July 6, 1965 J. HERRMANN ETAL 3,192,722

MINING SUPPORT

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Fig. 1

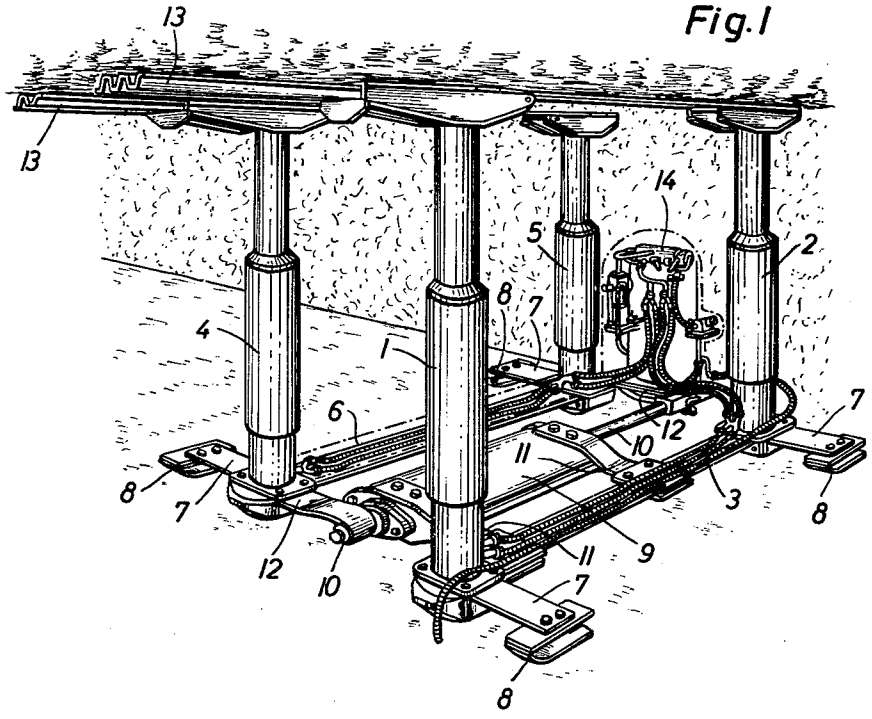
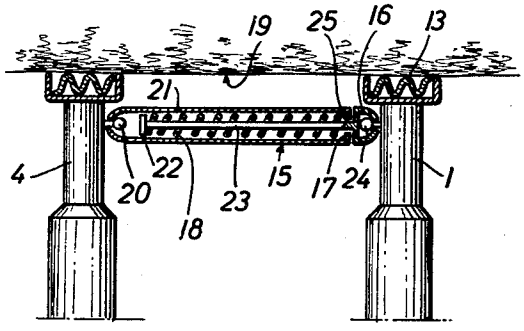



Fig. 2




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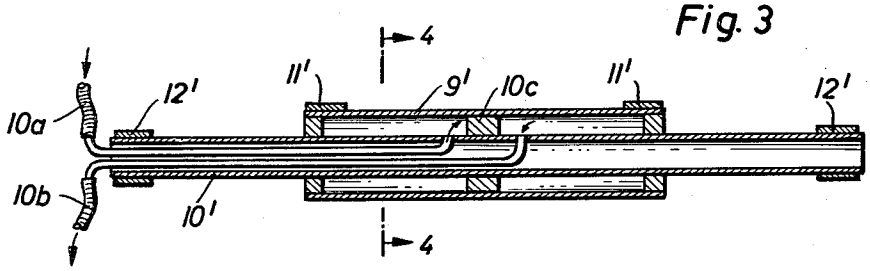
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MINING SUPPORT

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Fig. 3



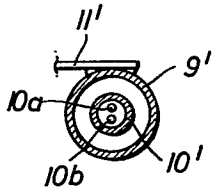
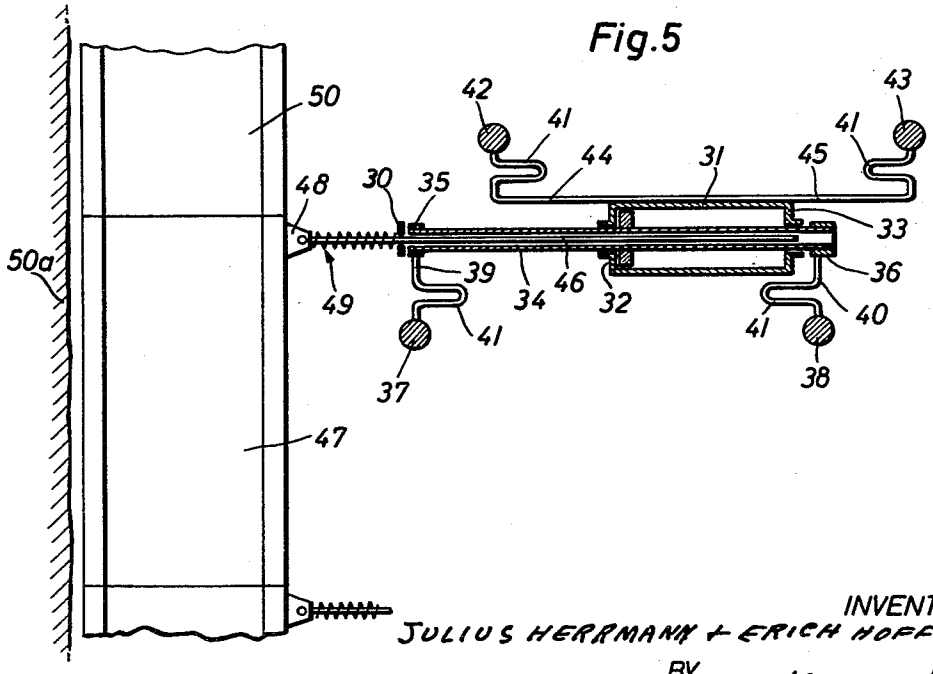




Fig. 4

Fig. 5



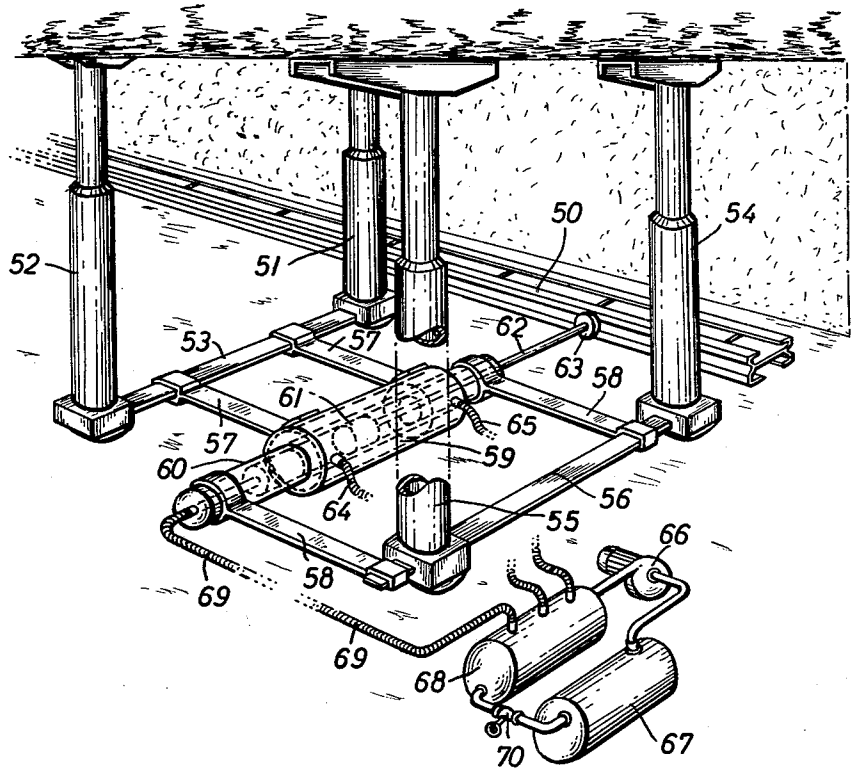

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Fig.6



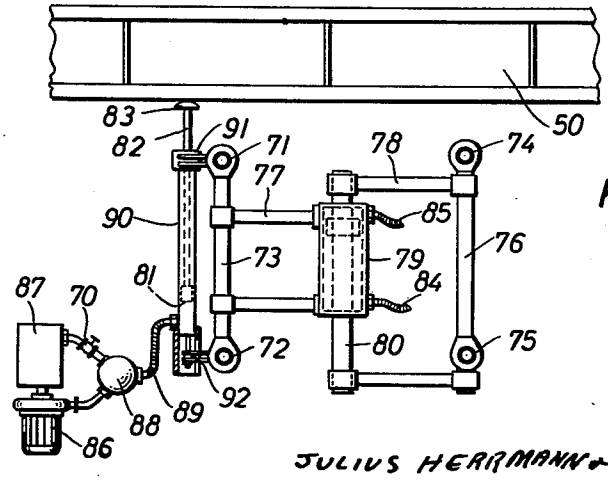




Fig.7

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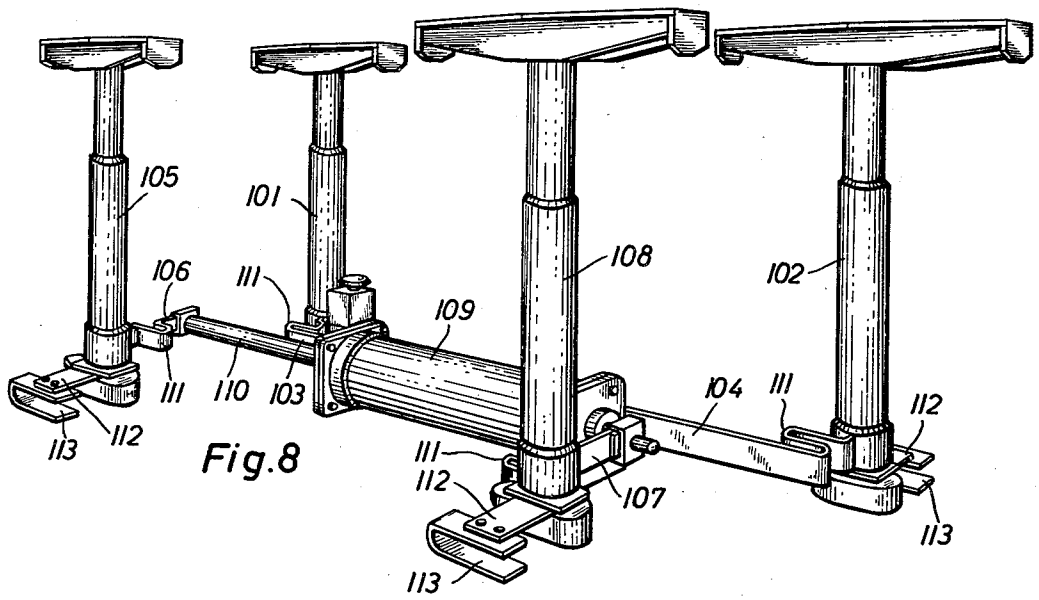



Fig.8

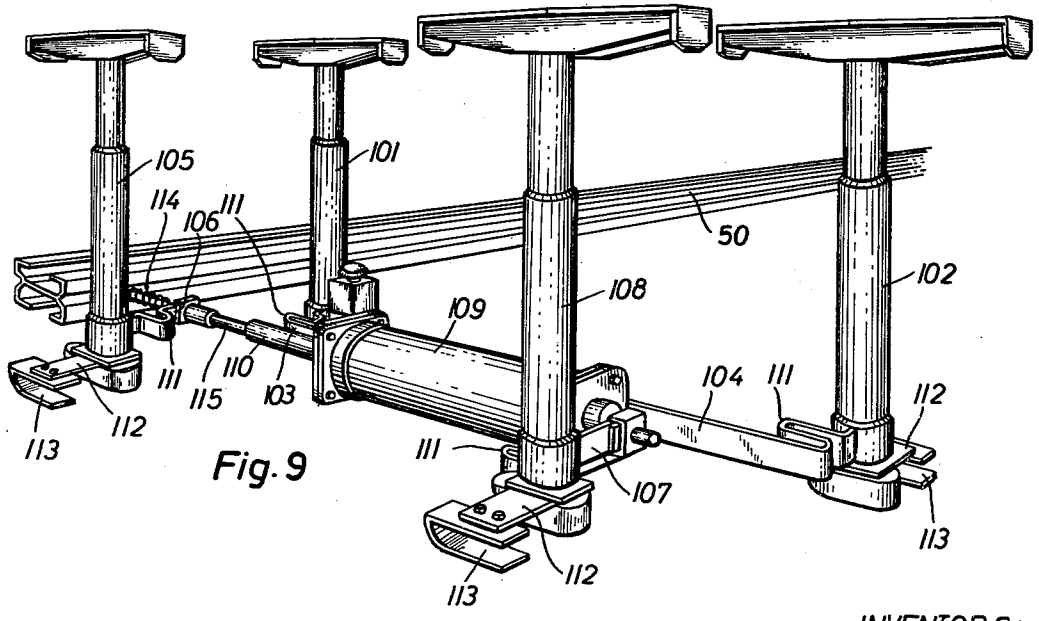



Fig.9

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United States Patent Office

3,192,722

Patented July 6, 1965

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3,192,722

# MINING SUPPORT

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Filed Sept. 14, 1960, Ser. No. 55,891

Claims priority, application Germany, Jan. 27, 1956, G 18,861; July 9, 1956, G 20,040; Oct. 9, 1959, G 28,124

36 Claims. (Cl. 61—45)

This invention relates to a mining support and the instant application is a continuation-in-part of copending U.S. applications Serial No. 635,271, filed January 22, 1957 and Serial No. 670,833, filed July 9, 1957, both now abandoned.

The invention more particularly relates to and has as its object a stable self-supporting mining support unit which may be automatically advanced and which may be used in connection with a longitudinally extending longitudinally extending long wall mining conveyor for advancing and urging the conveyor toward the mine face.

This and still further objects will become apparent from the following description read in conjunction with the drawing in which:

FIG. 1 is a perspective view of one embodiment of a mining support arrangement in accordance with the invention,

FIG. 2 is a partial side view showing parts in section of a modification of the embodiment in FIG. 1,

FIG. 3 is a sectional view of a modification of the piston-cylinder arrangement of FIG. 1,

FIG. 4 is a sectional view of the arrangement according to FIG. 3,

FIG. 5 diagrammatically shows a plan view of another embodiment of a mining support in accordance with the invention connected to a horizontally extending long wall mining conveyor,

FIG. 6 illustrates a further embodiment of the invention in diagrammatic view indicating enclosed parts in dotted line,

FIG. 7 illustrates a modification of the embodiment in FIG. 6, and

FIGS. 8 and 9 illustrate alternate modifications of the invention combining structural features from FIGS. 1 and 5.

The mining support in accordance with a first embodiment of the invention comprises a pair of spaced-apart, vertically positioned mining props, a connecting member, such as a connecting rail, connecting the lower portions of said props as a unit, and support means, such as at least one supporting strut connected to the base of the unit extending in a direction lateral to the rail to vertically support the unit.

There is preferably provided a second pair of spaced-apart, vertically positioned mining props connected at their lower portions by a second connecting rail positioned alongside the first-mentioned unit in spaced relationship substantially parallel thereto with means, such as a piston-cylinder arrangement, positioned between the units for alternately advancing each unit with respect to the other in a direction substantially parallel to the rails. In this embodiment the support means, such as the supporting struts, preferably extend on the sides of their respective units opposite the other unit. In addition to or alternately the two units may be connected together as a self-supporting unit, as, for example, by means of straps connecting one of the units to a piston rod of the piston cylinder arrangement, and the other of the units to the cylinder of the piston-cylinder arrangement.

Referring to the embodiment shown in perspective view

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in FIG. 1 of the drawing, a first frame or unit is formed from two vertically positioned, spaced-apart mining or pit props 1 and 2, which are connected together at their lower portions by means of the resilient connecting rail 3. Positioned alongside this frame or unit is a second frame or unit consisting of the pit or mining props 4 and 5, connected at the base portion by the resilient lower rail 6. The two frames or units are positioned side by side substantially parallel in spaced relationship to each other. The mining or pit props as shown are hydraulic props of well known construction, though any known or conventional pit or mining props may be used. Each of the frames 1, 2, 3 and 4, 5, 6, respectively, is provided with a pair of supporting struts 7 on the side opposite the other frame. The supporting struts 7 have slide runners or shoes 8 connected to their free ends and serve to maintain the frames in an upright position as a self-supporting unit. As shown, a supporting strut 7 is connected at the base portion of each of the props.

Between the two frames 1, 2, 3 and 4, 5, 6, respectively, a device for alternately advancing the frames with respect to each other in a direction parallel to the rails 3 and 6 is provided. As shown, this device consists of a piston-cylinder arrangement having the advancing cylinder 9, in which there is positioned in the conventional manner a double acting piston having a piston rod 10, which extends through the piston and through the cylinder in both directions. The frame 1, 2, 3, is connected by the two resilient straps 11 to the cylinder 9, while the other frame, 4, 5, 6, is connected by the two resilient straps 12 to the opposite ends of the piston rod 10. The straps 11 and 12 are preferably so shaped that the cylinder 9 is normally held slightly above the floor level. It is possible, however, to have the cylinder 9 rest on the floor and to serve with the straps 11 and 12 as lateral supports for the frame units.

The struts and straps are preferably developed as spring U-bolts or loop-shaped leaf springs.

The props 1, 2, 4 and 5, as mentioned, are of conventional construction and may have the conventional prop heads. Under certain circumstances, however, it may be desirable to connect the props of each framework with each other at their upper portion by one or more pressure supports, the minimum length of which is determined by stops, but which, upon the advance of one or the other frame can temporarily extend against the action of a spring. As shown, the prop heads of each of the two frames, 1, 2, 3 and 4, 5, 6, respectively, each bears a bank iron 13, which is so supported that upon advancing of the frames, they can be displaced with respect to the frames.

The hydraulic lines from the mining props and from the cylinder 9 are connected to a central control valve 14, which in turn is connected to the hydraulic pressure source. As shown, the props are provided with double hydraulic lines, though of course, depending on the prop construction, single lines might be used. By suitable actuation of the central control valve 14, props 1, 2, 4 and 5 may be raised or lowered, and the double-acting piston in the cylinder 9 may be moved in one or the other direction due to the alternate hydraulic charging of the cylinder on each side of the double-acting piston.

In operation, the entire support unit is self-supporting and need not be connected with the face of a mining conveyor though, of course, such connection is possible if desired. The prop system is generally used in long-wall mining, where mineral, such as coal, is continuously removed from the face of the mine, the prop system advanced, and the ceiling in back of the same where the mineral, such as coal, has been previously removed, allowed to collapse in the conventional manner. The support system is placed in the long wall shaft with the longitudinal axes of the rails 3 and 6 pointing toward the mine face. The props 1, 2, 4, and 5 are charged with

the hydraulic liquid, so that the same are raised and will form a support for the mine ceiling upon contact therewith. In order to advance the unit, the props of one of the frames, as for example, props 4 and 5 are lowered so as to relieve their pressure on the ceiling, by a suitable adjustment of the control valve 14. Thereafter hydraulic fluid is passed into the cylinder 9 by means of the control valve 14, so that the piston moves in a direction toward the left, as shown in the drawing, causing movement of the piston rod 10, and thus causing the frame 4, 5, 6 to slide along the mine floor toward the mine face, i.e., in the direction toward the left, as shown in the drawing, since the unit 1, 2, 3 is held firmly between the mine floor and the ceiling. After the advance has been completed, props 4 and 5 may be raised to their supporting position, and for further advance, the props 1 and 2 lowered and hydraulic fluid passed on the other side of the piston into the cylinder 9, causing the cylinder 9 to move toward the left, as shown in the drawing with respect to the piston rod 10, and moving the frame unit 1, 2, 3 in forward position (to the left, as shown in the drawing). In this manner, the unit may be continuously advanced as desired. The resilient construction of the struts 7 and the straps 11 and 12 prevent jamming, which might be caused by irregularities in the mine floor and the slide runners or shoes 8 greatly facilitate the advance.

FIG. 2 shows a construction in which corresponding supporting props of the respective frames are connected near the mine roof 19 with each other by one or more pressure supports 15. Thus, props 1 and 4 are interconnected at their upper ends by pressure support 15, the minimum length of which is determined by stops 16, 17, but which can extend temporarily against the action of a spring 18.

The pressure supports or connecting pieces 15 extending between props 1 and 4 include a hollow cylinder 21 pivotally attached at its socket end by joint 20 to prop 4 in which a plunger type disc 22 is arranged on the inner end of connecting piston type rod 23. The rod is pivotally attached via socket 16 and joint 24 to prop 1 and telescopes within cylinder 21. The end wall 17 of cylinder 21 adjacent to prop 1 is provided therein with an opening 25 through which rod 23 may be passed. Joints 20 and 24 are universal joints, as for example, of the ball and socket type as shown in FIG. 2. However, any other type joint suitable in connection with mining operations may be used. A spring 18 is inserted between end wall 17 and disc 22 which serves to keep connecting piece 15 in its normal position as shown in FIG. 2. Thus, connecting piece 15 forms a resilient connection between the two props 1 and 4, that is to say between two props of adjacent frames or units.

If between the props 1 and 4, as shown in FIG. 1 of the drawing, a connecting piece 15 were installed then it would be arranged according to the position of the frames in FIG. 1, parallel to the conveyor and perpendicular to the direction of the lower resilient rails 3 and 6. If then the prop 1 is advanced in the direction of the coal pile, while the prop 4 remains in the same position, then the connecting piece 15 assumes a slanting to diagonal position dependent upon the amount that prop 1 has been advanced, that is to say, the connecting piece 15 is no longer parallel to the conveyor as shown in the drawing, but rather is at an angle to it. At an advance of prop 1 which naturally is made together with the entire frame 1, 2, 3, the distance between the props 1 and 4 becomes, of course, greater. This greater distance is compensated for by the connecting piece 15 in such a way that against the force of the spring 18 the piston rod 23 is pulled out of the cylinder 21 a corresponding distance. The maximum distance between the two props 1 and 4 is thereby determined by the length over which the disc 22 via the piston rod 23 can



travel in the cylinder 21. This length corresponds practically to the length of the piston rod 23. If the prop 4 is later advanced toward prop 1 (again with the entire frame 4, 5, 6), the distance between the two props 1 and 4 becomes correspondingly smaller so that cylinder 21 and disc 22 with rod 23 of the connecting piece 15 telescopically co-act until they reach the position shown in FIG. 2 of the drawing. By means of two universal joints 20 and 24, the connecting piece 15 is positioned with unlimited mobility between the two props 1 and 4, since these joints, as already mentioned, make possible all movement of the props not only in a horizontal direction but also in a vertical direction.

In FIGS. 3 and 4, a modified form of the piston cylinder arrangement used in accordance with the invention is shown. Cylinder 9' is attached to one frame or unit by means of straps 11' while piston rod 10' is attached to the other frame or unit by means of straps 12'. The intermediate portion of piston rod 10' is slidably received within cylinder 9' and is provided with a double acting piston 10*c* slidable within cylinder 9'. Hydraulic fluid is alternately charged via lines 10*a* and 10*b* to the respective portions of cylinder 9' on each side of piston 10*c* in the conventional manner.

In this regard, when piston rod 10' is secured against movement and cylinder 9' is free to move, upon charging fluid through line 10*a* to the left side of cylinder 9' as viewed in FIG. 3, cylinder 9' will be forced to the left while any fluid present on the right side of cylinder 9' will be exhausted through line 10*b*. On the other hand, when cylinder 9' is secured against movement and piston rod 10' is free to move, upon charging fluid through line 10*b* to the right side of cylinder 9' as viewed in FIG. 3, piston rod 10' will be forced to the left while any fluid present on the left side of cylinder 9' will be exhausted through line 10*a*. Thus, the particular prop frames may be alternately moved forward and backward with respect to one another along substantially parallel paths of travel to move conveniently and efficiently the combined frames or units with safety and without the loss of vital overhead support of the mine ceiling.

The mining support in accordance with a further embodiment of the invention has drive means with a first part and a second part movable back and forth with respect to each other in a horizontal direction, as for example, a horizontally positioned piston cylinder arrangement. A first pair of spaced apart vertical mining props is positioned on one side of the drive means connected to the first part thereof, as for example, the piston rod of the piston cylinder arrangement, by resilient connecting means such as leaf springs. A second pair of mining props is positioned on the other side of the drive means and connected to the second part thereof, as for example, the cylinder of the piston cylinder arrangement, by resilient connecting means, such as, leaf springs. The props of each pair are spaced apart from one another in the direction of movement of the parts, as for example, the axial direction of the piston cylinder arrangement and are spaced apart from the adjacent props of the other pair in a direction transverse to the movement of the parts.

The props are preferably arranged to form corners of a parallelogram with the drive means, such as, the piston cylinder arrangement positioned in the central portion thereof. The resilient connecting means, such as, the leaf springs, are preferably so constructed that the same have a loop shaped bend therein between the prop and the part connected thereto in order to allow a springing action in a direction transverse the movement of the parts.

Referring to this second embodiment as shown in FIG. 5 of the drawing, the mining support has a piston cylinder arrangement with the pneumatic cylinder 31 provided with a cylinder head 32, at one end and a cylinder head 33 at the other end. A piston mounted on the piston rod

34 moves back and forth in the cylinder 31 by alternately introducing compressed air into cylinder 31 on each side of the piston in the conventional manner. The piston rod 34 is a double-ended piston rod with one end 35 extending through the cylinder head 32 and the opposite end 36 extending through the cylinder head 33.

A first pair of spaced apart mining props 37 and 38 is connected to the opposite ends of the piston rod 34 by means of resilient connecting members in the form of the leaf springs 39 and 40. The leaf springs 39 and 40 have the loop shaped bends 41 in order to allow increased resiliency and an increased springing effect in a direction transverse to the movement of the parts of the piston cylinder arrangement.

A second pair of spaced apart mining props 42 and 43 is connected to the cylinder 31 by means of resilient connecting members in the form of the leaf springs 44 and 45. The leaf springs 44 and 45 have the loop shaped bends 41 on the portions connected to the props 42 and 43 in the same manner and for the same purpose as the bends 41 in springs 39 and 40.

In place of the bends 41, another construction may be provided to insure increased resiliency in a direction transverse to the piston cylinder arrangement, as for example, coil springs or the like, suitably interposed in the connecting members between the props and the parts to which they are connected.

The mining props 37, 38, 42 and 43 may be of any conventional construction and are preferably in the form of a hydraulic pit prop which may be extended and retracted automatically by the introduction and withdrawal of a suitable hydraulic fluid.

The props are so positioned with respect to each other that the same form the corners of a parallelogram with the piston cylinder arrangement positioned in the central portion thereof.

In accordance with the preferred features of this second embodiment, the piston rod 34 is of hollow tubular construction and a connecting rod 46 extends into the hollow interior thereof from the end 35. This connecting rod 46 is therefore axially movable with respect to the piston rod 34. The end of the connecting rod 46 which extends out from the end 35 of the piston rod 34 is connected to a section of the horizontally extending long wall mining conveyor 47 by means of the vertical pivot joint 48. A compression spring 49 surrounds the portion of the connecting rod 46 between the joint 48 and the end 35 of the piston rod 34. A suitable spring bushing 30 is axially movable on the rod 46 and will contact the end 35 of the piston rod 34.

The longitudinally extending long wall mining conveyor 47 may be of conventional construction, as for example, as used in long wall mining in connection with a mining planer. The conveyor consists of individual sections 50 which are generally connected to each other for limited flexing between the sections so that the conveyor as a whole has limited flexibility in the manner of a snake or the like. The conveyor is positioned along the long wall mine face, such as a coal face, and the mining planer is drawn back and forth along the forward edge thereof by means of a flexible traction element, such as, a drive chain, and suitable drive means positioned at the ends of the conveyor. The conveyor is resiliently urged toward the mine face and as the mining planer is moved back and forth the planer removes coal from the mine face and plows the same into the conveyor for removal.

In operation, the mining support may be connected to the conveyor in the manner shown in the drawing with a number of similarly spaced apart supports extending along the length of the conveyor.

The support may be advanced toward the mine face in order to provide moving supports in accordance with the long wall mining system and to advance and urge the conveyor forward toward the mine face.

In order to advance the support from the position shown in the drawing, the props 37 and 38 are charged with hydraulic fluid, for example, so that the same are in firm holding contact with the mine ceiling and the mine floor while the props 42 and 43 are released from holding engagement. Compressed air is forced into the cylinder 31 on the cylinder head 32 side of the piston thus forcing the cylinder 31 forward in the direction of the conveyor, moving the props 42 and 43 therewith. When the head end 33 of the cylinder reaches the piston, the props 42 and 43 may be charged so that the same extend in holding engagement with the mine floor and mine ceiling and the props 37 and 38 released. Compressed air is then forced in the opposite end, i.e., the head 33 end of the cylinder so that the piston rod 34 is forced in the opposite direction moving the props 37 and 38 forward in the direction of the conveyor 47. In this manner, the support may be automatically "walked" in the direction of the mine face. The props 37, 38, 42 and 43 provide support for the mine ceiling in the vicinity of the conveyor and all four props may of course be simultaneously charged in holding engagement with the mine floor and ceiling. Additionally, the props provide a rigid holding support for the unit as a whole and allow the unit to urge the conveyor forwardly by the force exerted by the piston rod 34 on the compression spring 49. With the unit held in place, the forcing of the piston toward the head 32 will of course also resiliently force the conveyor 47 forward toward the mine face through the spring 49.

The arrangement of the connecting rod 46 slidably received within the hollow piston rod 34 and the pivotal connection 48 insures a mutual guiding of the mining support and the conveyor in the direction at right angles to the mine face.

The arrangement in accordance with this second embodiment of the invention insures that the distance between the prop pairs is maintained constant and at the same time insures that the prop pairs remain parallel to each other at all times during operation.

In accordance with a further feature of the invention, the mining support is provided with urging means for urging a long wall mining conveyor, for example, in the direction of movement of the mine support, i.e., in the direction of movement of the piston cylinder arrangement. The urging means may include a spring means mounted between the mining support and the conveyor, or may be a further auxiliary piston cylinder arrangement mounted for urging abutment against the conveyor in forward direction.

In accordance with one embodiment of the auxiliary piston cylinder arrangement, the main piston rod of the main piston cylinder arrangement is provided as a hollow rod adapted to receive slidably therewithin one end of a connecting rod for attachment to or forward abutment against a long wall mining conveyor section. The main piston rod may take the form of a hollow tube serving as an auxiliary cylinder for the auxiliary connecting rod that is attached to or placed in abutment with the conveyor section. The auxiliary connecting rod will naturally contain a double action piston element slidably along the auxiliary cylinder defined within a portion of the hollow main piston rod. Suitably, one end of the auxiliary connecting rod extends outwardly from the main piston rod, and has disposed thereon a compression spring and means for pivotally connecting the auxiliary connecting rod to a section of the long wall mining conveyor so as to provide pivoting about a vertical axis of pivot, if desired.

In accordance with an alternate embodiment, the auxiliary piston cylinder arrangement may be provided as a separate construction positioned in connected parallel relation with respect to one of the pairs of the props in the mining support.

Thus, an urging piston rod slidably movable within an urging cylinder is provided in either case such that

the urging piston rod extends outwardly from the urging cylinder for urging abutment with the long wall mining conveyor. Conveniently, a source of hydraulic or pneumatic pressure is applied to the auxiliary piston cylinder arrangement so as to maintain a constant positive pressure of the piston rod against the conveyor. By maintaining a constant pressure in the urging cylinder, the piston rod will exert a force against the conveyor so as to move the same in forward direction and the long wall from which the mineral is extracted will always bear a close proximity to the conveyor during the mining operation.

Referring to FIGURE 6, a conveyor **50** is disposed adjacent to the long wall of mineral to be extracted such as by a conventional mining planer whose operation is well known to the artisan. The surrounding mine roof is safely and efficiently supported by means of the prop frames **51, 52, 53** and **54, 55, 56**, which are maintained parallel with respect to one another and perpendicular with respect to the conveyor direction. Between these frames a piston cylinder arrangement is situated, including cylinder **59** to which frame **51, 52, 53** is connected by means of straps **57**, as well as piston rod **60** to which frame **54, 55, 56** is connected by means of straps **58**. Piston rod **60** is constructed with a hollow center portion defining an urging cylinder **61** in which one end of urging piston rod **62** is slidably movable. The other end of urging piston rod **62** is provided with a bearing surface **63** for abutment with conveyor **50**.

Frames **51, 52, 53** and **54, 55, 56** move back and forth with respect to one another in the conventional manner as described above under pneumatic or hydraulic actuation by means of flow lines **64** and **65**. On the other hand, piston **61** is urged in forward direction under positive hydraulic or pneumatic pressure communicated to urging cylinder **61** via line **69**. In this connection, for example, a compressor **66** draws hydraulic fluid from a reservoir **67** and forces it into container **68**. Since container **68** communicates via line **69** with cylinder **61**, a constant pressure may be readily maintained within urging cylinder **61** such that urging piston rod **62** will abut conveyor **50** and move the same in forward direction (toward the right, as viewed in FIGURE 6). Thus, the conveyor **50** will be maintained in close relationship with respect to a mine wall being extracted such that the extracted mineral will be conducted onto the conveyor and passed away from the site of the mining operation.

It will be appreciated that lines **64** and **65** may also be connected with container **68** via suitable control elements so that a single source of hydraulic fluid may serve to actuate the movement of the props by means of cylinder **59** and piston rod **60** as well as the urging piston cylinder arrangement. In the same way suitable connections may be provided for actuating mining props **51, 52, 54** and **55** in the manner described above.

It will be appreciated that while controls will be needed for actuating the raising and lowering of the props and for effecting the back and forth movement of the props by means if the main piston cylinder arrangement, in accordance with the preferred embodiment of the invention piston rod **62** will be maintained under constant positive pressure, such as the pressure present in container **68** which is communicated to cylinder **61** via line **69**. As the conveyor **50** moves in forward direction, yielding under the pressure force exerted by bearing surface **63**, piston rod **62** will move further outwardly of urging cylinder **61**. Any back pressure exerted by the planer device, for example, against conveyor **50** and urging piston rod **62**, would be transmitted through urging cylinder **61** and line **69** to container **68**. Any excess pressure will be relieved by excess pressure valve **70** acting between container **68** and reservoir **67**. After the passage of the planer, however, conveyor **50** will at once be again urged toward the mine face under the action of pressure in container **68** transmitted in forward direction via line **69** and urging cylinder **61** against urging piston rod **62**.

With respect to the embodiment shown in FIGURE 7, frame **71, 72, 73** is connected by means of straps **77** to cylinder **79** while frame **74, 75, 76** is connected via straps **78** to piston rod **80**. Hydraulic actuation is effected through lines **84** and **85**. The arrangement so far described is similar to that of FIGURE 6, and the operation of these elements is carried out as described above. An auxiliary urging piston cylinder arrangement in this embodiment is directly connected to one of the frames as a separate construction, here shown connected to frame **71, 72, 73**. In this case auxiliary urging cylinder **90** is connected at each end to prop **71** and prop **72**, respectively. Within cylinder **90** one end of piston rod **82** is slidably movable. Piston rod **82** is provided with piston element **81** at the end position within urging cylinder **90**. The other end of urging piston rod **82** is provided with a bearing surface **83** similar to bearing surface **63** of FIGURE 6 for urging abutment against conveyor **50**. For the forward actuation of piston rod **82**, a reservoir **87**, compressor **86**, container **88** and line **89** are provided which operate in the same manner as reservoir **67**, compressor **66**, container **68** and line **69**, of FIGURE 6. In this embodiment an excess pressure valve **70** is similarly provided for relieving back pressure caused by the planer against conveyor **50** and in turn against urging piston rod **82**, such pressure being transmitted to container **88**.

It will be seen that for efficient operation, auxiliary urging cylinder **90** is fixedly attached at its forward end by connector **91** to the base of prop **71** while the same is displaceably attached at its other end by connector **92** to the base of prop **72**. It will be appreciated that connectors **91** and **92** may allow sufficient play between urging cylinder **90** and frame **71, 72, 73** to compensate for the unevenness of the mine floor. A certain displacement is possible with respect to cylinder **90** and frame **71, 72, 73** in longitudinal direction so as to relieve undue stress and prevent possible damage to the parts.

The over-all operation of the embodiment of FIGURE 7 is analogous to that of the embodiment of FIGURE 6. The essential feature is to maintain a positive forward urging of the conveyor by means of the auxiliary urging piston cylinder arrangement. In this manner, the extracted mineral will not fall between the mine face and the conveyor so as to defeat the purpose of efficiently conveying the extracted coal which is sought to be conducted directly onto the conveyor. This efficiency is possible if the conveyor is maintained as closely as possible to the mine face so as to prevent the falling of extracted mineral therebetween.

With respect to FIGS. 8 and 9, various combined features are shown which illustrated the versatile constructions possible in accordance with the invention. In FIG. 8, prop frames **101, 102, 103, 104** and **105, 106 107, 108** are shown connected to cylinder **109** and piston rod **110**, respectively, in an analogous manner to that shown in the embodiment of FIG. 5. Thus, loop shaped bends **111** are provided in the connection between each prop and the corresponding piston cylinder part for the same purpose as shown in FIG. 5. Additionally, struts **112** and shoes **113** are included in order to maintain the props more rigidly aligned in vertical position. Concerning FIG. 9, a similar arrangement is provided but in this instance an urging arrangement, including a spring **114** disposed upon a rod **115** inserted within piston rod **110**, is provided in a manner analogous to the urging arrangement shown in FIG. 5.

It will be appreciated in accordance with the invention that the spring and rod urging means, in accordance with the embodiments of FIGS. 5 and 9, will be maintained under continuous compression by the corresponding advancement of the prop frames so that the conveyor **50** will in turn be continuously urged against the coal face

50*a* to be extracted by the force determined by the tension of the spring. Due to the urging engagement of the conveyor **50** with the coal face, the coal which is extracted by the planer device will automatically drop onto the conveyor and be passed from the site of extraction operations. As the planer device passes along the conveyor, it will be appreciated that a certain counter-force will be exerted on the conveyor and in turn on the spring. After the planer device has passed, the spring will expand once more to urge the conveyor again against the coal face. Preferably, the rod carrying the spring is pivotally connected to the conveyor for pivoting about a vertical axis of pivot. This allows a certain degree of play, as does the resilient connection between the individual props and the piston cylinder arrangement. Such play is necessary in mining operations because of the irregularities in the mine floor. The constructional connections of the parts are such that the individual props, the piston cylinder arrangement and the conveyor may adapt themselves to the irregularities which are ever present in the mine floor. While slight deviations may thus take place with respect to the various parts, the over-all arrangement is such that the necessary rigidity is present to maintain the desired over-all relation between the props, the piston cylinder arrangement and the conveyor.

This same action is carried out by the auxiliary piston cylinder arrangements of FIGS. 6 and 7 since the urging means, including the auxiliary piston rod, will abut the conveyor even though the same is not directly connected thereto. In consequence of the continuous hydraulic automatic pressure exerted upon the auxiliary piston, the conveyor will always be urged toward the coal face. Upon passage of the planer device and the counteracting forces which come into play, a portion of the hydraulic fluid will automatically return to the reservoir in the manner explained above. Of course, once the planer device has passed, the hydraulic fluid will again automatically urge the auxiliary piston against the conveyor because of the continuous urging force applied to the auxiliary piston.

In accordance with the foregoing, therefore, the invention provides urging means coactingly coupled with the props and piston cylinder arrangement so as to obviate the necessity for separate devices to urge the conveyor toward the mine face. Necessarily, in the markedly restricted area in a mine, the fewer encumbrances present the better. By avoiding additional apparatus and by effectively combining means for carrying out operations in a mine, the advantages of this invention are apparent.

By the provision for lateral supporting means, such as struts and shoes, the props of each frame may be more independently maintained with respect to the remaining props in the arrangement, and an over-all comparative rigidity will be present despite the vertical displacement offered by such lateral means.

As a result of the employment of resilient straps or straps having loop shaped bends, irregularities of the mine floor will offer no problem with respect to maintaining the entire arrangement in the desired relationship of the parts, especially in view of the horizontal displacement which may take place due to this construction.

These combined advantageous constructional features are effectively illustrated in FIGS. 8 and 9.

What is claimed is:

1. In a prop and conveyor arrangement for mines, in combination, elongated conveyor means adapted to extend along a mine face; front prop means located adjacent said conveyor means; rear prop means located adjacent said front prop means; and advancing means common to said conveyor means and said front and rear prop means and operatively connected to said conveyor means and said front and rear prop means for advancing said conveyor means, said front prop means, and said rear prop means toward the mine face, said advancing means including three elongated coaxial elements cooperating telescopically with each other and connected with said conveyor means, said front prop means, and said rear prop means so that when one of said elements move axially, the means connected therewith will also move.

2. In a prop and conveyor arrangement for mines, in combination, elongated conveyor means adapted to extend along a mine face; front prop means located adjacent said conveyor means; rear prop means located adjacent said front prop means at the side thereof opposite from said conveyor means so that said front prop means is located betwen said conveyor means and said rear prop means; and hydraulic advancing means common to said conveyor means and said front and rear prop means and operatively connected to said conveyor means and said front and rear prop means for advancing said conveyor means, said front prop means, and said rear prop means toward the mine face, said hydraulic means including three elongated coaxial elements cooperating telescopically with each other and respectively connected with said conveyor means, said front prop means, and said rear prop means so that when one of said elements moves axially the means connected therewith will also move.

3. In a prop and conveyor arrangment for mines, in combination, elongated conveyor means adapted to extend along a mine face; front prop means located adjacent said conveyor means; rear prop means located adjacent said front prop means at the side thereof opposite from said conveyor means so that said front prop means is located between said conveyor means and said rear prop means; and hydraulic advancing means common to said conveyor means and said front and rear prop means and operatively connected to said conveyor means and said front and rear prop means for advancing said conveyor means, said front prop means, and said rear prop means toward the mine face, said hydraulic means including a plurality of telescopically connected elements which shift telescopically with respect to each other for advancing said conveyor means, said front prop means, and said rear prop means, said elements being respectively connected with said conveyor means, said front prop means, and said rear prop means so that when one of said elements moves axially the means connected thereto will move therewith, and the element of smallest diameter being operatively connected with said conveyor means.

4. In a prop and conveyor arrangement for mines, in combination, elongated conveyor means adapted to extend along a mine face; front prop means located adjacent said conveyor means; rear prop means located adjacent said fron prop means at the side thereof opposite from said conveyor means so that said front prop means is located between said conveyor means and said rear prop means; and hydraulic advancing means common to said conveyor means and said front and rear prop means and operatively connected to said conveyor means and said front and rear prop means for advancing said conveyor means, said front prop means, and said rear prop means toward the mine face, said hydraulic means including a plurality of elements telescopically connected and shifting with respect to each other for advancing said conveyor means, said front prop means, and said rear prop means, said elements being respectively connected with said conveyor means, said front prop means, and said rear prop means so that when one of said elements moves axially the means connected therewith will also move, said hydraulic means including a front resilient means for transmitting the movement of the element connected to said front prop means to the latter and a rear resilient means for transmitting the movement of the element connected to said rear prop means to the latter, said front and rear resilient means respectively returning said front and rear prop means to predetermined angular positions, respectively, with respect to said elements after said front and rear prop means have respectively turned from said predetermined positions.

5. In a prop and conveyor arrangement for mines, in combination, elongated conveyor means adapted to extend along a mine face; front prop means located adjacent said

conveyor means; rear prop means located adjacent said front prop means at the side thereof opposite from said conveyor means so that said front prop means is located between said conveyor means and said rear prop means; and hydraulic advancing means common to said conveyor means and said front and rear prop means and operatively connected to said conveyor means and said front and rear prop means for advancing said conveyor means, said front prop means, and said rear prop means toward the mine face, said hydraulic means including a plurality of elements telescopically connected and shifting with respect to each other for advancing said conveyor means, said front prop means, and said rear prop means, said hydraulic means including a front resilient means for transmitting the movement of said elements to said front prop means and a rear resilient means for transmitting the movement of said elements to said rear prop means, said front and rear resilient means respectively returning said front and rear prop means to predetermined angular positions, respectively, with respect to said elements after said front and rear prop means have respectively turned from said predetermined positions, said front and rear resilient means respectively including a pair of substantially rigid sleeves respectively surrounding a pair of said elements and respectively fixed to said front and rear prop means.

6. In a prop and conveyor arrangement for mines, in combination, a plurality of coaxial telescopically connected elements including inner and outer end elements and at least one intermediate element; elongated conveyor means extending substantially perpendicularly with respect to the common axis of said elements and operatively connected with one of said end elements; front proper means operatively connected with said intermediate element; rear prop means operatively connected with the other of said end elements; and hydraulic conduit means extending at least in part along the interior of some of said elements for introducing hydraulic liquid into or removing hydraulic liquid from the interior of said elements; and urging means and valve means cooperating with said hydraulic conduit means for controlling the flow of hydraulic liquid to advance a preselected one of said elements with respect to the other two elements so that said conveyor means may be advanced with respect to said front and rear prop means when said one end element is advanced, so that said front prop means may be advanced with respect to said conveyor and rear prop means when said intermediate element is advanced, and so that said rear prop means may be advanced with respect to said conveyor means and front prop means when said other end element is advanced.

7. In a prop and conveyor arrangement for mines, in combination, elongated conveyor means adapted to extend along a mine face; front prop means located adjacent said conveyor means; rear prop means located adjacent said front prop means at the side thereof opposite from said conveyor means so that said front prop means is located between said conveyor means and said rear prop means; and a single hydraulic advancing means common to said conveyor means and said front and rear prop means and operatively connected to said conveyor means and said front and rear prop means for advancing said conveyor means, said front prop means, and said rear prop means toward the mine face, said hydraulic means including three elongated coaxial elements cooperating telescopically with each other and respectively connected with said conveyor means, said front prop means, and said rear prop means so that when one of said elements moves axially the means connected therewith will also move.

8. In a prop and conveyor arrangement for mines, in combination, elongated conveyor means adapted to extend along a mine face; front prop means located adjacent said conveyor means; rear prop means located adjacent said front prop means; and a single hydraulic advancing means common to said conveyor means and said front and rear prop means and operatively connected to said conveyor means and said front and rear prop means for advancing said conveyor means, said front prop means, and said rear prop means toward the mine face, said hydraulic means including three elongated coaxial elements cooperating telescopically with each other and connected with said conveyor means, said front prop means, and said rear prop means so that when one of said elements moves axially the means connected therewith will also move.

9. In a prop and conveyor arrangement for mines, in combination, elongated conveyor means adapted to extend along a mine face; one prop means located adjacent said conveyor means; another prop means located adjacent said one prop means; and advancing means common to said conveyor means and said one and another prop means and operatively connected to said conveyor means and said one and another prop means for advancing said conveyor means, said one prop means, and said another prop means toward the mine face, said advancing means including three elongated coaxial elements cooperating telescopically with each other and connected with said conveyor means, said one prop means, and said another prop means so that when one of said elements moves axially the means connected therewith will also move.

10. In a prop and conveyor arrangement for mines, in combination, elongated conveyor means adapted to extend along a mine face; one prop means located adjacent said conveyor means; another prop means located adjacent said one prop means; and a single hydraulic advancing means common to said conveyor means and said one and another prop means and operatively connected to said conveyor means and said one and another prop means for advancing said conveyor means, said one prop means, and said another prop means toward the mine face, said hydraulic means including three elongated coaxial elements cooperating telescopically with each other and respectively connected with said conveyor means, said one prop means, and said another prop means so that when one of said elements moves axially the means connected therewith will also move.

11. A mining support comprising a horizontal piston cylinder arrangement having a double headed cylinder with a piston movable back and forth therein, a double ended piston rod connected to said piston and extending through both said cylinder heads, a first pair of spaced apart vertical mining props positioned on one side of said piston cylinder arrangement connected to said piston rod by resilient connecting means including spring means between each prop and the piston rod for maintaining said first pair of props parallel with respect to the axial direction of said piston cylinder arrangement, and a second pair of mining props positioned on the other side of said piston cylinder arrangement connected to said cylinder by resilient connecting means including spring means between each prop and the cylinder for maintaining said second pair of props parallel with respect to the axial direction of said piston cylinder arrangement, the props of each pair being spaced apart from one another in the axial direction of said piston cylinder arrangement and being spaced apart from the adjacent props of the other pair in a direction transverse to said piston cylinder arrangement, said piston cylinder arrangement being situated with respect to said props at a level at which said arrangement is in supporting contact with the ground.

12. Mining support according to claim 11 in which said spring means are leaf springs and in which said piston rod is hollow and slidably receives therewithin a connecting rod for attachment to a long wall mining conveyor section, one end of said connecting rod extending outwardly from said piston rod and having disposed thereon a compression spring and means for pivotally connecting said connecting rod to a section of a long wall mining conveyor for pivoting about a vertical axis of pivot.

13. Mining support according to claim 12 wherein the piston and cylinder are provided with corresponding circular cross-sections.

14. A mining support comprising drive means having a first part and a second part movable back and forth with respect to each other in a horizontal direction, a first pair of spaced apart vertical mining props positioned on one side of said drive means and connected to said first part by resilient connecting means for maintaining said first pair of props parallel with respect to the direction of movement of said parts, and a second pair of spaced apart vertical mining props positioned on the other side of said drive means and connected to said second part by resilient connecting means for maintaining said second pair of props parallel with respect to the direction of movement of said parts, the props of each pair being spaced apart from one another in the direction of movement of said parts and being spaced apart from the adjacent props of the other pair in the direction transverse to the movement of said parts, said drive means being situated with respect to said props at a level at which said drive means is in supporting contact with the ground whereby said drive means via such resilient connecting means maintains the props of each pair normally vertical to provide a self-supporting prop arrangement yet capable of resiliently accommodating unevenness in the mine floor.

15. Mining support according to claim 14 in which said props are arranged to form the corners of a parallelogram with said drive means positioned in the central portion thereof, said drive means being a piston cylinder arrangement with said first pair of mining props connected to the piston rod thereof, and the second pair of mining props connected to the cylinder thereof.

16. Mining support according to claim 15 in which said connecting means includes a resilient connecting member extending in a direction parallel with respect to the direction of movement of said parts connecting each pair of props as a frame unit and first connecting straps connecting said first pair of props forming a first frame unit to said piston rod and second connecting straps connecting said second pair of props forming a second frame unit to said cylinder.

17. Mining support according to claim 16 wherein the piston and cylinder are provided with corresponding circular cross-sections, two transverse first connecting straps being provided one near each prop of the first frame unit for connecting said first frame unit to said piston and two transverse second connecting straps being provided one near each prop of the second frame unit for connecting said second frame unit to said cylinder.

18. Mining support according to claim 17 in which a ceiling support bar is provided connecting the upper portions of the props in each pair in limited sliding engagement therewith in a direction substantially parallel to said connecting rail.

19. Mining support according to claim 16 in which said connecting member is a resilient connecting rail connecting the lower portions of said props as a frame unit and a resilient support means is provided connected to the base of said frame unit extending in a direction lateral to said connecting rail to vertically support the frame unit.

20. Mining support according to claim 19 in which said support means is a support strut extending laterally outwardly in a direction remote from the opposite pair of props having a slide runner connected to the free end thereof.

21. Mining support according to claim 14 in which a horizontal transversely linearly extendable elongated support means is provided transversely linkably connecting the upper portion of one of the props of said first pair and the upper portion of the adjacent prop of said second pair.



22. Mining support according to claim 21 in which said support means includes a rod connected at one end by universal joint means to one of said props and a tube connected at one end by universal joint means to the other of said props, the other end of said rod being telescopingly received within the other end of said tube and normally urged by resilient means into closed telescoping engagement with said tube.

23. Mining support according to claim 14 in which said mining props are hydraulic mining props.

24. Mining support according to claim 14 in which said resilient connecting means are resilient straps.

25. Mining support according to claim 14 in which said resilient connecting means are leaf springs.

26. Mining support according to claim 25 in which each said leaf spring is disposed in a vertical plane and has a loop shaped bend between each prop and the part connected thereto.

27. A mining support comprising drive means having a first part and a second part movable back and forth with respect to each other in a horizontal direction, a first pair of spaced apart vertical mining props positioned on one side of said drive means and connected to said first part by resilient connecting means for maintaining said first pair of props parallel with respect to the direction of movement of said parts, and a second pair of spaced apart mining props positioned on the other side of said drive means and connected to said second part by resilient connecting means for maintaining said second pair of props parallel with respect to the direction of movement of said parts, the props of each pair being spaced apart from one another in the direction of movement of said parts and being spaced apart from the adjacent props of the other pair in the direction transverse to the movement of said parts, said drive means being situated with respect to said props at a level at which said drive means is in supporting contact with the ground whereby said drive means via such resilient connecting means maintains the props of each pair normally vertical to provide a self-supporting prop arrangement yet capable of resiliently accommodating unevenness in the mine floor, urging means being provided connected to said mining support for urging away from said mining support a long wall mining conveyor in the direction of movement of said parts.

28. Mining support according to claim 27 in which said urging means includes compression spring means for resiliently urging said conveyor.

29. Mining support according to claim 27 including a connecting rod, for attachment to a long wall mining conveyor section, connected to one of said parts for limited axial movement relative to said part in the direction of movement of said parts.

30. Mining support according to claim 29 including a compression spring resiliently biasing said connecting rod to at least a partially extended position with respect to the part connected thereto and including means for pivotally connecting said connecting rod to a section of a long wall mining conveyor for pivoting about a vertical axis of pivot.

31. Mining support according to claim 27 in which said urging means includes an urging piston cylinder arrangement, the urging piston rod of which is positioned for urging a long wall mining conveyor in the direction of movement of the urging piston rod.

32. Mining support according to claim 31 in which said drive means includes a piston cylinder arrangement with said first pair of mining props connected to the piston rod thereof, and the second pair of mining props connected to the cylinder thereof, and in which said piston rod is hollow along at least a portion thereof and defines therewithin an urging cylinder, and one end of an urging piston rod is provided slidably movable within said urging cylinder, the other end of said urging piston rod extending outwardly thereof for urging a long wall

mining conveyor in the direction of movement of the urging piston rod.

33. Mining support according to claim 32 wherein the drive means piston rod, including the hollow piston rod urging cylinder therewithin, and the drive means cylinder are provided with corresponding annular cross-sections, and the urging piston rod is provided with a corresponding circular cross-section.

34. Mining support according to claim 31 in which said urging piston rod is normally outwardly urged under constant positive force.

35. Mining support according to claim 34 wherein said force is fluid force acting on said urging piston rod in said urging cylinder at constant predetermined pressure.

36. Mining support according to claim 31 in which said urging piston cylinder arrangement includes an urging cylinder positioned in parallel relation to one of said pairs of props and resiliently connected to at least one of the props of such pair, and an urging piston rod slidably movable within said urging cylinder, one end of said urging piston rod extending outwardly of said urging cylinder for urging said long wall mining conveyor.




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