Jan. 3, 1967 K. E. BLÄSER ETAL 3,295,331

MOVABLE MINING SUPPORT

Filed April 3, 1964 2 Sheets-Sheet 1

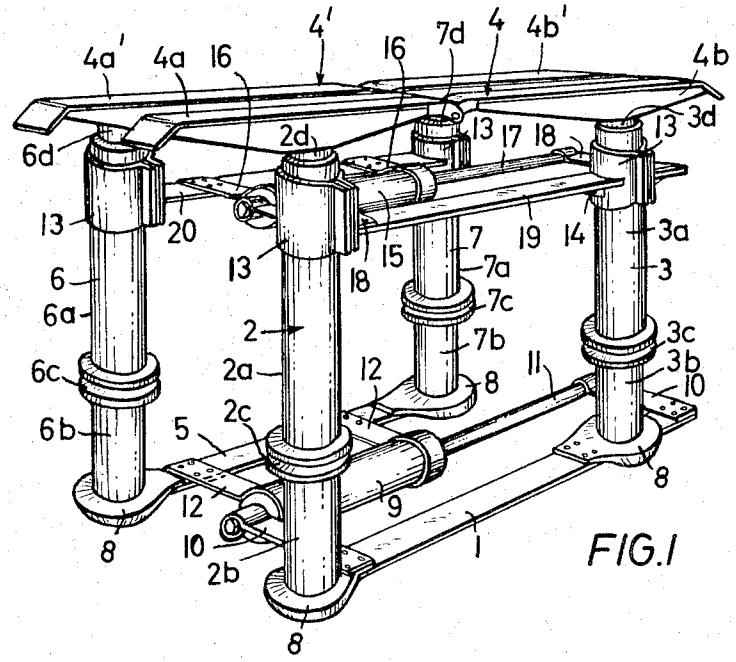

FIG.1

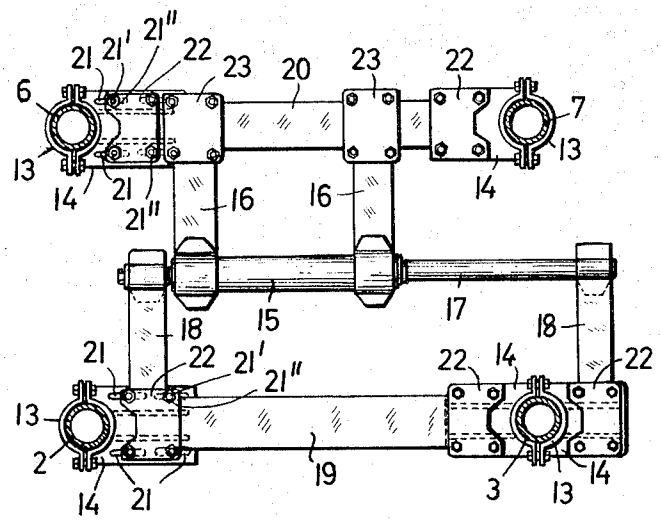

FIG.4

INVENTORS

KARL ERNST BLÄSER, GÜNTHER DOMMANN

BY

Burgess, Dinklage & Sprung

ATTORNEYS

Jan. 3, 1967 K. E. BLÄSER ETAL 3,295,331

MOVABLE MINING SUPPORT

Filed April 3, 1964 2 Sheets-Sheet 2

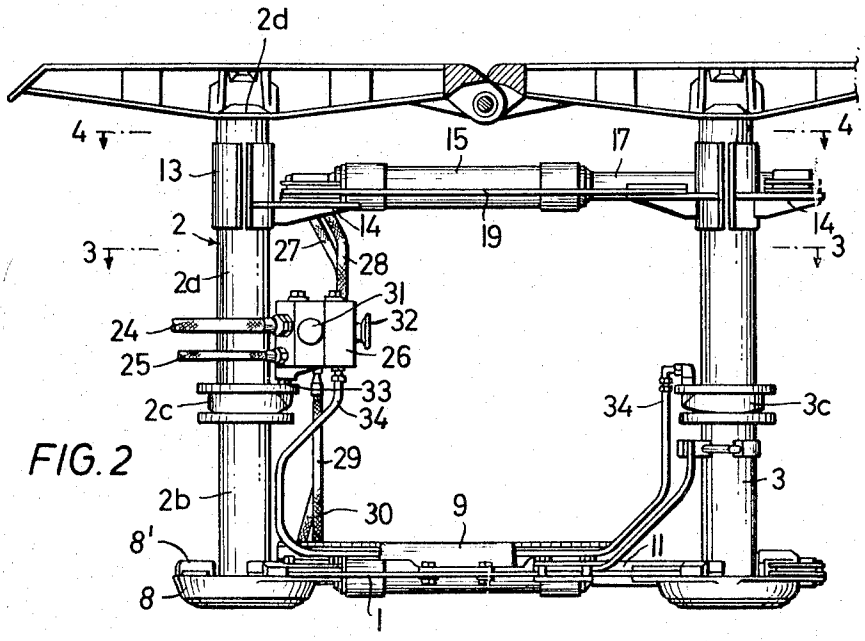

FIG. 2

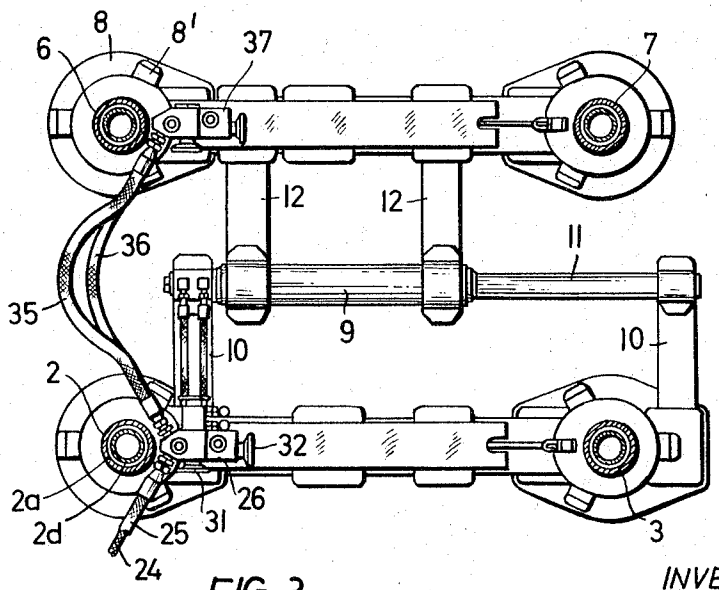

FIG. 3

INVENTORS:
KARL ERNST BLÄSER, GÜNTHER DOMMANN
BY
Burgess, Dinklage & Sprung
ATTORNEYS

United States Patent Office

3,295,331

Patented Jan. 3, 1967

3,295,331
MOVABLE MINING SUPPORT

Karl Ernst Bläser, Lunen, and Günther Dommann, Wethmar, near Lunen, Germany, assignors to Gewerkschaft Eisenhutte Westphalia, Wethmar, near Lunen, Westphalia, Germany, a corporation of Germany

Filed Apr. 3, 1964, Ser. No. 357,113
Claims priority, application Germany, Apr. 5, 1963, C 37,467
12 Claims. (Cl. 61—45)

The present invention relates to a movable mining support, and more particularly to a mining support including both lower and upper drive means and a first and a second pair of mining props which are operatively interconnected at vertically spaced apart points by said lower and upper drive means, the upper drive means being vertically spaced above the lower drive means for suitable connection with the appropriate props thereat for stable operations in mining seams of great depth or height.

It is known to provide mining supports or mining frames, such that along the lower portion thereof a moving means or drive means is positioned for guiding the mining support in longitudinal direction. Specifically, a piston-cylinder arrangement utilizing a double acting piston on a piston rod which extends through both heads of the cylinder is provided, such that the cylinder portion is connected to one pair of parallel props on one side of the piston cylinder arrangement while the piston rod is connected to another pair of parallel props on the other side of the piston cylinder arrangement. In this way, each pair of parallel props, which may be said to form a prop frame, may be alternately shifted or moved or advanced with respect to the other pair of parallel props or prop frame. Generally, the prop frame which remains stationary is maintained in supporting engagement with the mine ceiling and mine floor whereas the prop frame to be shifted is released from engagement with the mine ceiling so that upon actuation of the piston cylinder arrangement the released prop frame may slide along the mine floor in the desired direction parallel to the axis of the piston rod. Thereupon, the already shifted prop frame may be placed in engagement with the mine ceiling and mine floor and for the next shifting in the same direction, the previously stationary prop frame may be released from engagement with the mine ceiling and mine floor and in turn shifted in the desired direction while the previously shifted prop frame remains in supporting engagement with the mine ceiling and mine floor.

Where the mining frames or mining supports are to be used in seams of great height or depth, the normal dimensions of the mining props must be extended. While it will be appreciated that conventional mining props, which may be of the hydraulically actuated type, include a pair of telescoping sections for changing the length of the prop, depending upon the height of the working area, i.e. between the mine floor and mine ceiling, such props are not long enough to accommodate working areas where the mine ceiling is extremely far above the mine floor. This is usually due to the fact that the seam being worked runs vertically extremely high and therefore as the mineral is extracted, the height of the chamber being worked increases as well. Nevertheless, support is required for the overhead portion or roof portion of the mine chamber, and this must be provided by extension means for the usual prop frames.

For this purpose, base members or pedestal members may be detachably positioned below the normal lower end of the conventional pit props or prop frames so as to increase the height of the over-all prop working range. Of course, with great seam depths or heights, due to the high position of the center of gravity of the mining frame including the prop frames and the base extensions or pedestals under the props, the upper end portions of the props and/or of the prop frames must be handled in a certain manner to prevent tipping of the mining frame arrangement. Guide means of various kinds have been used to improve the stability of such extended mining frames, and in particular guide rods have found widespread use, but these compel a circular or curved guiding of the props at their upper ends during the shifting of the particular prop frame, even though the piston cylinder arrangement at the lower end portion of the mining frame is able to maintain predominately parallel guidance of the prop frame being shifted as against the prop frame remaining stationary. With the curved guiding of the upper ends of the props of the frame being shifted, the resulting tilting of the upper ends of the props causes many practical difficulties, inasmuch as it is not possible consistently to bring back the upper ends of the props of the shifting frame at the end of the shifting movement precisely parallel to the stationary prop frame as regards the vertical direction. Accordingly, in continuous operations in mines, such as for the extraction of coal by the long wall method, all four props of two prop frames making up the mining frame cannot always be maintained precisely vertically between the horizontal seam and the overhead seam but instead this may only be attained by manual adjustment repeatedly of the shifting prop frame. However, with the manual adjustment of the particular shifting prop frame, the necessary support of the mine roof or mine ceiling must be sacrificed until the tilted prop frame is set again precisely vertically. Naturally, such extensive and repeated release of the ceiling support and the setting of the props in the desired manner after each shifting movement is carried out not only lead to an unnecessary stress exerted on the overhead seam or mine ceiling, but also represent a time consuming and expensive proposition labor-wise.

It is an object of the present invention to overcome the foregoing drawbacks and to provide a mining support which may be used perdominately in seams of great depth or height and which contains a pair of prop frames suitably guided by drive means to prevent tilting during the shifting of one of the prop frames with respect to the other.

It is another object of the present invention to provide a movable mining frame of the foregoing type in which a precise guiding of the props in each prop frame of the mining frame is assured along the entire height of each prop frame.

It is still another object of the present invention to provide a mining frame of the foregoing type in which the driving means forces are distributed proportionally throughout the height of the props in each prop frame.

Other and further objects of the present invention will become apparent from a study of the within specification and accompanying drawing in which:

FIG. 1 is a schematic perspective view of one embodiment of the present invention showing a mining frame including two separate pairs of mining props, each pair forming in turn a prop frame, particular parts, such as hydraulic flow lines and control devices having been omitted for clarity of illustration,

FIG. 2 is a schematic side elevational view of the embodiment of FIG. 1 illustrating in greater detail the constructural arrangement of parts and the presence of flow lines and the like,

FIG. 3 is a schematic sectional view taken along the line 3—3 of FIG. 2, and

FIG. 4 is a schematic sectional view taken along the line 4—4 of FIG. 2.

It has been found in accordance with the present invention that a mining support for use especially in mining seams of great depth may be provided which comprises lower drive means having a first lower part and a second lower part movable back and forth with respect to each other in a horizontal direction, a first pair of spaced apart vertical mining prop means positioned on one side of said lower drive means and connected at a lower level to said first lower part, a second pair of spaced apart vertical mining prop means positioned on the other side of said lower drive means and connected at said lower level to said second lower part, upper drive means having a first upper part and a second upper part movable back and forth with respect to each other in a horizontal direction, the upper drive means being vertically spaced above the lower drive means with the first upper part being connected at an upper level to the first pair of spaced apart prop means and the second upper part being connected at the upper level to the second pair of spaced apart prop means. Thus, the lower and upper drive means are separately connected to the prop means at the lower and upper levels respectively, for maintaining the first and second pairs of prop means substantially parallel with respect to the direction of movement of the drive means parts. The prop means of each pair are suitably spaced apart from one another in the direction of movement of the drive means parts and are spaced apart from the adjacent prop means of the other pair of prop means in the direction transverse to the movement of the driven means parts.

Advantageously, the lower drive means is situated with respect to the prop means at a lower level at which the lower drive means is in supporting contact with the ground, the prop means each including a bottom stationary prop-element and a top extensible prop element carried by the bottom stationary prop element, whereby the upper drive means may be situated with respect to the prop means at an upper level near the upper end portion of the bottom stationary prop element. Desirably, the first and second lower and upper drive means parts are correspondingly connected to the prop means by resilient connecting means.

The drive means may each take the form of a piston cylinder arrangement including a double acting piston on a piston rod with both ends of the piston rod extending outwardly through the corresponding ends of the cylinder. In this way one pair of prop means may be connected to the piston rod of each of the superimposed moving means with the second pair of prop means being connected to the cylinder of each of the moving means so as to form a stable structure permitting the desired shifting of one pair of props with respect to the other without tilting of the mining frame or the need for readjusting manually the positioning of the shifted props to achieve a vertically parallel mining frame arrangement once again.

Referring to the drawing, FIG. 1 shows a first pair of props **2**, **3** in the form of a prop frame with the longitudinally extending lower connecting strap or skid **1** and the longitudinally extending roof cap **4** in the form of separate cap members *4a* and *4b* linkably inter-connected at their adjacent ends. A second prop frame is provided by the corresponding props **6** and **7** inter-connected at their lower ends by the connecting strap or skid **5** and at their upper ends by the roof cap *4'* comprised of similar cap members *4a'* and *4b'* linkably interconnected at their adjacent ends. Each prop is seated in a base cup **8** which preferably is rounded on its under side to accommodate the mine floor especially where the mine floor is uneven. Thus, the props **2** and **3**, on the one hand, and **6** and **7**, on the other hand, are parallel with respect to one another and spaced apart not only from the other props in the same prop frame but also from the adjacent prop in the other frame.

Normally, mining support props, such as hydraulic pit props include a bottom stationary prop element *2a*, *3a*, *6a*, *7a*, and a top extensible prop element *2d*, *3d*, *6d*, *7d*. However, where the height of the working space is greater than usual, the props will be provided with a base or pedestal *2b*, *3b*, *6b*, *7b*, under the bottom end or foot *2c*, *3c*, *6c*, *7c*, as the case may be. In this way, the over-all height of the mining frame or mining support including the prop frames may be increased for suitably supporting the mine roof to a height including not only that represented by the particular bottom stationary prop element and pedestal but also the top extensible prop element when fully extended.

A lower driving means is provided at the lower portion of the mining support or mining frame and takes the form of a piston cylinder arrangement including a double acting piston (not shown) carried on a piston rod **11** extending at each end through the corresponding head of the cylinder **9**. The ends of the piston rod **11** are connected via straps **10** extending in a direction transverse to the axial direction of the piston cylinder arrangement to the first prop frame while correspondingly the ends of the cylinder are connected by means of the transverse straps **12** to the second prop frame. Superimposed in spaced vertical relation to the first piston cylinder arrangement is a second or upper piston cylinder arrangement, including a similar piston (not shown) movable back and forth on piston rod **17** within cylinder **15**. The upper drive means or piston cylinder arrangement **15**, **17** is connected by means of the transverse straps **18** on the ends of piston rod **17** to the first prop frame via the longitudinally extending strap **19** and the brackets **14** (see FIGS. 2 and 4), the brackets **14** being in turn connected to the appropriate bottom stationary prop element by means of the clamps **13**. In like manner, the transverse straps **15** interconnect the ends of the cylinder **15** with the second prop frame at the longitudinal strap **20** in turn connected via brackets **14** (see FIGS. 2 and 4) and clamps **13** to the appropriate bottom stationary prop element.

Preferably, the lower drive means **9**, **11**, and the upper drive means **15**, **17** take the form of double acting piston cylinder arrangement which utilize hydraulic fluids, such as hydraulic oil or even pneumatic fluid to force the piston on rod **11** or rod **17**, first in one direction, up to the full amplitude of movement of the piston in that direction within the cylinder, and thence, in the opposite direction toward the other end of the cylinder, the actuation in each direction being achieved by introducing the hydraulic medium into the cylinder chamber in question on the appropriate side of the piston. Such mechanisms are well known and need not be described or shown in great detail for a proper understanding of the present invention.

In order to advance one of the prop frames with respect to the other, as for example, in the advancement of the prop frame **2**, **3**, **1**, **4**, the top extensible prop elements *6d* and *7d* are raised until the prop frame **6**, **7**, **5**, *4'* is in supporting engagement with the mine floor and mine ceiling while the top extensible prop elements *2d* and *3d* are released from engagement with the mine ceiling. Hydrau-

lic fluid is then passed to the same corresponding side of the piston within the cylinders 9 and 15 so that the piston rods 11 and 17 will be displaced toward the right as shown in FIG. 1 in a simultaneous manner whereby to displace in turn the first prop frame suitably connected therewith. For displacing the prop frame in the opposite direction, of course, hydraulic fluid would merely be passed into the appropriate cylinders 9 and 15 on the opposite side of the respective piston therewithin. After this has been accomplished, top extensible prop elements 2*d* and 3*d* are once more raised into engagement with the mine ceiling to provide once again the over-all overhead support desired. For the shifting or displacement of the second prop frame 6, 7, 5, 4', a similar operation will take place, which includes first releasing the top extensible prop elements 6*d* and 7*d* from engagement with the mine ceiling and then energizing the piston cylinder arrangements in the appropriate manner to urge the second prop frame in the desired direction. It will be appreciated that after each shifting movement, the appropriate prop frame will be extended into engagement with the mine ceiling once more to provide the desired support, yet because of the construction and arrangement of the lower and upper piston cylinder arrangements with respect to the prop frames, there will be no undesirable tilting of the particular prop frame out of its normal vertical path of movement during the shifting.

The lower drive means 9, 11 is preferably situated with respect to the various props at a lower level at which the cylinder 9 is in supporting contact with the ground, while the upper drive means 15, 17 is situated preferably with respect to the various props at an upper level near the upper end portion of the bottom stationary prop element, the clamps 13 permitting vertical adjustment of the upper piston cylinder arrangement on the bottom stationary prop elements. Furthermore, the clamps 13 permit the upper piston cylinder arrangement to be detachably secured to the prop frames to permit simple assembly and disassembly of the various parts for transport to and from various parts of the mine where the same will be used.

Preferably, the straps 1, 5, 19, 20, 10, 12, 18, 16 are preferably resilient in nature to permit slight deviation from the normal positioning of the parts under stresses occasioned by unevenness in the mine floor and/or mine ceiling. Generally, however, the various props are arranged to form the corners of a parallelogram with the upper and lower drive means respectively. Each prop frame, of course, will be maintained in rectangular disposition even during the shifting of the particular prop frame.

As may be seen in FIG. 2, each particular prop means, as for example, with respect to prop 2, includes in addition to the top extensive prop element a combined bottom stationary prop element having a lower pedestal member 2*b* and an upper carrier member 2*a*, the top prop element 2*d* being carried by the carrier member 2*a* for extension from and retraction into such carrier member. The pedestal member 2*b* is carried in the base cup 8 which is provided with adjustment fingers 8' for adjustably positioning the pedestal therein and releasably securing the same thereat. The inflow line 24 and outflow line 25 connectable with a source of hydraulic fluid are provided to supply the control valve mechanism 26 with hydraulic fluid so that the same may be passed to and from the upper piston cylinder arrangement 15, 17 by means of the inflow line 27 and return line 28, and so that hydraulic fluid may also be passed to the lower piston cylinder arrangement 9, 11 by means of the inflow line 29 and return line 30. Furthermore, by means of line 33, hydraulic fluid may be supplied to and from the appropriate pit prop 2 for extending and retracting the top prop element 2*d*. The valve control knob 31 regulates the flow of hydraulic fluid to and from the particular prop 2 and the knob 32 controls the flow of hydraulic fluid to and from the particular piston cylinder arrangement. Specifically, in the case of the pit props, the knob 31 may provide for flow of hydraulic fluid from line 24 into the prop means to extend the top prop element 2*d*, or for flow from the prop means through line 25 to retract top prop element 2*d*, or even to shut off the flow of hydraulic fluid altogether so as to maintain a certain amount within the prop means comparable to the height of the over-all prop means desired. On the other hand, the knob 32 will permit flow simultaneously to the same side of the piston in each of cylinders 9 and 15 so that movement of the piston rods 11 and 17 will occur simultaneously, the hydraulic fluid occupying the portion of the particular cylinder on the opposite side of the piston being returned through the appropriate outflow line into the control valve 26 and thence through the line 25.

Conveniently, a further flow line 34 will be provided for simultaneously passing hydraulic fluid to the foot 3*c* of prop 3 for operating that pit prop in the same manner as pit prop 2, the knob 31 serving to open and close the flow lines 33 and 34 simultaneously to achieve a raising and lowering of the prop frame in question in the proper manner.

As may be seen from FIG. 3, a further set of lines including inflow line 35 and outflow line 36 are provided to connect the control valve 26 with the control valve 37, whereby to provide in a similar manner flow communication thereat for the hydraulic pit props 6 and 7 to raise and lower the same in a manner described in connection with the raising and lowering of the pit prop 2.

It will be appreciated that normally control valve 37 will be closed when knob 31 of control valve 26 is positioned to permit inflow or outflow of hydraulic fluid to the pit props 2 and 3. Since one pit prop frame is meant to be maintained in supporting engagement with the mine ceiling, this will be understood. However, the flow lines to the upper and lower piston cylinder arrangements should be connected in parallel to provide simultaneous proportional energizing of the two driving means, whereby the force exerted during the shifting of a particular prop frame will be distributed vertically equidistantly therealong. In the past, all of the driving force was exerted along the base of the mining support and with extremely tall prop frames, such arrangement becomes unwieldly and causes undue stress on the working parts and tilting of the upper portions of the prop frame requiring manual repositioning as noted above.

In FIG. 4, the connections via the straps 19 and 20 between the upper piston cylinder arrangement 15, 17, and the appropriate prop frames are shown. The brackets 14 may be provided with longitudinally extending slots 21 defined therein so as to accommodate bolts 21' attached via suitable nuts 21'' to the attachment plates 22 carried on the ends of the longitudinally extending straps 19 and 20. The same kind of arrangement may be provided at straps 1 and 5 to accommodate the lower piston cylinder arrangement 9, 11 thereat. By reason of the presence of such slots, slight adjustments in the positioning of the various prop means may be carried out as desired.

It will be appreciated by the artisan that a particular advantage lies in providing the upper and lower piston cylinder arrangements of the same configuration and size so that they may be interchanged as for example when the mining support or mining arrangement has been disassembled and is ready to be reassembled for operation once again. Of course, by providing the piston cylinder arrangements with corresponding circular cross-sections, the straps 10, 12 or 16, 18 may be rotated toward one another until they lie substantially in the same plane whereby the separate parts of the over-all arrangement may be stored in a compact condition until they are again to be used. Hence, the various parts of the mining frame or mining support may be simply and easily transported in a compact manner and even placed upon a coal conveying machine, such as a double chain scraper conveyor of the

conventional type for conveyance along a mine corridor. It will be obvious that because of the nature of the connections between the various parts, simple and rapid reassembly may take place for the purposes intended.

In accordance with a specific embodiment of the present invention therefore a mining support is provided which includes a pair of substantially superimposed, vertically spaced apart horizontally extending piston cylinder arrangements, each arrangement having a double headed cylinder with a piston hydraulically movable back and forth therein and a double ended piston rod connected to the piston and extending correspondingly outwardly through both the cylinder heads, as well as a first and a second pair of spaced apart vertical mining props. Each prop of each pair includes a bottom stationary prop element, having a lower pedestal member and an upper carrier member, and a top extensible prop element, the top prop element being carried by the carrier member for extension from and retraction into such carrier member, the first pair of props being positioned on one side of the piston cylinder arrangements and the second pair of props being positioned on the other side of such arrangements. Lower first and second resilient connecting means are provided for one of the arrangements and upper first and second resilient connecting means are provided for the other of the arrangements. Accordingly, one of the piston cylinder arrangements is positioned at a lower vertical level corresponding to the level of the lower portion of the lower pedestal members with the piston rod thereof being connected by the lower first connecting means to the lower pedestal members of the first pair of props and with the cylinder thereof being connected by the lower second connecting means to the lower pedestal members of the second pair of props, and the other of the piston cylinder arrangements is positioned at an upper vertical level corresponding to the level of the upper end portion of the upper carrier members with the piston rod thereof being connected by the upper first connecting means to the upper carrier members of the first pair of props and with the cylinder thereof being connected by the upper second connecting means to the upper carrier members of the second pair of props, whereby to maintain at the lower and upper levels, the first and second prop pairs parallel with respect to the axial direction of the piston cylinder arrangements, the props in each pair being spaced apart from one another in axial direction and from the adjacent props of the other pair in a direction transverse to the axial direction. Preferably, the lower level piston cylinder arrangement is in supporting contact with the ground and both pistons and cylinders are provided with corresponding circular cross-sections, the two piston cylinder arrangements being operatively coupled in parallel flow communication with a common source of hydraulic fluid for simultaneous actuation in the same axial direction to produce an additive motive force on a corresponding pair of props proportionally distributed along the vertical height of the pair of props. The lower pedestal members are also preferably detachably connected to the lower piston cylinder arrangement and due to the presence of the clamps and bracket means at the upper end portion of each upper carrier member, the upper piston cylinder arrangement is conveniently detachably connected to the props, so as to afford ready detachment of the two piston cylinder arrangements for disassembling the mining support.

It will be appreciated, therefore, that by reason of the construction of the present invention, not only will the individual props be conducted precisely along their entire height in the shifting of the prop frames, but also in continuous operation a perpendicular position with respect to all of the props will be always assured. Since the forces necessary for shifting or advancing each frame with respect to the other are distributed by means of two separate drive means, each individual drive means, i.e. piston cylinder arrangement, may be appropriately smaller and lighter than the piston cylinder arrangements heretofore employed, i.e. those positioned only between the lower skids at the bottom of the arrangement. Moreover, by providing the lower and upper drive means in parallel flow connection with the hydraulic fluid source, only one control device is necessary, whereupon the over-all improvement of the invention may be practiced without the need for more complicated and expensive control equipment than would be used with a single drive means.

As will be appreciated, the individual prop means are removably attached at their bases to the lower piston cylinder arrangement, and the same is true of the attachment between the upper portions of the prop means and the upper piston cylinder arrangement. Therefore, the individual moving means may be installed between the prop frames at any given depth or height of seam being worked, independently of the total length of the props. Naturally, the length of the props may be increased by providing a lower pedestal member of increased length and by extending to the fullest the top prop element and correspondingly the upper advancing means or moving means may be adjusted in height above the lower advancing means or moving means in turn. By favorably positioning the upper piston cylinder arrangement near the upper end portion of the upper carrier member, a crowding of the two moving means with respect to each other is avoided, free space is provided therebetween for the workmen, and excessive or unbalanced forces on the various parts, as for example during the shifting or advancing of one of the prop frames, are avoided. Depending upon the height of the lower pedestal member upon which the normal prop is mounted, the hose connections or flow lines for the hydraulic fluid, etc. may be positioned advantageously at about an intermediate height between the lower and upper moving means. Thus, the flow lines to the two piston cylinder arrangements will be of approximately equal length.

In any case, it will be appreciated that a mining support or mining frame of the instant type is suitable not only for accommodating seams of great depth or height but also may be used independently of the depth both in horizontal or steep strata, inasmuch as a vertical positioning of all of the props in continuous operation will be assured with respect to the horizontal.

While the lower piston cylinder arrangement, preferably resting upon the mine floor, serves to increase the support and stability of the two prop frames with respect to the horizontal, substantially increased reinforcement of the upper portions of the mining frame or mining support is achieved by the use of the longitudinal straps 19 and 20 which tend to keep the props in each pair in non-deformable disposition with respect to one another whereby the stability of the entire mining frame will be increased. Nevertheless, the longitudinal straps 19 and 20, as well as the longitudinal straps 1 and 5, and the transverse straps 10, 12, 16, 18, are preferably made of resilient metal or spring metal and suitable slots are provided for the connection between the appropriate longitudinal strap and the corresponding prop, especially with regard to the upper straps, in order to render the over-all mining support sufficiently resilient to give under extreme forces, whereby to better accommodate unevenness in the mine floor and mine ceiling.

It will be appreciated that the instant specification is set forth for the purpose of illustration and not limitation, and that changes and modifications will occur to the artisan which may be made without departing from the spirit and scope of the present invention, such invention being limited only by the scope of the appended claims.

What is claimed is:

1. Mining support comprising lower drive means having a first lower part and a second lower part operatively interconnected and movable back and forth with respect to each other in a horizontal direction, a first pair of

spaced apart vertical mining prop means positioned on one side of said lower drive means and connected at a lower level to said first lower part, a second pair of spaced apart vertical mining prop means positioned on the other side of said lower drive means and connected at said lower level to said second lower part, upper drive means having a first upper part and a second upper part operatively interconnected and movable back and forth with respect to each other in a horizontal direction, said upper drive means being vertically spaced above said lower drive means with said first upper part being connected at an upper level to said first pair of space apart prop means and said second upper part being connected at said upper level to said second pair of spaced apart prop means, said lower and upper drive means being separately connected to said prop means at said levels for maintaining said first and second pairs of prop means substantially parallel with respect to the direction of movement of said parts, the prop means of each pair being spaced apart from one another in the direction of movement of said parts and being spaced apart from the adjacent prop means of the other pair of prop means in the direction transverse to the movement of said parts.

2. Support according to claim 1 wherein said lower drive means is situated with respect to said prop means at a lower level at which said lower drive means is in supporting contact with the ground, said prop means each includes a bottom stationary prop element and a top extensible prop element carried by said bottom stationary prop element, and said upper drive means is situated with respect to said prop means at an upper level near the upper end portion of said bottom stationary prop element.

3. Support according to claim 2 wherein said first and second lower and upper parts are correspondingly connected to said prop means by resilient connecting means.

4. Support according to claim 3 wherein said prop means are arranged to form the corners of a parallelogram with said lower and upper drive means positioned therebetween, each said drive means being a piston cylinder arrangement including a double acting piston on a piston rod with both ends of said rod extending outwardly through the corresponding ends of the cylinder, with said first pair of prop means being connected to the piston rod of said lower moving means and the second pair of prop means being connected to the cylinder of said lower moving means, and with said first pair of prop means being connected correspondingly to one of the piston rod and cylinder of said upper drive means and said second pair of prop means being connected correspondingly to the other of said piston rod and cylinder of said upper drive means.

5. Support according to claim 4 wherein said connecting means include a separate resilient connecting member extending in a direction parallel with respect to the direction of movement of said parts connecting each of said pairs of prop means at said lower level and a separate resilient connecting means extending in said direction connecting each of said pairs of prop means at said upper level, to form a rectangular prop frame unit, respectively, of said first pair of prop means and of said second pair of prop means, and further include first connecting straps connecting said first pair of prop means forming a first frame unit separately to the piston rods of said moving means and second connecting straps connecting said second pair of prop means forming a second frame unit separately to the cylinders of said moving means.

6. Support according to claim 5 wherein said pistons, piston rods, and cylinders are provided with corresponding circular cross-sections, two first lower transverse connecting straps being provided at said lower level one near each prop means of the first frame unit and two first upper transverse connecting straps being provided at said upper level one near each prop means of the first frame unit for connecting said first frame unit to said piston rods, and two second lower transverse connecting straps being provided at said lower level one near each prop means of the second frame unit and two second upper transverse connecting straps being provided at said upper level one near each prop means of the second frame unit for connecting said second frame unit to said cylinders.

7. Mining support comprising a pair of substantially superimposed, vertically spaced apart horizontally extending piston cylinder arrangements, each arrangement having a double headed cylinder with a piston hydraulically movable back and forth therein and a double ended piston rod connected to said piston and extending correspondingly outwardly through both said cylinder heads, a first pair and a second pair of spaced apart vertical mining props being positioned on the other side of said arrangetionary prop element, having a lower pedestal member and an upper carrier member, and a top extensible prop element, said top prop element being carired by said carrier member for extension from and retraction into said carrier member, said first pair of props being positioned on one side of said arrangements and said second pair of props being positioned on the other side of said arrangements, lower first and second resilient connecting means for one of said arrangements and upper first and second resilient connecting means for the other of said arrangements, one of said piston cylinder arrangements being positioned at a lower vertical level corresponding to the level of the lower portion of the lower pedestal members with the piston rod thereof being connected by said lower first connecting means to the lower pedestal members of said first pair of props and with the cylinder thereof being connected by said lower second connecting means to the lower pedestal members of said second pair of props, and the other of said piston-cylinder arrangements being positioned at an upper vertical level corresponding to the level of the upper end portion of said upper carrier members with the piston rod thereof being connected by said upper first connecting means to the upper carrier members of said first pair of props and with the cylinder thereof being connected by said upper second connecting means to the upper carrier members of said second pair of props, for maintaining at said lower and upper levels said first and second pairs of props parallel with respect to the axial direction of the piston cylinder arrangements, the props in each pair being spaced apart from one another in the axial direction of said arrangements and being spaced apart from the adjacent props of the other pair in a direction transverse to said axial direction.

8. Support according to claim 7 wherein the lower level piston cylinder arrangement is in supporting contact with the ground and both pistons and cylinders are provided with corresponding circular cross-sections.

9. Support according to claim 7 wherein the two piston-cylinder arrangements are operatively coupled in parallel flow communication with a common source of hydraulic fluid for simultaneous actuation in the same axial direction to produce an additive motive force on a corresponding pair of props proportionally distributed along the vertical height of said pair of props.

10. Support according to claim 9 wherein the lower pedestal members are detachably connected to the lower arrangement and detachable bracket means are provided at the upper end portion of each said upper carrier member for detachably connecting the upper arrangement thereto, whereby said arrangements may each be detachably connected to said props.

11. Support according to claim 7 wherein said connecting means include coacting bolts and slot means, with said bolts received in said slot means for adjustment of the positioning of a particular prop with respect to a corresponding piston cylinder arrangement.

12. Support according to claim 7 wherein control means for a source of hydraulic fluid including flow lines con-

nected to said arrangements is provided, said control means being positioned on one of said props at a level intermediate said lower and upper vertical levels and said flow lines operatively extending therefrom substantially equidistantly to said arrangements, respectively, whereby the lower pedestal members and upper carrier members are correspondingly so dimensioned and the vertical positioning of the upper level piston cylinder arrangement at the upper end portions of said upper carrier members is so disposed that the flow lines from said control means to said arrangements are of substantially equal flow length.

References Cited by the Examiner

UNITED STATES PATENTS

3,192,722	7/1965	Hermann et al.	61—45.2

FOREIGN PATENTS

1,143,771	2/1963	Germany.
883,407	1961	Great Britain.

CHARLES E. O'CONNELL, *Primary Examiner.*
JACOB SHAPIRO, *Examiner.*