United States Patent [19]

Welzel et al.

[11] **3,745,772**

[45] **July 17, 1973**

[54] **HYDRAULIC ROOF-SUPPORT FRAME**

[75] Inventors: **Josef Welzel; Hans Bull,** both of Wuppertal-Elberfeld; **Alfred Maykemper,** Wuppertal-Barmen, all of Germany

[73] Assignee: **Hermann Hemsheidt Maschinenfabrik,** Wuppertal-Elberfeld, Germany

[22] Filed: **Dec. 10, 1971**

[21] Appl. No.: **206,794**

[30] **Foreign Application Priority Data**

Dec. 23, 1970 Germany ..... P 20 63 466.6

[52] **U.S. Cl.** ..... **61/45 C,** 248/357

[51] **Int. Cl.** **E21d 15/44**

[58] **Field of Search** ..... 61/45 R, 45 D, 45 C; 248/357, 354 H; 299/31, 33; 91/170 MP

[56] **References Cited**

UNITED STATES PATENTS

1,788,102	1/1931	Gilbert	287/98
3,235,038	2/1966	Nesslinger	287/98 X

FOREIGN PATENTS OR APPLICATIONS

1,085,706	10/1967	Great Britain	61/45 D
92,217	9/1968	France	61/45 D
1,088,000	9/1960	Germany	61/45 D
1,143,771	2/1963	Germany	61/45 D

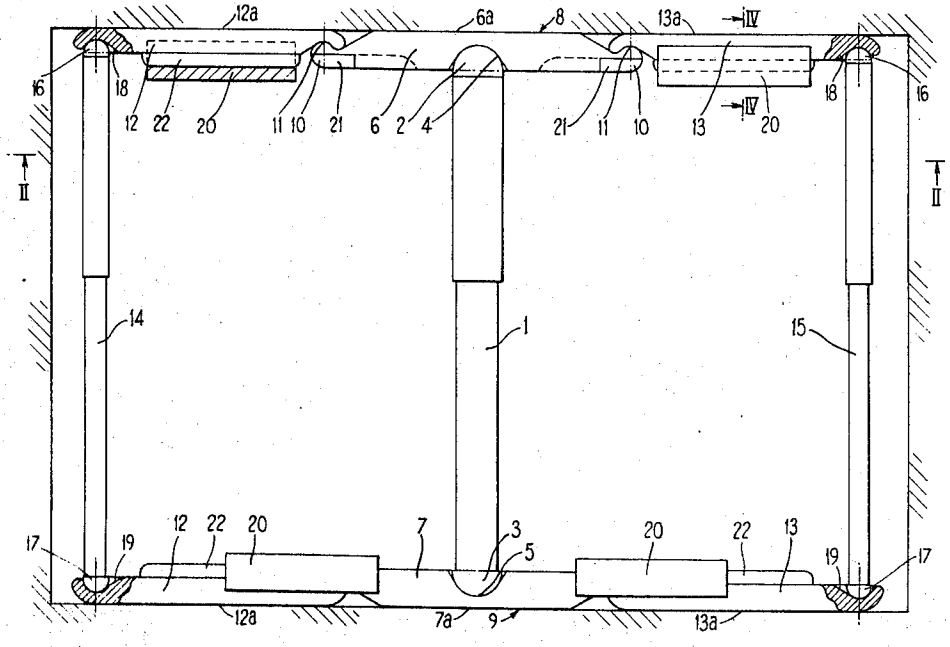
Primary Examiner—Dennis L. Taylor

Attorney—Hyman Berman et al.

[57] **ABSTRACT**

An hydraulic roof-support frame comprising floor and roof beams each of articulated construction, two outer hydraulic props extending between outer sections of the beams, at or near the ends of the latter, and at least one intermediate hydraulic prop, of greater strength than the outer props, extending between central portions of the beams, the said central portions having roof-engaging and floor-engaging surfaces of substantially greater area than the corresponding surfaces on the outer sections of the beams.

5 Claims, 4 Drawing Figures



PATENTED JUL 17 1973

3,745,772

SHEET 1 OF 2

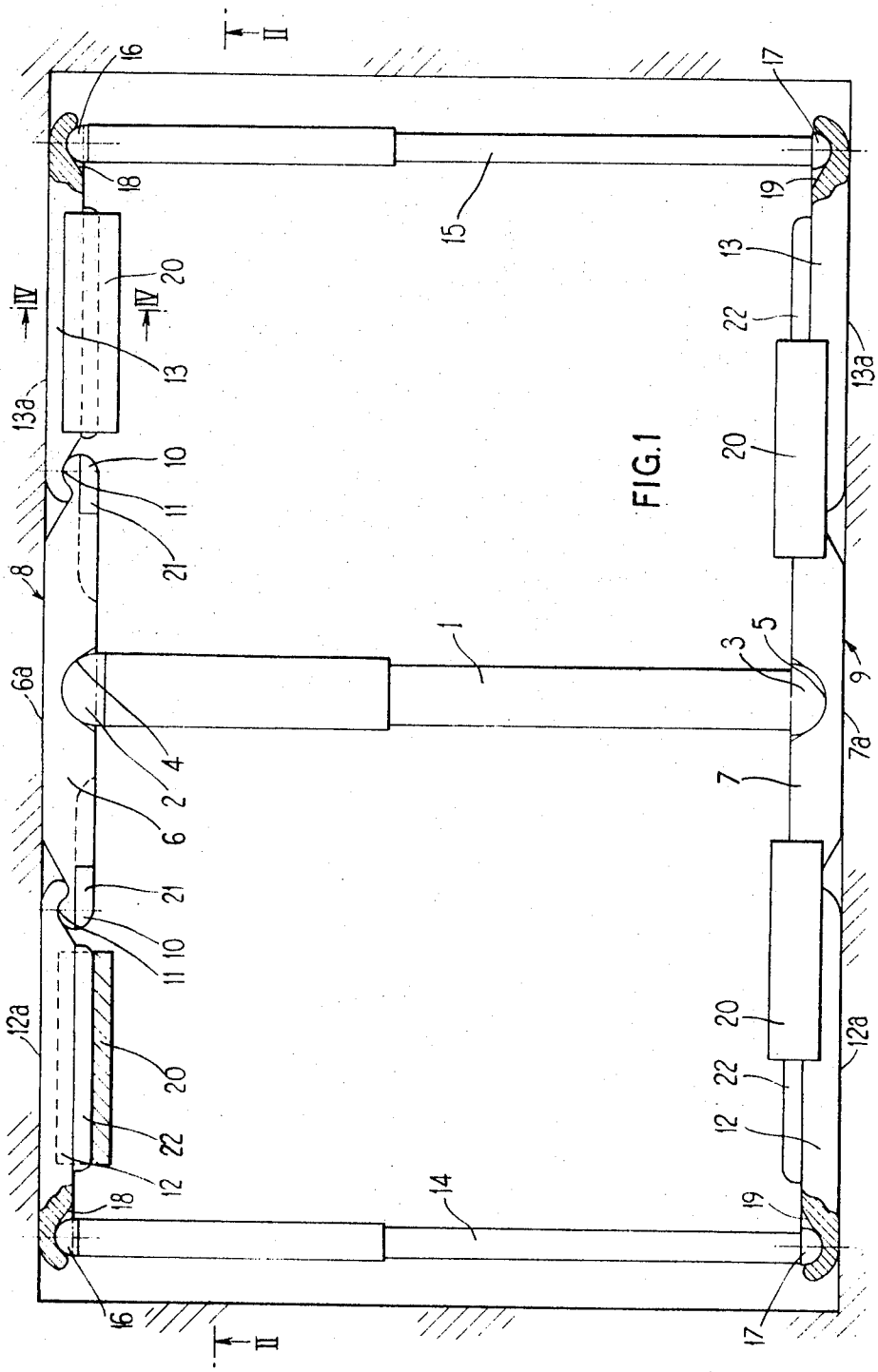


FIG. 1

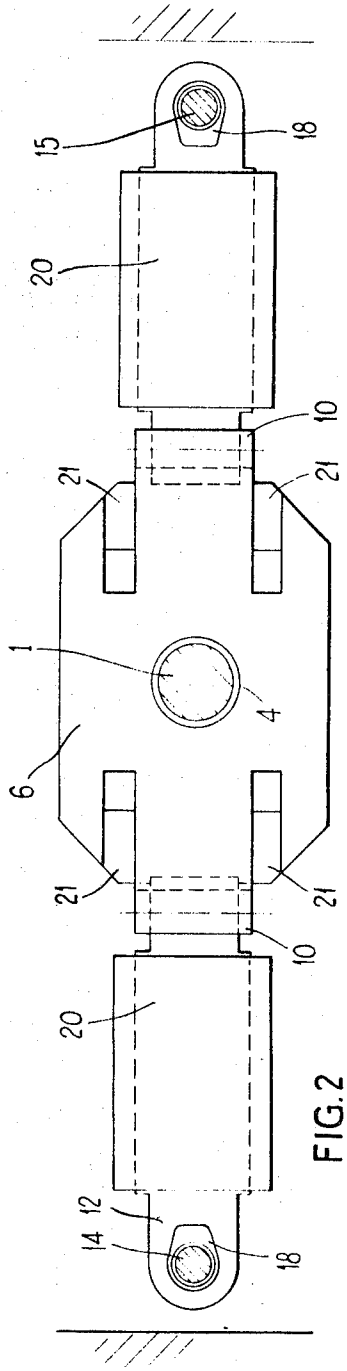


FIG.2

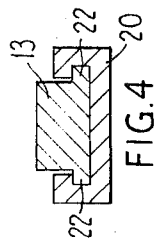


FIG.4

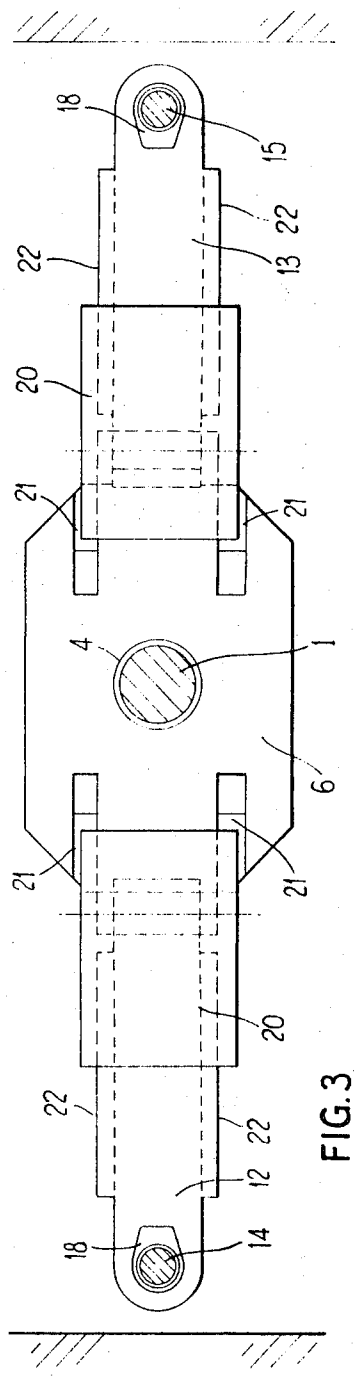


FIG.3

HYDRAULIC ROOF-SUPPORT FRAME

This invention relates to hydraulic roof-support frames for use in mines and other underground workings, the frames comprising floor and roof beams and hydraulic props extending between them.

Coal faces and other underground mineral deposits are increasingly being worked with fully-mechanised cutting machines with the result that the roof-supports in the galleries or "roads" of the mine need to be rigidly placed in position in their final form. Steel roof-support frames comprising two spaced-apart props surmounted by a roof beam or plate are frequently used for this purpose, but they have the disadvantage that large roof spans are then insufficiently supported over the central section of the roof beam which therefore frequently becomes deformed so that subsequent propping-up of the beam is required. Even if one or more additional intermediate props are inserted to support the beam, they cannot permanently strengthen a gallery or road which is under considerable pressure from the surrounding earth, rock or mineral deposits. Further, the beam does not support the load fully until the roof has sunk under that pressure, as the props and the beam are not braced so as to provide active support but are merely wedged against the side-walls and roof of the gallery or road. Another disadvantage is that the roof-support is bulky and is relatively expensive to install, so that if the cutting machinery advances rapidly, the roof-support is left behind or delays the advance. Also, after a roof-support has been fitted in position, it is uneconomic to remove it for reuse because of the high cost of transporting and erecting its component parts which have, in any case, usually become considerably deformed.

As will be evident from the above description, the roof-support does not adequately support the central part of the roof where the greatest bending stress occurs. The resulting flaking and fissuring of the mineral or rock surrounding the road or gallery reduces the stability of the latter particularly if the additional pressure caused by the mining work in progress loosens stones and rocks so that they fall into the road. This and the associated floor creep which also frequently occurs cannot be prevented by using intermediate props, especially if the solid rock surrounding the road or gallery has already developed fissures or has begun to flake. Consequently, a considerable amount of extra work is required, quite apart from extra props, in order to strengthen the roof-supports in the road or gallery and to maintain the latter at the desired width and height.

With these considerations in mind, the aim of the present invention is to provide a roof-support which is immediately operative, which can easily be installed and re-used, and which reduces or largely prevents flaking and fissuring of the rock surrounding a road or gallery where the roof-support is installed.

The invention is accordingly directed to an hydraulic roof-support frame comprising floor and roof beams each of articulated construction, two outer hydraulic props extending between outer sections of the beams, at or near the ends of the latter, and at least one intermediate hydraulic prop, of greater strength than the outer props, extending between central portions of the beams, the said central portions having roof-engaging and floor-engaging surfaces of substantially greater area than the corresponding surfaces on the outer sections of the beams.

The main advantage of this new form of roof-support frame is that the roof of the road or gallery is now actively supported over its central portion, the main bearing force being transmitted to the intermediate prop or props, while the end props have the subordinate function of providing additional support for the roof adjacent the side walls of the road or gallery. Preferably, the main bearing force on the intermediate prop or props is applied to the floor and roof of the road or gallery by central portions of the roof and floor beams which are rigid and of large area, thus largely preventing the rock surrounding the road or gallery from yielding and breaking. Any breaking-up or creep of the floor caused by settlement or by the additional pressure of mine-working in progress is also actively counteracted by the intermediate prop or props (which can bear a load considerably exceeding the load due to settlement) and by the large-area central portion of the floor beam. If the road or gallery is unusually wide, two or more intermediate props can be used to take the main bearing force.

When the end props need to be removed in order to erect a delivery device (such as a conveyor) along one of the walls of the road or gallery, two or more sections of each beam are locked together to form a rigid assembly, without structural alterations being required. The components of the frame are all designed so that they can easily be transported and rapidly placed in position, using suitable tools. After use, the frame can easily be taken down and re-used, particularly as deformation of the components does not occur to an appreciable extent.

An example of a roof-support frame in accordance with the invention is shown in the accompanying drawings, in which:

FIG. 1 is a side view of the roof-support frame;

FIG. 2 is a section taken on the line II — II in FIG. 1;

FIG. 3 is a view similar to FIG. 2 showing the manner in which the sections of the roof beam are locked together; and

FIG. 4 is a section taken on the line IV — IV in FIG. 1.

The roof-support frame shown in the drawings comprises a centrally-disposed, telescopic, hydraulic intermediate prop **1** forming the main bearing element of the support frame, the prop **1** being provided with part-spherical top and bottom bearing surfaces **2, 3** releasably engaging in corresponding recesses **4, 5** formed in the central sections **6, 7** of roof and floor beams **8, 9**. The identical beam sections **6** and **7**, which are rigid and have roof-engaging and floor-engaging surfaces **6***a* and **7***a* of large area, are formed with sloping or bevelled ends **10** forming bearing surfaces which pivotally engage under or in corresponding recesses **11** in end sections **12** and **13** of the roof and floor beams, the end sections being narrower than the central sections **6** and **7** with the result that their roof-engaging and floor-engaging surfaces **12***a* and **13***a* are substantially smaller in area than the surfaces **6***a* and **7***a*. The beams **8** and **9** are therefore of articulated construction, it being appreciated that the three sections of each beam can be pivotally connected together in a different manner if so desired. Preferably, the end sections **12** and **13** of the roof and floor beams are of identical construction so that they can be interchanged if that is required.

Arranged at or near the ends of the beams **8** and **9** are two outer, telescopic, hydraulic props **14** and **15** which are of smaller diameter than the intermediate prop **1**. Like the prop **1**, the outer props **14** and **15** each have part-spherical top and bottom bearing surfaces **16** and **17** releasably engaging in recesses **18** and **19** in the end sections **12** and **13** of the beams **8** and **9**, the recesses **18** and **19** being smaller than the recesses **4** and **5** for the prop **1**.

The sections of each beam **8** and **9** can be locked together in pairs so as to form rigid units by means of locking shoes **20** which can slide along slideways **21** and **22** on the beam sections so as to prevent pivoting movement between the sections. This is illustrated in FIG. **3** and also on the floor beam **9** in FIG. **1**. Other locking elements instead of the shoes **20** could be used for the same purpose.

It will thus be seen that the roof-support frame shown in the drawings takes the main load of the roof on the centrally-disposed prop **1** which is stronger than the outer props **14** and **15**. Further, the beams **8** and **9** are both of articulated construction while, at the same time, having locking means for locking together adjacent sections of each beam to form a rigid structure.

We claim:

1. An hydraulic roof-support frame comprising a floor beam and a roof beam, each of said beams being composed of a central section and two outer sections articulated thereto, two outer hydraulic props extending between the respective outer sections of the roof beam and the floor beam at locations adjacent the ends of the beams, at least one intermediate hydraulic prop, of greater load-bearing capacity than either of the said outer props, extending between the said central sections of the beams, roof-engaging and floor-engaging surfaces on the central and outer sections of the roof beam and floor beam respectively, the roof-engaging and floor-engaging surfaces on the central sections of the roof and floor beams each being of substantially greater area than the individual roof-engaging and floor-engaging surfaces on the outer sections of the beams, guide-ways on the beam sections extending longitudinally thereof, and locking shoes slidingly mounted on the said guide-ways, each of said locking shoes being movable from an inoperative position in which the shoe is located on one beam section only into a locking position where the shoe straddles two adjacent beam sections and thus locks the said adjacent beam sections against relative pivoting movement.

2. An hydraulic roof-support frame as claimed in claim **1**, in which the ends of the hydraulic props are removably seated in bearing surfaces which form recesses in the beams, the bearing surfaces for the intermediate prop being larger than those for the outer props.

3. An hydraulic roof-support frame as claimed in claim **1**, in which the outer sections of each beam are pivotally connected to the central section of the respective beam in a releasable manner by means of cooperating, inter-engaging surfaces on the adjacent ends of the beam sections.

4. An hydraulic roof-support frame as claimed in claim **1**, in which the two beams are identical to each other.

5. An hydraulic roof-support as claimed in claim **2**, in which the ends of the props are of part-spherical shape so as to seat in the recesses in the beams.

* * * * *