Feb. 10, 1970 H. J. VON HIPPEL 3,494,135

UNDER LOAD ADVANCEABLE MINE ROOF SUPPORT

Filed Dec. 2, 1968 4 Sheets-Sheet 1

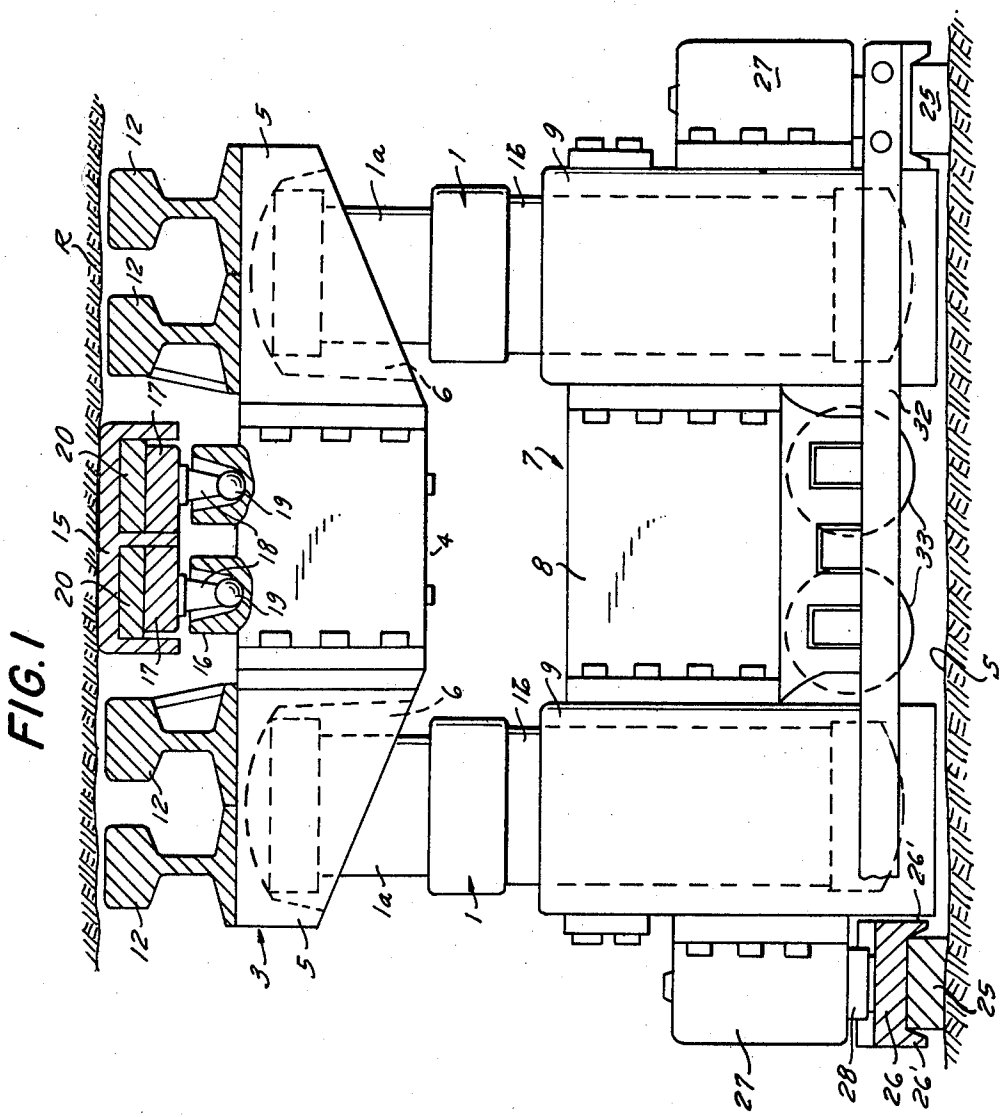


FIG. 1

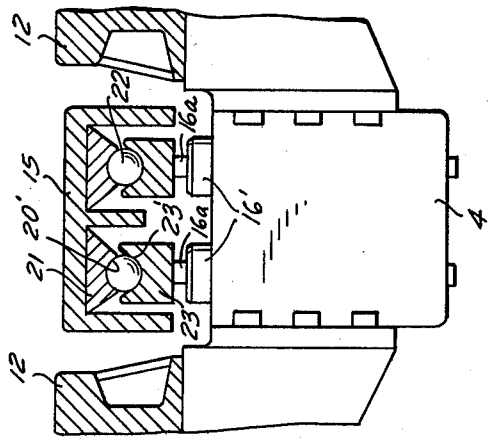


FIG. 1a

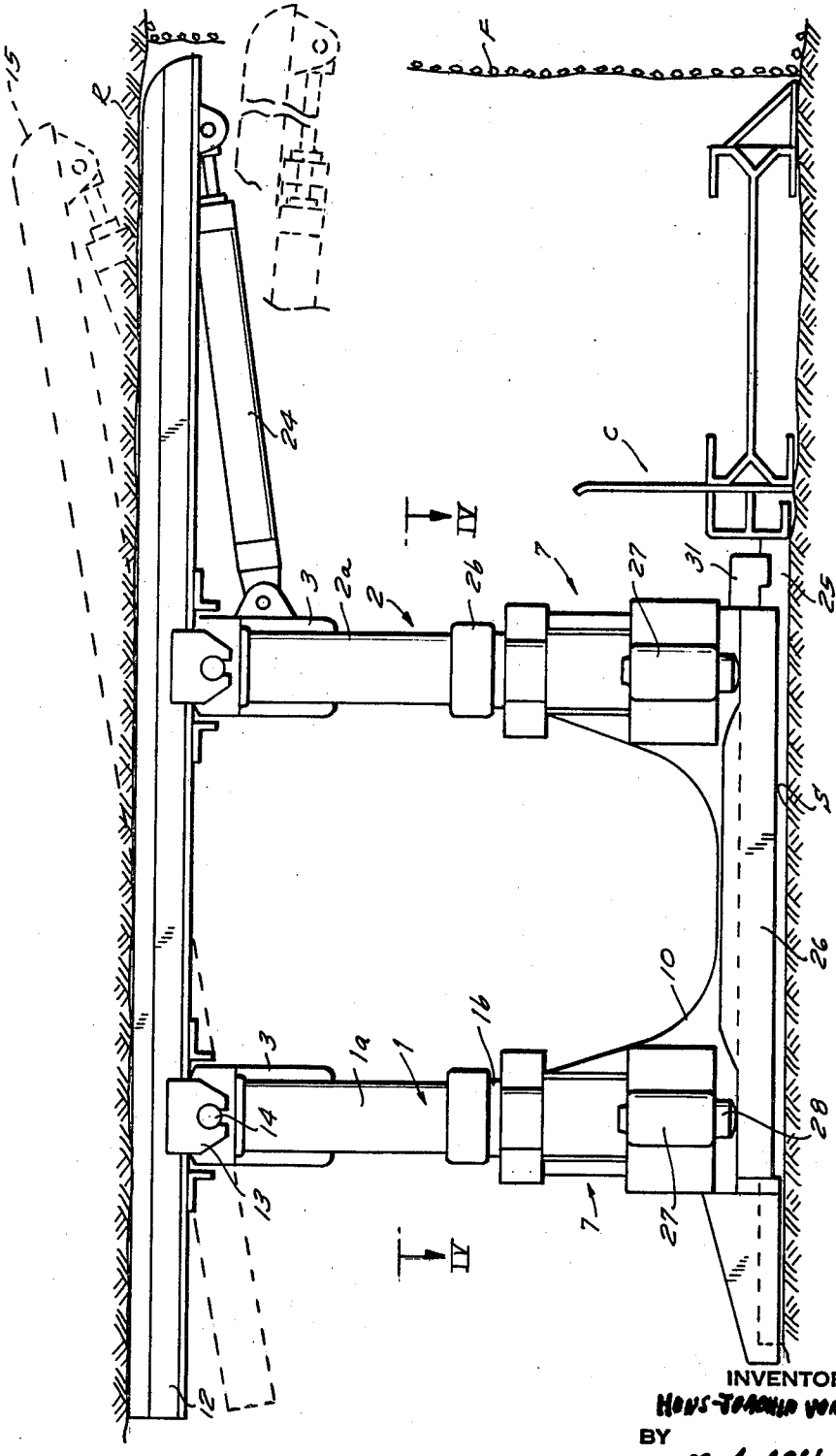
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UNDER LOAD ADVANCEABLE MINE ROOF SUPPORT

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FIG. 2



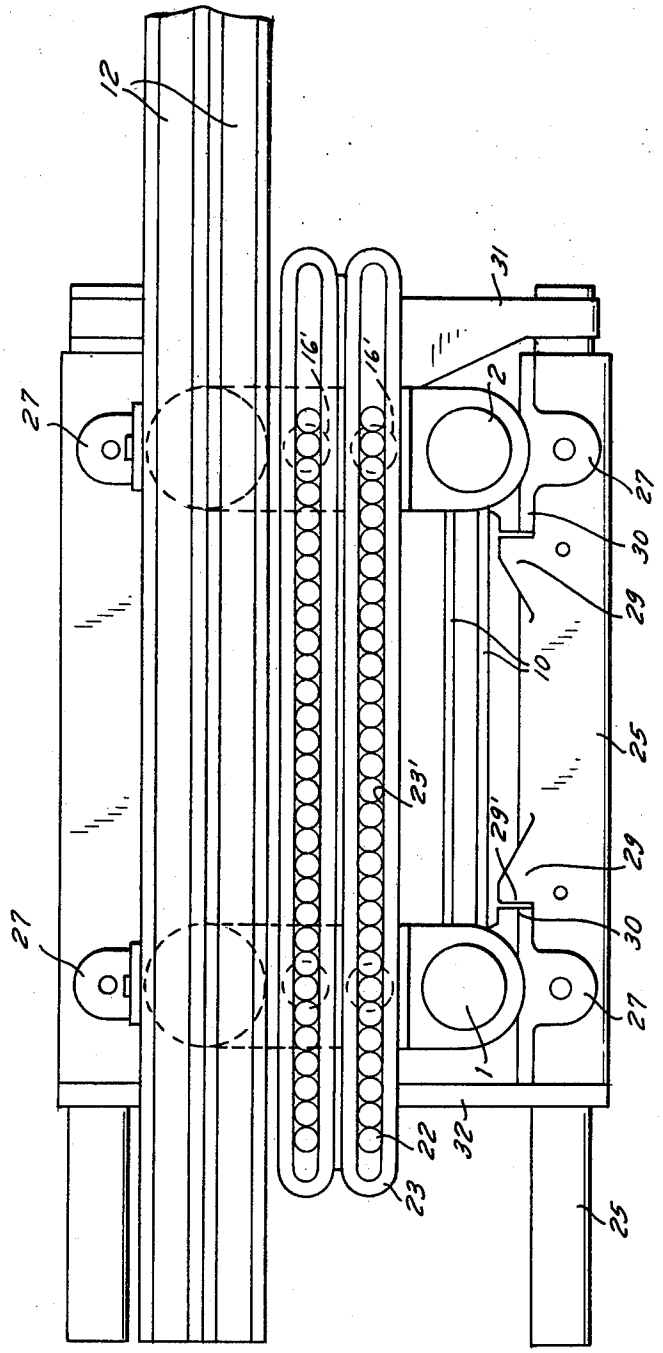
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UNDER LOAD ADVANCEABLE MINE ROOF SUPPORT

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FIG. 3



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UNDER LOAD ADVANCEABLE MINE ROOF SUPPORT

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FIG. 5

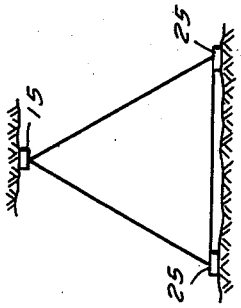
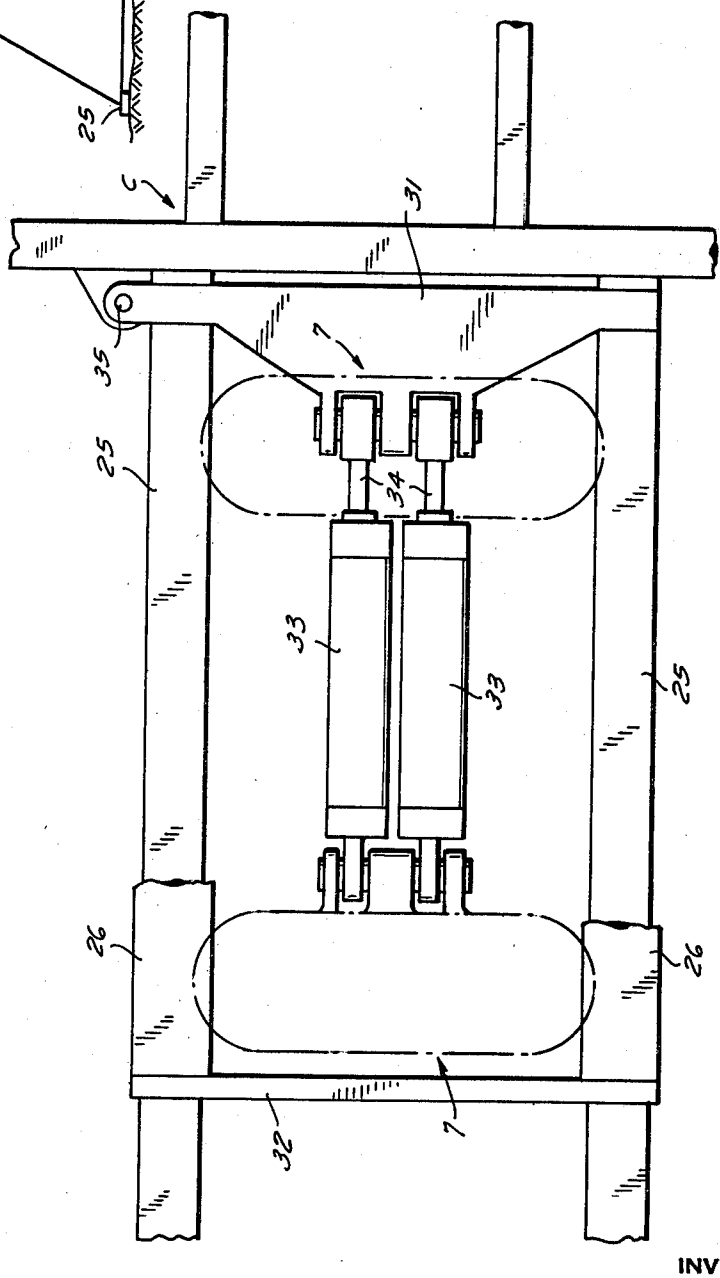


FIG. 4



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UNDER LOAD ADVANCEABLE MINE ROOF SUPPORT

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Int. Cl. E21d *15/45, 23/18;* E04g *25/04*
U.S. Cl. 61—45 21 Claims

ABSTRACT OF THE DISCLOSURE

A mine roof support movable under load toward and away from a mine face and including four extensible and contractable upright props arranged in two pairs spaced in direction of movement of the support from each other and frame means connecting the props to form a substantially rigid unit therewith. The frame means include a pair of elongated roof engaging means extending transversely spaced from each other in the aforementioned direction. The mine roof support includes further an elongated cap member arranged between the pair of roof engaging means and movable in longitudinal direction and in direction toward and away from the roof relative thereto, a pair of elongated mine sole engaging beams extending in the direction of movement of the mine roof support, and fluid operated means connected to the unit and the beams for moving the unit and the beams relative to each other in the aforementioned direction.

BACKGROUND OF THE INVENTION

The present invention relates to apparatus for supporting the roofs of mine galleries or other mine excavations. More particularly, the invention relates to improvements in so-called walking mine roofs supports which are movable stepwise towards the mine face in an underground excavation and wherein the moving parts are preferably actuated by hydraulic and/or pneumatic systems.

Such mine roof supports are known in the art and they include fluid operated substantially upright extensible and contractable props and elongated roof and sole engaging members extending in the direction of movement of the mine support and being respectively connected to the upper and lower ends of the props so as to be respectively pressed against the roof and the sole of a mine gallery during extension of the props.

Mine roof supports of this type are also known in the art in which two props spaced in direction of movement of the support from each other are connected by the roof and sole engaging members to a rigid frame and in which two such frames are arranged spaced from each other transverse to the direction of movement and in which advancing means are provided between the frames and connected thereto in such a manner to stepwise advance the frames while the props of one frame are in collapsed and the other in extended position so that the other frame forms a proper support during advance of the one frame. This known arrangement has, however, the disadvantage that the roof of the mine gallery above the collapsed frame is not properly supported during advance thereof, and in addition, the other frame, even in extended position, does not form a stable support structure, especially if the sole of the mine gallery is inclined in direction transverse to the advancing direction. In such an arrangement, the frames are liable to tilt to a certain extent in this transverse direction so that the support will tend to move transverse to its advancing direction during setting

of the support and movement of the props from the collapsed to the extended position.

It is an object of the present invention to provide for a mine roof support which can be advanced under load and which avoids in the above-mentioned disadvantages of such supports known in the art.

It is a further object of the present invention to provide a mine roof support of the aforementioned kind which is perfectly stable during advance thereof so that any transverse movement of the support will be positively prevented and which also properly supports the roof of the mine gallery during stepwise advance of the support.

SUMMARY OF THE INVENTION

With these objects in view, the mine roof support according to the present invention, which is movable under load toward a mine face, mainly comprises two pairs of extensible and contractable substantially upright props arranged spaced in a direction substantially normal to the mine face from each other, frame means rigidly connecting the props of each pair and the two pairs of props to each other so as to form with the props a substantially rigid unit, in which the frame means include a pair of elongated roof engaging members extending in the aforementioned direction substantially parallel and spaced from each other between the pair of props and being respectively connected to the upper ends of the respective props to be pressed against the mine roof when the props are extended, an elongated cap member arranged between the roof engaging members, means carried by the frame means and connected to the cap member for moving the latter relative to the roof engaging members in longitudinal direction and for pressing the cap member independent from the props against the mine roof, and advancing means connected to the frame means in the region of the lower ends of the props for moving the unit toward and away from the mine face.

In this construction, the props connected by the frame means to a rigid unit will form a stable structure and since the cap may be independently from the props pressed against the roof, the latter may be properly supported during stepwise advance of the support while the props are in contracted position.

The means for moving the elongated cap member in longitudinal direction and for pressing the same against the mine roof preferably comprise pressure means carried by upper bridges forming part of the frame means and extending respectively between each pair of props, elongated guide means extending in the longitudinal direction of the cap member and being carried by the pressure means movable toward and away from the roof, complementary guide means on the cap member and engaging the elongated guide means for guiding the cap member in longitudinal direction, and extensible and contractable means between the cap member and the frame means for moving the cap member in longitudinal direction. The elongated guide means and the complementary guide means may slidingly engage each other with abutting faces, or preferably, rolling elements, for instance a plurality of balls, may be arranged between the two guide means so as to reduce the friction during relative movement of the cap and the remainder of the mine roof support. The pressure means may comprise two fluid operated cylinder and piston means carried by each of the upper bridges spaced in direction transverse to the elongation of the cap member from each other and the elongated guide means may comprise two elongated guide members connected to the cylinder and piston means to be carried thereby so that the cap member will be supported substantially at four points, whereby the cap member may adjust its position to any unevenness of the roof.

The advancing means for stepwise advancing the unit towards the face of a mine gallery may comprise a pair of lower substantially parallel beams extending transversely spaced from each other in direction of the desired advance of the unit. The lower beams have bottom faces adapted to engage the sole of the mine gallery, whereas a pair of upper beams, connected to the frame means for movement in the advancing direction therewith, slidingly engage with lower faces thereof the upper faces of the sole engaging beams. Fluid operated cylinder and piston means extending in the advancing direction are connected at opposite ends respectively to the lower sole engaging beams and the upper beams for moving the same relative to each other in the aforementioned direction to stepwise advance the unit towards the mine face. Preferably the upper beams are connected to the frame means movable toward and away from the sole and in such an arrangement there are also provided means for pressing the lower faces of the upper beams against the upper faces of the lower beams thereby moving the unit in substantial vertical direction relative to the sole engaging beams. The beams of each pair of upper and lower beams are preferably arranged to opposite sides and laterally outwardly of the unit so as to increase the support base of the unit.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a partially sectioned end view of the mine roof support according to the present invention, seen from the end of the support which faces away from the mine face;

FIG. 1*a* is a partial, partially sectioned end view similar to FIG. 1 and showing a modification of the arrangement shown in FIG. 1;

FIG. 2 is a side view of the mine roof support;

FIG. 3 is a partial top view of the mine roof support shown in FIG. 2 with some parts of the support removed;

FIG. 4 is a partial schematic cross-section taken along the lines IV—IV of FIG. 2; and

FIG. 5 is a schematic view illustrating the principle of the mine roof support according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawing, and more specifically to FIGS. 1 and 2 of the same, it will be seen that the mine roof support according to the present invention may comprise two pairs of props **1** and **2** each including a lower cylinder **1***b*, respectively **2***b*, and an upper piston **1***a*, respectively **2***a*, slidably guided in the cylinder for movement in substantially vertical direction so that each prop may be moved between an extended and collapsed position by feeding pressure fluid, for instance oil, into the respective cylinder or discharging pressure fluid therefrom. The means for feeding pressure fluid into and out of the respective cylinders are of standard construction, known in the art, and therefore not illustrated in the drawing. The two pairs of props **1** and **2** are arranged spaced from each other in the direction of the desired advance of the mine roof support and the props of each pair are spaced from each other in direction transverse to the advancing direction. The four props of the mine roof support are connected by frame means to form with the latter a substantially rigid unit. The frame means preferably comprise a pair of upper bridges **3** which respectively extend between the upper ends of the pair of props **1** and **2**. Each of the upper bridges preferably comprises a central part **4** connected by screws or similar

connecting means to a pair of outer parts **5**. Each of the outer parts is formed with a cavity **6** having a curved top face against which the corresponding curved face on the upper end of the piston of the respective prop abuts. The frame means further comprise a pair of lower bridges **7** which respectively extend between and rigidly connect the cylinders of the respective pair of props to each other. Each of the lower bridges **7** comprise a central portion **8** and two outer portions **9** which are connected rigidly to each other by screw means or the like. Each of the outer portions **9** is formed with a central blind bore closed at the bottom in which the cylinder of the respective prop is tightly seated. The central portion of each of the lower bridges is preferably formed of two parts so as to provide an open space into which the lower end of the central portion **4** of the respective upper bridge may partly extend when the props are in the fully collapsed position. The frame means further comprise a plurality of plates **10** extending, as best shown in FIGS. 2 and 3, between the lower bridges **7** and being fixedly connected thereto in a manner known in the art so as to rigidly connect the lower bridges to each other. The top edge of each plate is curved, as best shown in FIG. 2, to provide a passageway between the two pairs of props **1** and **2** through which an operator may walk. In addition, the frame means comprises preferably two pairs of elongated roof engaging members **12** extending between and with opposite ends respectively outwardly beyond the upper bridges **3** and being arranged above the outer portions **5** of the latter and either rigidly connected thereto by being for instance welded with their bottom faces to the top faces of the outer portions **5** of the upper bridges, or pivotally connected thereto by connecting portions **13** which engage pivot pins **14** laterally projecting from the outer portion **5** of the upper bridges as shown in FIG. 2.

An elongated cap member **15** of preferably U-shaped cross-section as best shown in FIG. 1 is arranged between the roof engaging members **12** extending substantially parallel thereto. The cap member **15** is movable in longitudinal direction relative to the roof engaging members **12** and also movable toward and away from the roof R of a mine gallery independent from the props. In order to press the upper face of the cap member **15** against the roof R, pressure means are provided, which preferably include a pair of fluid operated cylinder and piston means **16** mounted in corresponding cavities of the central portions **4** of the upper bridges **3**. A pair of elongated guide members **17** extend within the U-shaped profile of the cap **15** and pins **18** fixedly connected at the upper ends thereof to the respective guide member **17** extend with lower ball-shaped ends **19** into corresponding cavities formed in the upper ends of the cylinder and piston means **16** so that the guide members **17** are supported by the cylinder and piston means to be movable therewith in vertical direction while being slightly tiltable with respect thereto. The guide members **17** slidingly engage with upper faces thereof the bottom faces of complementary guide members **20** which are fixed in a convenient manner to the cap member **15** so that the latter is slidingly guided for movement in longitudinal direction. The cap member **15** is thus supported at four spaced points on the four cylinder and piston means **16** so that the cap member may adjust its position to any unevenness of the roof R. By extending the cylinder and piston means **16** carried by the two bridges **3** respectively to a greater or lesser extent, the cap member **15** may be moved from a substantial horizontal position, as shown in full lines in FIG. 2, to upwardly or downwardly inclined positions as shown in dotted lines in this figure to properly abut over the full length thereof against a horizontally extending or inclined roof R. Extensible or collapsible means which are preferably in the form of fluid operated cylinder and piston means **24** are provided for moving the cap member **15** in longitudinal direction relative to the roof engaging members **12**. Preferably, a pair of such cylinder and piston

means 24 are arranged parallel to each other and pivotally connected at opposite ends, in the manner as best shown in FIG. 2, to a front portion of the cap member 15 and to the upper bridge 3 connecting the pair of props 2 which are located closer to the face F of the mine gallery than the pair of prop members 1. By feeding pressure fluid in one or the other direction into the cylinder and piston means 24, the cylinder and piston means 24 may be extended or collapsed so as to move the cap member 15 in longitudinal direction relative to the roof engaging members 12.

FIG. 1*a* illustrates in cross-section a slightly different arrangement for supporting and guiding the cap member 15. In this arrangement a pair of lower guide members 23 are supported tiltable in longitudinal direction in a manner not shown in the drawing on the piston rods 16*a* of the cylinder and piston means 16' carried by each of the central portions 4 of the upper bridges 3, whereas a pair of complementary guide members 21 are arranged fixedly connected to the cap member 15 above corresponding the lower guide members 23. Each of the lower guide members 23 is formed with a longitudinal extending groove 23' and each of the upper guide members 21 is formed with the corresponding longitudinal extending groove 21' and a plurality of rolling elements, preferably in form of balls 22, are arranged between the lower guide member 23 and the upper guide member 21 and guided in the grooves 21' and 23'. The arrangement shown in FIG. 1*a* differs from the arrangement shown in FIG. 1 mainly by the rolling elements 22 sandwiched between the upper and lower guide members so that the friction during longitudinal movement of the cap member 15 is reduced in the arrangement of FIG. 1*a* as compared with the arrangement of FIG. 1.

The cap member 15 of the arrangement shown in FIG. 1*a* is again moved in longitudinal direction by cylinder and piston means 24 pivotally connected at opposite ends to the front portion of the cap member and to the upper bridge 3 connecting the pair of props 2 in the manner as described before, but in this arrangement only a single cylinder and piston means 24 is sufficient.

The mine roof support according to the present invention includes further means for advancing the support stepwise toward the mine face F. The advancing means preferably comprise a pair of lower substantially parallel beams 25 extending transversely spaced from each other in the direction in which the mine roof support is to be advanced and the beams 25 have bottom faces which engage the sole S of the mine gallery. A pair of upper beams 26 connected to the frame means for movement in longitudinal direction therewith, in the manner which will will be described in detail later on, have lower faces respectively slidingly engaging upper faces of the sole engaging beams 25, and extensively and contractible means 33 are provided connected at opposite ends respectively to the lower sole engaging beams 25 and to the frame means for moving the frame means in longitudinal direction relative to the lower beams. Each of the upper beams 26 preferably has a pair of side flanges 26' extending downwardly beyond the upper face of the respective lower beam 25 so that the upper beam is guided on side faces of the respective lower beam. Each of the upper beams 26 also has a pair of noses 29 which project spaced from each other in the direction of elongation of the respective upper beam 25 inwardly therefrom, as best shown in FIG. 3, and each of the noses 29 has an end face 29' extending substantially normal to the elongation of the beam and adapted to engage a corresponding face 30 provided on a corresponding projection on each of the lower bridges 7. In this way each of the upper beams 26 is constrained to move in longitudinal direction with the frame means while being movable with respect to the latter in substantial vertical direction toward and away from sole S of the mine gallery. In order to press the upper beams 26 against the lower beams 25 a pair of cylinders 27 are integrally connected to opposite ends of each of the lower bridges 7 and a piston 28 in each of the cylinders 27 engages with its bottom face the top face of the respective upper beam 26 to press the latter in downward direction against the respective lower beam 25. As best shown in FIG. 1, the pairs of upper and lower beams 25 and 26 and the corresponding cylinder and piston means 27 and 28 are arranged laterally and outwardly of opposite ends of the lower bridges 7 so that the width of the supporting base of the whole structure is in this way increased.

The advancing means further comprise extensible and contractable means which preferably include a pair of cylinders 33 extending in longitudinal direction of the beams, as best shown in FIG. 4, in which pistons, not shown in this figure, are slidably guided and the piston rods 34 projecting beyond the cylinders 33 are pivotally connected, in the manner as best shown in FIG. 4, to a cross head 31 which is rigidly connected by screws or the like at opposite ends to the front ends of the lower beams 25, whereas the rear ends of the cylinders 33 are pivotally connected, in the manner shown in FIG. 4, to the lower bridge 7 which connects the rear props 1. The rear ends of the upper beams 26 are likewise connected by a cross member 32. Pressure fluid, for instance pressure oil, may be fed into the cylinders 33 and be discharged therefrom, in a manner well known in the art and not shown in the drawing, to move the piston rods 34 relative to the cylinders 33. The cross head 31 may be connected, preferably releasable, to a conveyor C by a pin 35, in the manner as indicated in FIG. 4, so as to move the conveyor C towards the mine face F during advance of the cross head 31 toward the mine face, or such movement may be accomplished simply by having the front ends of the lower beams 25 abut against a corresponding portion of the conveyor C.

The above-described mine roof support may be operated as follows:

Assuming each of the props may be expanded with a maximum force of 100 tons and the pressure exerted by the cylinder and piston means 16 to press the cap member 15 against the roof R of the mine gallery is 80 tons, then in the roof engaging member 12 will be pressed against the roof with a total force of 320 tons, that is the roof engaging members 12 at each side of the arrangement will be loaded with 160 tons. If it is now desired to advance the mine roof support toward the mine face F, the pressure exerted by the cylinder and piston means 16 against the cap member 10 is for instance reduced to 10 tons and the cylinder and piston means 24 are expanded by feeding pressure fluid thereinto so that the cap member 15 is advanced towards the mine face F while being pressed with a pressure of 10 tons against the roof R. During such an advance the cap member 15 may be inclined, upwardly or downwardly from a horizontal position, as indicated in dotted lines in FIG. 2, corresponding to the inclination of the roof. Subsequently thereto, the pressure in the cylinders 27 is reduced so that the bottom ends of the lower bridges may rest on the sole S of the mine gallery and pressure fluid is fed into the cylinders 33 so that the piston rods 34 are moved towards the right, as shown in FIG. 4, to thus move the cross head 31 and the lower sole engaging beams 25 connected thereto in direction towards the mine face F, whereby also the conveyor C is advanced towards the mine face. Subsequently, thereto, the cylinders 16 and 27 are fully loaded so that the cap member 15 is pressed with a force of 80 tons against the roof R whereas the lower beams 25 are each pressed with a force of 40 tons against the sole S. If the pressure exerted by the four props is now reduced to a total pressure of about 79 tons, then the piston 28 in the cylinders 27 will lift the unit formed by the props and the frame means slightly from the sole S and in this condition pressure fluid is fed into the cylinders 33 in such a direction to draw the piston rods 34 inwardly to thereby move the aforementioned unit towards the mine face F. During such movement the upper beams 26 and

the unit connected thereto for longitudinal movement in the manner as described above will be properly guided on the lower beams. At the same time, the cylinder and piston means **24** are likewise contracted to exert thereby a pulling force on the upper bridge **3** which connects the the pair of props **2**.

After the mine roof is thus advanced toward the mine face, the four props are again loaded to a maximum extent without reducing the pressure in the cylinder and piston means **16**. The pressure on the pistons **28**, however, is reduced so that the support is ready for the next advancing step. The support is again in a position to take a total load of 400 tons.

The engaging faces of the beams **25** and **26** are dimensioned in such a manner so that a specific pressure of 40 kg./cm.^{2} is not surpassed. Preferably graphite lubrication is used between the engaging faces of the beams to reduce the friction.

Since the mine roof support according to the present invention may be located closely adjacent to the conveyor C, the whole arrangement may be used, when the distance between the pair of props **1** and **2** is about one meter, in a mine gallery of a width of about 2.5 meters.

It is also possible to arrange the conveyor C instead of in the space between the mine face F and the pair of props **2** in the space between the pair of props **1** and **2**.

The above-described construction will be stable during each phase of the aforementioned described operation and displacement transverse to the advancing direction will be positively prevented. The whole support may be considered as statically determinate triangle, as shown in FIG. 5, having a base equal to the distance between the sole engaging beams **25** and carrying at its apex the cap member **15**.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of mine roof supports which can be advanced under load differing from the types described above.

While the invention has been illustrated and described as embodied in a mine roof support which will remain stable during the advance thereof, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. A mine roof support movable under load toward and away from a mine face comprising, in combination, two pairs of extensible and contractable substantially upright props arranged spaced in a direction in which the support has to be advanced from each other; frame means rigidly connecting the props of each pair and the two pairs of props to each other so as to form with the props a substantially rigid unit, said frame means including a pair of elongated roof engaging members extending in said directions substantially parallel and transversely spaced from each other between said pair of props and being respectively connected to the upper ends of the respective props to be pressed against the mine roof when said props are extended; an elongated cap member arranged between said roof engaging members; means carried by said frame means and connected to said cap member for moving the latter relative to said roof engaging members in longitudinal direction and for pressing said cap member independent from said props against the roof; and advancing means connected to said frame means in the region of the lower ends of said props for moving said unit toward and away from the mine face.

2. A mine roof support as defined in claim **1**, wherein said frame means comprises further an upper and a lower bridge for each pair of props, said upper and said lower bridge extending between the props of the respective pair and being respectively connected at opposite ends to upper and lower end portions of the props of the respective pair.

3. A mine roof support as defined in claim **2**, wherein said means for moving said elongated cap member in longitudinal direction and for pressing the same against the mine roof comprise pressure means carried by the upper bridges, elongated guide means extending in said direction and carried by said pressure means movable toward and away from the roof, complementary guide means on said cap member and cooperating with said elongated guide means for guiding said cap member in longitudinal direction, and extensible and contractable means between said cap member and said frame means for moving said cap member in longitudinal direction.

4. A mine roof support as defined in claim **3**, wherein said elongated guide means has an upper guide face and said complementary guide means a lower guide face slidingly engaging said upper guide face.

5. A mine roof support as defined in claim **4**, wherein said pressure means comprises two fluid operated cylinder and piston means carried by each of said upper bridges spaced in direction transverse to the elongation of said cap member from each other, and wherein said elongated guide means comprises two elongated guide members respectively carried by said cylinder and piston means universally tiltable to a limited extent with respects thereto.

6. A mine roof support as defined in claim **3**, and including rolling elements between said elongated guide means and said complementary guide means.

7. A mine roof support as defined in claim **6**, wherein said pressure means comprises two fluid operated cylinder and piston means carried by each of said upper bridges spaced in direction transverse to the elongation of said cap member from each other, and wherein said elongated guide means comprises two elongated guide members connected to and carried by said cylinder and piston means, said rolling elements being sandwiched between each of said elongated guide members and a corresponding complementary guide member fixed to said cap member.

8. A mine roof support as defined in claim **7**, wherein each elongated guide member and complementary guide member is formed with elongated groove and wherein said rolling elements are constituted by balls located in said grooves.

9. A mine roof support as defined in claim **3**, wherein said extensible and contractable means comprises at least one fluid operated cylinder and piston means connected at opposite ends respectively to the end of the cap member which is adapted to face the mine face and to said frame means.

10. A mine roof support as defined in claim **1**, wherein said roof engaging members and said elongated cap member extend with opposite ends respectively beyond said pair of props.

11. A mine roof support as defined in claim **1**, wherein said roof engaging members are constituted by rail road rails.

12. A mine roof support as defined in claim **1**, wherein said advancing means comprises a pair of lower substantially parallel beams extending transversely spaced from each other in said direction and having bottom faces adapted to engage the sole of a mine gallery, a pair of upper beams connected to said frame means for movement in said direction therewith and having lower faces respectively slidingly engaging upper faces of said sole engaging lower beams, and extensible and contractable means extending in said direction and connected at op-

posite ends respectively to said sole engaging lower beams and to said frame means for moving the frame means and said lower beams relative to each other in said direction so as to advance said unit toward said mine face.

13. A mine roof support as defined in claim **12**, wherein each of said upper beams has a pair of flanges extending downwardly beyond the upper face of the respective lower beam so as to be guided on side faces of the latter.

14. A mine roof support as defined in claim **12**, wherein said upper beams are connected to said frame means movable toward and away from the sole of the mine gallery and including means fixed to the frame means for pressing said lower faces of said upper beams against said upper faces of said lower beams for thereby moving said unit in substantially vertical direction relative to said lower sole engaging beams.

15. A mine roof support as defined in claim **14**, wherein said beams in each pair of upper and lower beams are respectively arranged to opposite sides and laterally outwardly of said unit.

16. A mine roof support as defined in claim **14**, wherein each of said upper beams has a pair of noses spaced in direction of the elongation of the respective beam from each other and projecting in direction transverse to the elongation from the respective beam, each of said noses having an end face extending in said transverse direction and adapted to engage a corresponding end face provided on said frame means.

17. A mine roof support as defined in claim **12** and including means connecting said lower beams to each other for simultaneous movement in said direction.

18. A mine roof support as defined in claim **17**, wherein said connecting means comprise a cross head extending to and being connected at opposite ends to front ends of said lower beams which are directed toward the mine face.

19. A mine roof support as defined in claim **17**, wherein said extensible and contractable means comprise fluid operated cylinder and piston means having opposite ends respectively pivotally connected to said cross head and said frame means.

20. A mine roof support as defined in claim **19**, wherein said frame means comprises further an upper and a lower bridge for each pair of props, said upper and said lower bridge extending between the props of the respective pair and being respectively connected at opposite ends to the upper and lower end portions of the props of the respective pair, and wherein said cylinder and piston means are connected at one of the ends thereof to that lower bridge means which extends between the pair of props which is spaced further from the mine face than the other pair.

21. A mine roof support as defined in claim **20**, wherein said cylinder and piston means comprises two cylinders and two pistons respectively arranged in said cylinders, and said cylinders and pistons therein being arranged symmetrically with respect to a longitudinal plane of symmetry of said unit, said cylinders and said pistons being respectively connected to said cross head and said lower bridge tiltable about pivot axes extending substantially normal to said plane of symmetry.

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U.S. Cl. X.R.

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