the roof of the mine; and extensible and retractable prop means between said base means and said roof plate means; guide means between said supporting frames interconnecting the latter for generally parallel longitudinal movement with respect to each other between two limiting positions and for pivotal movement about axes parallel to the direction of said relative longitudinal movement, said guide means comprising a longitudinally extending guide rail carried by each of said supporting frames and a guide member slidably receiving each of said guide rails; means for effecting an advancing longitudinal movement of either one of said supporting frames with respect to the other when the prop means of said one supporting frame is retracted and the prop means of said other supporting frame is extended; and coupling means connected between said supporting frames permitting said relative longitudinal and pivotal movements for maintaining the one frame in parallel relation with respect to the other frame during such advancing movements; said coupling means comprising a pair of coupling members having adjacent ends pivotally interconnected and opposite ends pivotally connected with the respective supporting frames, the axes of said pivotal connections being parallel with the direction of extension and retraction of said prop means.

2. A face support device as defined in claim **1** wherein said supporting frame advancing means comprises an elongated flexible pulling element having two opposite ends, each operatively connected to respective of said supporting frames and adapted to be trained, intermediate said two opposite ends, about roller guide elements carried by a face conveyor at fixed positions thereon in longitudinal alignment with the respective operative connections with said supporting frames.

3. A face support device as defined in claim **1** wherein said guide rails comprise rods of circular cross-section carried by the base means of respective supporting frames and wherein said guide member includes sleeve portions of circular cross-section receiving said rods with ample play.

4. A face support device for a coal mine or the like comprising: a pair of parallel supporting frames each including base means for engaging the floor of the mine; roof plate means for engaging the roof of the mine; and extensible and retractable prop means between said base means and said roof plate means; guide means between said supporting frame interconnecting the latter for generally parallel longitudinal movement with respect to each other between two limiting positions and for pivotal movement about axes parallel to the direction of said relative longitudinal movement, means for effecting an advancing longitudinal movement of either one of said supporting frames with respect to the other when the

prop means of said one supporting frame is retracted and the prop means of said other supporting frame is extended; and coupling means connected between said supporting frames permitting said relative longitudinal and pivotal movements for maintaining the one frame in parallel relation with respect to the other frame during such advancing movements; said supporting frame advancing means comprising a flexible pulling element having its ends fixed respectively to the base means of said supporting frames and adapted to be trained about roller guide elements carried by a face conveyor at fixed positions thereon in longitudinal alignment with the respective positions at which the ends thereof are fixed to the base means of said supporting frames, a longitudinally extending hydraulic piston and cylinder unit carried by one of said base means and roller means carried by one end of said piston and cylinder unit about which said flexible element is trained.

5. A face support device for a coal mine or the like comprising: a pair of parallel supporting frames each including base means for engaging the floor of the mine; roof plate means for engaging the roof of the mine; and extensible and retractable prop means between said base means and said roof plate means; guide means between said supporting frames interconnecting the latter for generally parallel longitudinal movement with respect to each other between two limiting positions and for pivotal movement about axes parallel to the direction of said relative longitudinal movement; means for effecting an advancing longitudinal movement of either one of said supporting frames with respect to the other when the prop means of said one supporting frame is retracted and the prop means of said other supporting frame is extended; and coupling means connected between said supporting frames permitting said relative longitudinal and pivotal movements for maintaining the one frame in parallel relation with respect to the other frame during such advancing movements; said prop means of each of said supporting frames including a hydraulic prop having an upright axis, and wherein said coupling means comprises a pair of coupling members having adjacent ends pivotally interconnected and opposite ends pivotally connected with the props of respective supporting frames, the axes of said pivotal connections being parallel to the axes of said props.

6. A face support device as defined in claim **5** wherein each of said coupling members comprises spring means having hinge means secured to opposite ends thereof.

7. A face support device as defined in claim **6** wherein the spring means of each coupling member comprises spaced upper and lower strips of spring steel having their opposite ends bent and fixedly interconnected by a rigid hinge element.

8. A face support device as defined in claim **5** wherein the axis of the pivotal interconnection between said coupling members is disposed in advance of a plane passing through the axes of the pivotal connections of said coupling members with said respective props.

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JACOB SHAPIRO, *Primary Examiner.*