MOBILE FACE SUPPORT
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ABSTRACT OF THE DISCLOSURE
A face support 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 which are coupled by means of a bipartite coupling member the parts of which are so connected to each other and to the supporting frames that they can pivot on a shaft which is substantially parallel to the props. The guide rails and the guide members cooperating therewith are so constructed that the guide members can turn with respect to the centerline on the guide rails. The coupling member is sufficiently rigid that a released frame is kept upright by this coupling member, the parts of which are generally rectangular and consist of spring steel strips bent at right angles and provided with hinges, as described in the U.S. patent application 524,528 which has not yet become public inspection. The foregoing abstract should not be construed as indicating the principles or scope of the invention disclosed in this document.

Background of the invention
The construction described in the U.S. patent application of Fontein, Ser. No. 524,528, filed Feb. 2, 1966, relates to a face support device for long-wall faces in 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 frame in parallel relation to the seam as they are advanced even when side to side inclination in the seam are encountered. The guide rails and the guide members cooperating therewith are so constructed that the guide members can turn with respect to the centerline 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 sufficiently 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.

The coupling means 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. If the frames are moreover advanced by means of a pulling member extending from a point of a 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. As the parts of the coupling member consists of leaf springs, this enables a certain displacement of the supporting frames with respect to each other in a direction normal to the floor, which is necessary to overcome irregularities in the floor when a released frame is advanced.

Consequently, one demand made on the rectangular parts of the coupling member is a high torsional stiffness to present the supporting frames from leaning over, another demand is that the said parts should have not too high a bending resistance to enable the frames to be advanced along an uneven floor. In the known construction in which the connecting parts between the hinges of the rectangular parts of the coupling member consist of spring steel strips the ends of which are rigidly connected to the hinges, no adequate compromise can be found between the required high torsional stiffness and the desired low bending resistance.

Summary of the invention
According to the invention, at least one hinge part of each rectangular part of the coupling member is movably connected to the leaf springs of that rectangular part, by means of a pivot extending normal to the plane of the rectangular part.

The springs no longer act as rods clamped on two sides, but as rods clamped on one side, so that, at the same vertical force, or at the same vertical displacement of the hinge parts, the same torsional stiffness is retained. Conversely, at one end of the said bending resistance, heavier leaf springs can be used, which increases the torsional stiffness. Thus the thickness of the springs can be raised from 8 mm. to 12 mm., as a result of which, in a gallery with an inclination of 30°, leaning over of the supporting frames from the vertical to the floor can be reduced from over 4° to at most 20°. If the dip is great, so that the vertical projection of the centers of gravity of the props is far outside their bases, some inclination of the frames cannot yet be completely avoided even with this improved construction.

The invention furthermore provides a construction which enables the props to be reset perpendicularly to the dip after they have been advanced. This has been achieved by causing at least two hinge pins of the rectangular parts of the coupling member to stand at an angle to each other such that the frame of one the props are inclined in the direction opposite to that of the inclination caused by gravity.

If, in the case where the angle included by the two rectangular parts of the coupling member points away from the working face, the angle formed by the shaft of the hinge between the lower frame (as seen in the direction of the dip) and a rectangular part of the coupling member, and on the other hand, the central hinge pin between the two parts of the coupling member, is made to diverge towards the floor, the props of both frames will, after the release and during the advance of the frame, come to be so inclined with regard to the central hinge pin that the inclination owing to gravity is thereby opposed. Thus a compensation is obtained for the deviation of the props from the position perpendicular to the dip. In the previous case the desired compensation can also be achieved by making the hinge pin of the upper frame diverge towards the roof with respect to the central pin. A combination of these two constructions can also be used. In the case where the angle included by the parts of the coupling member points towards the working face the desired effect can be ob-
tained by disposing the hinge pins in such a way that the angle included by the central hinge pin and the hinge pin of the lower frame diverges towards the roof, and/or the angle included by the central pin and the hinge pin of the upper frame diverges towards the floor.

The required angle between the hinge pin can be obtained by placing wedge-shaped spacers between a rectangular part and one or more hinge parts. The angle between the hinge pins can also be obtained by replacing one or both rectangular parts of the coupling element by trapezium-shaped parts. This lends simplicity to the construction, it being possible to alter the angle included by the two pins by changing the length of the base and/or of the upper side. The said angle between the pins can be determined by simply measuring these lengths.

In face galleries having a very strong dip it may be necessary to take further measures in order to achieve the desired effect such as changing the height of the hinged parts at the hinge pins. This can be achieved if at least one part of mutually engaging hinge parts is provided with more than two seating elements spaced equally apart. Then the hinge parts can be shifted in height with respect to each other, over a distance equal to the interval between two seating elements, so that the compensating effect obtained after the release of a supporting frame and during the advance thereof can be reinforced. The height over which this shift is made depends on the required degree of compensation and on the number of seating elements used.

**Brief description of the drawing**

The invention will be further explained with reference to the embodiment shown in the drawing where

FIGURE 1 shows a generally elevational perspective view of a movable face support with coupling member;

FIGURE 2 is a front elevation view of the rectangular parts of the coupling member according to the invention;

FIGURE 3 is a front elevation view similar to FIGURE 2, but of a simpler construction of the rectangular parts;

FIGURE 4 is a top plan view of the coupling member;

FIGURE 5 is a side elevation view of the rectangular parts of the coupling member provided with a wedge-shaped spacer;

FIGURE 6 is a side elevation view of a trapezium-shaped part of a coupling element;

FIGURE 7 is a side elevation view of a hinge that can be shifted in height; and

FIGURE 8 is a side elevation view of the same hinge after such a shift has been made.

**Description of the preferred embodiment**

According to FIGURE 1 a movable face support consists of two supporting frames 1 and 1', each comprise two hydraulic props 2 and 2' and 3 and 3' respectively, with roof plates 4 and 4' and 5 and 5', respectively, and which rest on the floor of the seam by means of base plates 6 and 6', respectively. The dip H in the drawing is supposed to be such that frame 1' is lower than frame 1. The two supporting frames 1 and 1' are pivotally connected by a coupling member consisting of two rectangular parts which member is shown in detail in FIGURE 2. In FIGURE 1, the angle included by these parts points away from the face. To this end props 3 and 3' are provided with brackets 10 and 10' respectively, which are designed as hinge parts and to which hinge parts 11 and 11', respectively, are connected by means of hinge pins 12 and 12' extending parallel to the props. The latter parts are provided with leaf springs 13 and 13' respectively which are pivotally connected to hinge parts 14 and 14' respectively, by means of pivot pins 29 and 29' and 30 and 30', respectively. Thus it is achieved that the ends of the springs can turn with respect to the hinge parts 14 and 14', so that the springs 13 and 13' act as rods clamped on one side, in the embodiment on the side of the hinge parts 14.

The leaf springs 13 and 13' can advantageously be given the shape of a bracket by connecting the strip ends bent at right angles, as shown in FIGURE 3 by references 13a and 13'a.

FIGURE 4 shows a top plan view of the coupling member in which, according to the details of FIGURE 5, spacers 31 and 32 and 31', respectively are placed between the hinge parts 11 and 14 and 11' and 14', respectively, (which in this embodiment are not provided with forks 27 and 28 and 27' and 28') and the springs 13 and 13', respectively, and the hinge parts and the spacers are fixed to the springs by means of bolts and washers not shown in the drawing. In the embodiment shown here one of the spacers has been replaced by wedges 32' and 32''. This ensures that the hinge pins 12' and 15 will include an angle, which diverges towards the floor, so that, upon advancement of the frame towards A, compensation for the dip H will be provided. If necessary, additional of the other hinge parts may be provided with similar wedges.

FIGURE 6 depicts a simpler design of the coupling member in which one or both rectangular parts have been replaced by trapezium shaped parts, wherein the leaf spring 13'b is shorter than spring 13'c. Also in this case, the hinge parts 11' and 14' include an angle which diverges towards the floor.

FIGURE 7 shows a design of one of the hinges in this case the hinge composed of the parts 10' and 12' and 11', with the parts 10' and 11' being movable in height with respect to each other along their pin 12'. The hinge parts 10' and 11' are provided with seating elements 33, 33', etc. and 34, 34' etc., respectively, connected by means of the pin 12'. FIGURE 8 shows the same parts after their relative position has been changed.

Without departing from the principles of the invention, the angles included by the hinge pins can be changed depending primarily on the amount of dip of the face gallery to effect a virtually perpendicular positioning of the frames with respect to the dip after the support has been advanced. An added advantage secured by using the apparatus of the invention is that the force exerted on the floor by the lower frame (as seen in the direction of the dip) is reduced, while in the case of the upper frame this force is increased, which results in elimination of the unequal distribution of forces to which a frame resting on a sloping plane is subjected. Consequently, the forces needed for advancing each of the supporting frames can be distributed more uniformly that in the case that the hinge pins are parallel. Since the greatest force needed for advancing the frames can thus be reduced, a smaller advancing cylinder may be used.

The angle included by the two hinge pins may lie in one plane, but the pin may also form an angle in two planes normal to each other, which is the case if the rectangular or trapezium-shaped part of a coupling member is twisted.

In a strongly inclined face the movable joint between the hinge parts and the leaf springs will preferably be combined with hinge pins that include an angle in the manner described.

Because the specific embodiments described herein can be modified without departing from the principles of the invention disclosed herein, the present invention should be understood to include all such modifications as are within the spirit and scope of the following claims.
What is claimed is:

1. In a movable face support which includes two parallel supporting frames; extensible and retractable upright prop means; guide means between said supporting frames interconnecting the latter for generally parallel longitudinal movement with respect to each other 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 receiving each of said guide rails, the guide rails being longitudinally movable on said guide member; 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 extended; and coupling means interconnecting the latter for generally parallel longitudinal movement with respect to each other 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 receiving each of said guide rails, the guide rails being longitudinally movable on said guide member; 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 extended; and coupling means comprising a pair of coupling members; each coupling member comprising a generally rectangular spring steel strip part having two generally vertical sides, and a generally lateral top and bottom extending between said sides in a plane; hinge parts, respectively secured to each side of each strip part; pivot means pivotally interconnecting the hinge parts on adjacent sides of the two strip parts; pivot means pivotally connecting the opposite sides of the two strip parts to the respective frames; the improvement wherein: said coupling members being hingedly connected to the guide members by hinge means including pivot pins received in the laterally outer of said hinge parts of the two generally rectangular spring steel strip parts and hingedly connected to each other by hinge means comprising a pivot pin received in the laterally inner of said hinge parts; at least two of said pivot pins being so canting with respect to one another that, during advance of the respective frame, the prop means thereof are inclined in the direction opposite to that of their tendency to lean due to gravity were said two pivot pins both substantially vertical.

2. In a movable face support which includes two parallel supporting frames; extensible and retractable upright prop means; guide means between said supporting frames interconnecting the latter for generally parallel longitudinal movement with respect to each other 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 receiving each of said guide rails, the guide rails being longitudinally movable on said guide member; 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 extended; and coupling means comprising a pair of coupling members; each coupling member comprising a generally rectangular spring steel strip part having two generally vertical sides, and a generally lateral top and bottom extending between said sides in a plane; hinge parts, respectively secured to each side of each strip part; pivot means pivotally interconnecting the hinge parts on adjacent sides of the two strip parts; pivot means pivotally connecting the opposite sides of the two strip parts to the respective frames; the improvement wherein: at least one hinge part of each coupling member generally rectangular spring steel strip part is connected to the respective generally rectangular spring steel strip part by a pivot joint having a pivot axis extending normal to the plane of the respective generally rectangular spring steel strip part.

3. The movable face support of claim 2 wherein at least one hinge part of each coupling member generally rectangular part is connected thereto by pivot means extending normal to the plane of the generally rectangular part.

4. The movable face support of claim 2 wherein canting of at least one of said pivot pins is effected by interposition of a wedge shaped spacer between the respective side of the respective generally rectangular part and the respective hinge part.

5. The movable face support of claim 2 wherein the said two opposite sides of at least one of said generally rectangular part are oblique with respect to one another to constitute a trapezium shaped part.

6. The movable face support of claim 2 wherein at least two hinge parts coupled by a pivot pin each comprise a plurality of interdigitable elements which hinge parts are constructed and arranged to be interdigitated with one another at least two longitudinally displaced positions with respect to the pivot axis thereof.

7. The movable face support of claim 3 wherein at least two hinge parts coupled by a pivot pin each comprise a plurality of interdigitable elements which hinge parts are constructed and arranged to be interdigitated with one another at least two longitudinally displaced position with respect to the pivot axis thereof.

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