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ADVANCEABLE MINING PROP ARRANGEMENT CONTAINING STABILIZER MEANS

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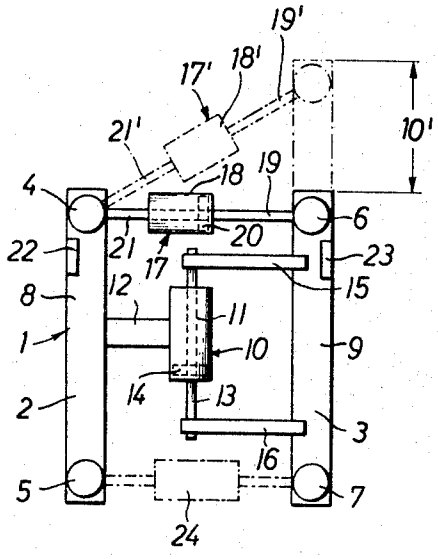

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ADVANCEABLE MINING PROP ARRANGEMENT CONTAINING STABILIZER MEANS

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13 Claims. (Cl. 61—45)

ABSTRACT OF THE DISCLOSURE

Advanceable mining prop arrangement for supporting a mine roof including two prop units in substantially parallel disposition, interconnected by guiding and energizable advancing means (e.g. an advancing piston-cylinder means or advancing cylinder) for shifting the units longitudinally with respect to one another from a side-by-side position of the two units to an advanced position of one unit with respect to the other, with energizable stabilizer means (e.g. a piston-cylinder device or stabilizer cylinder) supporting the two units in substantially aligned upright parallel disposition both in the side-by-side position and advanced position of the two units, such stabilizer means being swingably connected at the respective ends thereof to a part of the respective units to permit swinging of the stabilizer means when the units are successively shifted, the stabilizer means being connected with the units such that in the first or side-by-side position of the units the cylinder of the stabilizer means is normal to the longitudinal direction of advance of the units whereas in the second or advanced position of one unit with respect to the other such stabilizer cylinder is situated at an acute angle to the direction of advance, the stroke of the stabilizer means, e.g. piston-cylinder means, being such that in the first or side-by-side position such stabilizer means has a minimum effective length determined by the maximum incursion of the piston rod thereof within the cylinder while in the second or advanced position of one unit with respect to another such stabilizer means has a maximum effective length determined by the maximum excursion of said piston rod with respect to such cylinder, and control means for controlling the supply of pressure medium to the piston-cylinder device of the stabilizer means.

The present invention which is a continuation of application Ser. No. 529,018 filed Feb. 21, 1966, now abandoned, relates to an advanceable mining prop arrangement suitably stabilized substantially throughout the advancement cycle, and more particularly to a pair of upright props, each disposed in a substantially vertical plane and operatively interconnected by energizable reciprocal advancing means, with the vertical planes of said props being maintained in parallel relation, and energizable adjustable length stabilizer means interconnecting the upper end portions of said props, with the stabilizer means and advancing means being operatively connected for simultaneous concordant energizing thereof to achieve relative length linear displacement of one said prop with respect to the other with controlled proportionate displacement of said stabilizer means and in turn said advancing means.

Mining prop arrangements are known which are usually used in connection with a conventional mining conveyor whereby to guide a mining machine, such as a mining planer, along the mine face for the extraction of

mineral therefrom, with the conveyor and in turn the mining machine associated therewith being advanced in increments or in a more or less continuous manner under the urging force of an advancing cylinder, i.e., double-acting piston-cylinder means, or by means of the mining prop arrangement associated with the conveyor for supporting the mine roof at the site of mining operations. Various constructions of the foregoing type are known in the art, as may be appreciated from U.S. Patents 2,691,514; 2,702,697; 2,745,651; 3,169,377; 3,174,289; 3,186,179, and 3,192,722. In particular, a mining prop arrangement is shown in the aforesaid U.S. Patent 3,192,-722, which includes a pair of prop frames, each including a pair of extensible and retractable mining props interconnected at their heads and feet by a roof cap and base respectively, with such frames being operatively interconnected by a piston-cylinder means, such that upon energizing the piston-cylinder means in a first step, the prop frame connected to one of the moving parts is advanced whereupon energizing in the second step results in the advance of the other frame connected to the other part. Of course, when a particular prop frame is to be advanced, the same is retracted from engagement with the mine roof.

Where unevenness is encountered in the mine floor, the advancing of one prop frame, such as in an arrangement of the type disclosed in the aforesaid U.S. Patent 3,192,-722, causes one prop frame to diverge from the normal parallel relationship with the other prop frame. In effect, one prop frame may tilt outwardly or inwardly toward the other prop frame and thus decrease the sufficient support of the mine roof in the area in question. Specifically, in sloped and in steep bedding or mine floor areas, the heavy roof caps on the mining frames utilized tend to drift constantly in the direction of the dip, i.e. slope, or the like, due to their weight and the weight of the props carrying the roof caps.

Heretofore, hydraulic correcting cylinders had been utilized in order to increase the stability of the entire prop system, including the pair of mining prop frames, coupled for alternate advancement with an interposed advancing means, such as a double-acting piston-cylinder means, the hydraulic correcting cylinders serving in particular to prevent any drift or divergence of one frame with respect to the other and also resisting the racking over or straining of the props, sill or base skid, and cap, of the particular mining prop frame.

Such correcting cylinders have provided some degree of improvement in the stability of mining prop frames, with respect to one another, but have not actually proven to be an ideal solution in terms of the specific constructions proposed. Accordingly, previous constructional proposals, such as swing links provided between adjacent props, for example, in the form of spring links or telescoping links, or the like, have been revived and recourse had to them in practice. Nevertheless, such links have not proven to be satisfactory for the desired purpose either because the length compensation that is required between adjacent props of separate, side-by-side, prop frames being stabilized in advancing one with respect to the other, is achieved by exerting forces on the prop frames which derogate from any corrective tendency to maintain the props in parallel relation. Instead, the length compensation achieved by positive force, such as a tension spring, compression spring, mechanical force to swing and/or telescope the link parts together, in the ultimate prevents a perfect guidance system from being attained. The positive forces utilized, in order to be effective, exert an extraneous force onto the prop frames, which force, under the advancing conditions, and in terms of any unevenness in the mine floor, causes the prop frames to drift or

tilt, or the like, with respect to one another rather than to maintain proper alignment.

Further proposals in this regard involve the provision for so-called link compensating devices between the links attached to the adjacent two props of the prop frames in question. Actually, the link compensating devices were disposed between such links, in the form of cams, or the like, and the props to which the links were connected. Such cam constructions produced a lengthening or shortening of the links, in dependence upon the angle of swing of the links with respect to the longitudinal direction of advance of the parallel prop frames situated thereat.

All of the foregoing devices have proven very expensive in practice, and it has developed that trouble still occurs under actual mining conditions, insofar as both frames of a set gradually drift in the direction of the dip, i.e., in the case of sloping mine floors, whereupon the miner must particularly retract both frames from supporting engagement with the mine roof and straighten them out with a block and tackle, in the usual case, before extending the frames into the required supporting contact. Naturally, danger to the mine workmen is always present where such adjustments of the prop frames are necessary.

It is an object of the present invention to overcome the foregoing drawbacks and to provide an advanceable mining prop arrangement suitably stabilized substantially throughout the advancement cycle.

It is another object of the present invention to provide a pair of upright props, each disposed in a substantially vertical plane and operatively interconnected by energizable reciprocal advancing means, with the vertical planes of said props being maintained in substantially parallel relation, and energizable adjustable length stabilizer means interconnecting the upper end portions of said props, with the stabilizer means and advancing means being operatively connected for simultaneous concordant energizing thereof to achieve relative length linear displacement of one said prop with respect to the other, as well as controlled proportionate displacement of said stabilizer means and in turn said advancing means.

It is another object of the present invention to provide such a prop arrangement including a pair of mining prop frames interconnected by reciprocal advancing means along the lower portion of such frames and interconnected by way of two adjacent props at a particular longitudinal end of the arrangement near the upper ends of such props by a stabilizer means having a minimum and maximum effective length dependent upon the maximum stroke of the reciprocal advancing means utilized, whereby the advancement of one frame with respect to the other will define by way of the prop frames a vertical planar parallelogram while the assumed angular position of the stabilizer means will define by the vertical plane in which it is disposed and a plane normal to the parallel vertical planes in which the prop frames are disposed, a planar triangle, independently of any uneven condition in the mine face, so that the prop frames will not tilt from their normal parallel disposition with respect to one another.

It is a further object of the present invention to provide an improvement in an advanceable mining prop frame arrangement in which the correcting cylinder of compensating length connected to adjacent props on the two frames is provided with a predetermined minimum effective length corresponding to the width between the adjacent parallel frames and a maximum effective length corresponding to the hypotenuse of the aforementioned planar triangle, the angle defined between such hypotenuse and the normal plane intersecting the parallel planes when the two prop frames are even with one another in side-by-side relation, being determined by the maximum stroke of the advancing means.

It is another object of the present invention to provide stabilizer means in the form of correcting cylinders for an arrangement of the foregoing type which make possible

the perfect guidance of the hydraulically operated advanceable mining prop systems, such as side-by-side mining prop frames, substantially independently of unevenness in the mine floor and especially where substantially steep to pronouncedly steep bedding is encountered.

It is still a further object of the present invention to provide a stabilizer means which is inexpensive in construction, efficient, durable and extremely practical in use, and which minimizes any danger to the miner from cave-in of the mine roof being supported during and after the advancement of the arrangement in question.

Other and further objects of the present invention will become apparent from a study of the within specification and accompanying drawing in which the figure shown illustrates a plan view of a mining prop arrangement in accordance with the present invention which is provided with stabilizer means in the form of a correcting cylinder transversely connecting adjacent props of the two prop frames for maximum excursion in direct dependence upon the maximum stroke of the advancing piston-cylinder means separately interconnecting the prop frames.

It has now been found, in accordance with the present invention, that an advanceable mining prop arrangement may be provided which is suitably stabilized throughout the advancement cycle by means of stabilizer means of changeable length interconnecting a pair of upright props, each disposed in a substantially vertical plane and operatively interconnected by energizable reciprocal advancing means, with the vertical planes of said props being maintained in parallel relation. The stabilizer means advantageously takes the form of energizable adjustable length stabilizer means, with such stabilizer means and advancing means being operatively connected for simultaneous concordant energizing thereof to achieve relative length linear displacement of one said prop with respect to the other with controlled proportionate displacement of said stabilizer means and in turn said advancing means.

In particular, the construction of the present invention relates to hydraulically operated parallel advanceable mining prop frame systems having a hydraulic advancing device or motive means disposed between the two prop frames, as well as correcting cylinders of minimum and maximum effective length disposed at a level spaced from the lower portions of the prop frames for regulating the spacing of the roof caps of the frames from one another, thereby to prevent tilting or divergence as between the frames, regardless of mine floor unevenness. In the starting position, i.e., where the two frames are precisely side-by-side, whereby to form a rectangle with respect to a horizontal plane intersecting the same, the stabilizer means, e.g., a correcting cylinder, is disposed approximately perpendicularly to the longitudinal direction of advance of the frames. The stabilizer means connects the ends of the frames by way of adjacent props at the particular corresponding frame ends in question. The correcting cylinders may be hydraulically energized advantageously from either end, if desired.

Accordingly, whereas in the past, compensating length correcting cylinders were utilized, having no concordance with the advancing means, such as a double-acting piston-cylinder arrangement, in accordance with the present invention tilting of the prop frames is prevented by disposing stabilizer means, e.g., a correcting cylinder, so that in the starting position it is precisely perpendicular to the longitudinal direction of advance, and so that its maximum excursion, i.e., maximum effective length, is precisely equal to the hypotenuse of a right triangle having one leg defined by the starting position minimum length and the other leg measured by the length of the stroke of the advancing cylinder of the frame arrangement simultaneously energized therewith. The system of the invention is based on the fact that the stabilizer means, e.g., in the form of correcting cylinders, in the rest position, i.e., before the start of an advance, must always be perpendicular to the longitudinal direction of advance.

Only in this way is it possible for the correcting cylinders in question to undergo exclusively an elongation during the advancing step, rather than, as in the case of any other angular disposition corresponding to less than the full advancing stroke of the advancing means, an alternate shortening and lengthening.

Referring to the drawing, a hydraulically operated advanceable mining prop arrangement is shown in which one prop frame may be advanced in step-like progression with respect to the other, and thereafter alternately such other prop frame then brought forward to assume the side-by-side relationship of the frames. Prop frame arrangements of the type in question are generally known, as is clear from a review of the aforementioned U.S. Patent 3,192,722.

Specifically, advanceable mining prop arrangement **1** includes the upright substantially vertical and substantially parallel mining prop frames **2** and **3**. Frame **2** is composed of a pair of upright mining props **4** and **5** interconnected at their lower end portions by a common elongated base skid **8**, or the like, and frame **3** is composed of a pair of upright props **6** and **7** interconnected at their lower end portions by a common elongated base skid **9**. These prop frames each include in the usual case a roof cap (not shown) of conventional design affixed to the upper ends of the respective props in a frame in the same manner as the skid interconnects the lower ends of the props of such frames. The props are generally provided in the form of extensible and retractable props, for example, hydraulically operated jacks, i.e., pit props, whereby to extend the given frame into supporting engagement with the mine roof, upon energizing the props to extend the same, and to retract the frames from supporting engagement upon retracting the props accordingly. Each prop frame is thus more or less in the form of an upright rectangular configuration, and the two frames are interconnected by the reciprocal advancing means **10**, in this case shown as a double-acting piston-cylinder arrangement including the cylinder **11** connected by the arm **12** with the skid **8** and the piston rod **13** carrying the double-acting piston **14** thereon, intermediate its ends, such that piston **14** is received slidably and operatively within cylinder **11**, with the ends of piston rod **13** extending through the appropriate heads of cylinder **11**. The ends of piston rod **13** are connected by arms **15** and **16** with the skid **9**. Thus, upon retracting props **4** and **5** and then energizing the piston-cylinder means **10** while maintaining props **6** and **7** in extended position, frame **2** may be advanced in the longitudinal direction a given distance depending upon the stroke of the piston **14** within cylinder **11**, whereupon props **4** and **5** may be extended to place the roof cap thereof (not shown) into engagement with the mine roof. Then, props **6** and **7** may be retracted and the reverse procedure undertaken to bring prop frame **3** forward to approach the even position with frame **2**, once again, and then props **6** and **7** extended once again to place the roof cap thereof (not shown) into engagement with the mine roof. This procedure for advancing in a step-like manner the pair of mining prop frames **2** and **3** is known from the aforesaid U.S. Patent 3,192,722. However, where unevenness is encountered in the mine floor, for instance where a semi-steep to steep bedding is concerned, since the two frames are usually interconnected with the advancing piston-cylinder means at their lower end portions via connecting arms between the piston-cylinder means and the skids, and since in the usual instance these skids and connecting arms are provided of resilient metal straps, or the like, to accommodate unevenness in the mine floor and adverse conditions, the frames may often diverge from their normal parallel disposition and tilt outwardly or inwardly toward one another. In this connection, it will be appreciated that often gangue and in particular mineral or rock particles may be dispersed along the mineway such that in the direction of advance the frames must slide over such particles, and this may be achieved with a minimum of trouble where the connecting arms, skids, or the like, are formed of resilient metal.

In order to stabilize the prop frames with respect to one another in their substantially parallel relationship, regardless of unevenness in the mine floor caused by particles or lumps of gangue, such as mineral, coal or rocks, or the like, or inherent in terms of a semi-steep or steep bedding, the mining prop arrangement of the type described, for instance, is provided with a stabilizer means in accordance with the invention shown in the form of a changeable length piston-cylinder arrangement **17** disposed between the adjacent props **4** and **6** at one corresponding end of prop frames **2** and **3** in the longitudinal direction of advance. The stabilizer means **17** includes the double-acting cylinder **18** attached via link arm **19** to the upper end portion of prop **6** as well as the piston rod **21** carrying piston **20** which is attached to the upper end portion of prop **4**. Piston rod **21** carries the piston **20** which is slidably and operatively received within cylinder **18** such that the over-all effective length of the stabilizer means including cylinder **18**, link arm **19** and piston rod **21** may vary in dependence upon the stroke inherently possible with cylinder **18**, between a predetermined minimum effective length and a predetermined maximum length. The minimum effective length is that length between props **4** and **6**, considering stabilizer means **17** as being disposed in a transverse base plane substantially vertically disposed and intersecting at right angles the substantially vertical and substantially parallel planes in which the frames **2** and **3** are disposed. The maximum effective length of the stabilizer means **17** is appreciated from the dot-dash configuration shown in phantom in the drawing. Here, piston **20'** is shown at maximum excursion of piston rod **21'** with respect to cylinder **18'** whereby the over-all effective length of link arm **19'**, cylinder **18'**, and piston rod **21'** exists, which maximum over-all effective length is defined by the linear portion of a transverse hypotenuse substantially vertical plane in which stabilizer means **17'** is disposed, such hypotenuse vertical plane intersecting the substantially parallel planes in which the frames **2** and **3** are disposed. The maximum effective length of the stabilizer means **17'** is achieved upon energizing the advancing piston-cylinder means **10**, for example, to displace in the forward longitudinal direction of advance the frame **3** so that the same reaches the position shown in phantom. The linear distance **10'** of advance is specifically dependent upon and measured by the maximum stroke of the advancing means **10**, i.e., the maximum stroke of piston **14** within cylinder **11**.

In order that the prop frames **2** and **3** be kept in their desired parallel and vertical relationship, i.e., free from drift or tilt regardless of unevenness in the mine floor and/or semi-steep to steep bedding conditions, a certain amount of flexibility may exist in the connections between the advancing means **10** and the prop frames **2** and **3** as well as between the piston arm **21** and prop **4**, on the one hand, and link arm **19** and prop **6**, on the other hand. Advantageously, to accomplish such flexibility, the arms **12**, **15** and **16** may be provided of flexible metal and/or the points of connection of arms **12**, **15** and **16** to the respective prop frame may be by way of hinge means, pivot means, or the like, so long as the aforesaid parallel disposition is maintained, and/or cylinder **11** and/or piston **14** may be of circular cross-section to permit some rotation about the longitudinal axis of rod **13**, and/or the points of connection of arms **15** and **16** to the free ends of rod **13** may be hinge connections, or the like. All of such means will permit vertical displacement within the aforementioned parallel planes of frames **2** and **3**.

Insofar as the stabilizer means of the invention are concerned, in order to permit the angular disposition thereof (as shown in phantom in the figure), the points of attachment of piston rod **21** to the upper end of prop **4**

and link arm **19** to the upper end of prop **6** may be similarly pivotal or hinged in nature, appropriate means being used, as the artisan will appreciate, to achieve a swinging relation about the vertical axis of props **4** and **6**, respectively, of the stabilizer means **17** and, in particular, the corresponding piston rod **21** and link arm **19**. Additionally, some swinging and/or pivoting may exist about the horizontal axis of each of the frames with respect to the connections of piston rod **21** and link arm **19**, respectively, in order to permit the vertical displacement of frames **2** and **3** within their planes to be achieved without hindrance from the separate connections of the stabilizer means **17'** with the corresponding props **4** and **6**. These horizontal swinging connections may be achieved in the same manner as the flexible connections of arms **12**, **15** and **16**, so long as the same do not detract from the minimum and maximum effective length features of the stabilizer means **17'**.

In order to achieve the advantages of the present invention and thus maintain the prop frames **2** and **3** in the desired substantially vertical and substantially parallel spaced apart relation, the minimum effective length of the stabilizer means **17** is determined by the distance apart of props **4** and **6** when frames **2** and **3** are precisely side-by-side in relation, such that stabilizer means **17** is disposed in a transverse substantially vertical plane normal to the parallel planes of frames **2** and **3**. Thence, upon advancing frame **3**, for example, the full extent of the stroke of the advancing piston-cylinder means **10** to achieve the advancement corresponding to the distance **10'**, by simultaneous corresponding energizing of stabilizer piston-cylinder means **17**, the maximum effective length of stabilizer means **17'** will be achieved and such stabilizer means will be in the position shown at **17'**, i.e., disposed in a transverse substantially vertical angular plane intersecting the parallel planes of frames **2** and **3** so as to form a hypotenuse of a right triangle with the normal plane in which stabilizer means **17** prior to advancement was disposed and the longitudinal extension of the vertical plane of frame **3**, in the particular instance, designated by the distance **10'** which in turn corresponds with the maximum stroke of the advancing piston-cylinder means **10**. The planar right triangle thus produced determines the dimensional features to be incorporated in the construction of the stabilizer means of the present invention when used with a given advanceable mining prop frame arrangement of the type shown or of any similar type in which one prop frame is advanced with respect to the other and in which the prop frames are meant to be maintained in stabilized upright, substantially parallel and substantially vertical spaced apart relation. Thus, the minimum effective length of the stabilizer means **17** is determined by the maximum incursion of piston rod **21** within cylinder **18**, and the maximum effective length of stabilizer means **17'** is determined by the maximum excursion of piston rod **21'** with respect to cylinder **18'**. This over-all stroke represents the difference in effective length between the minimum effective length of stabilizer means **17** when in the starting position precisely normal to the frames **2** and **3** and the maximum effective length of stabilizer means **17'** in the position shown in phantom, i.e., the hypotenuse dimension of the resultant right triangle with the base dimension distance between props **4** and **6** and the maximum stroke distance **10'** or triangle height corresponding to the maximum stroke of advancing means **10**.

Of course, the maximum stroke of the advancing means **10** must be considered in determining the precise difference in effective length achieved by the stabilizer means **17** as aforesaid, and the maximum effective stroke must be utilized in advancing one prop frame with respect to the other in order to achieve the stabilizing effect of the invention when the maximum stroke of the stabilizer piston-cylinder means **17** is achieved. The stroke of the advancing piston-cylinder means **10** and the stroke of the stabilizer means **17** must be precisely proportional to one another in terms of the right triangle relationship shown in order that after the forward advance over the distance **10'**, the maximum effective length of the stabilizer means **17'** will be such that the hypotenuse distance in question will be achieved and thereby the two frames maintained in parallel vertical relationship.

Even where unevenness or semi-steep or steep bedding might be encountered, so long as the planar triangular relationship is maintained, the prop frames will be stabilized in parallel vertical disposition. If the stroke of the advancing means **10** and the stroke of the stabilizer means **17** were not maintained in the desired proportional relationship, in terms of the planar triangle concept, and if precise control of the energizing of both such piston-cylinder means were not maintained to achieve simultaneous advance and maximum excursion of piston rod **21**, then deviation from the parallel relationship of the frames would occur. It is of utmost significance that in accordance with the present invention trial and error adjustments manually by the operator or by way of automatic compensation in an automatic hydraulic control system operating the prop arrangement, are no longer needed. Such trial and error changes can never achieve with the instant efficiency the maintenance of the prop frames in the desired parallel relationship where unevenness and sloping conditions in the mine floor are encountered. Specifically, if the amplitude of the stabilizer piston-cylinder means were less than that of the advancing means, the prop frames would tilt toward one another upon achieving maximum stroke upon advance, and on the other hand, if the amplitude of the stabilizer piston-cylinder means were greater than that of the advancing means, the prop frames would diverge upwardly from one another since in this instance a greater distance would exist than the theoretical hypotenuse distance noted above. To return to the parallel relationship of the prop frames in the case of a tilting toward or away from one another as described, would require trial and error adjustments in an attempt to achieve the precise parallel relationship desired. Not only would this be time-consuming and perhaps never achieved in practice, but also precise and expensive control equipment would be necessary to accomplish this result, and then considering the possibilities of leakage in a hydraulic system, the safety of the supporting arrangement might be impaired. Moreover, during the time when such trial and error adjustments would be carried out, the immediate mine roof area would be deprived of its necessary support, all to the detriment of the operation, and during this time pronounced danger of cave-ins would exist.

In contrast to the foregoing procedure, in accordance with the present invention, by precise proportioning of the minimum and maximum length of the stabilizer means to the maximum stroke of the advancing piston-cylinder means, no constant attention by the mine workmen is necessary and the operator may merely energize simultaneously the advancing piston-cylinder means and the stabilizer piston-cylinder means, whereupon the maximum stroke of each will be attained and, in turn, the precise planar triangular relationship will exist, so long as the prop frames prior to advance are maintained in precise side-by-side relationship with the stabilizer means extending in a transverse plane normal to the parallel planes of the adjacent prop frames.

Advantageously, the stabilizer piston-cylinder means and the advancing piston-cylinder means may be connected to a common hydraulic pressure source, and as used herein, the term "hydraulic" is meant to include not only hydraulic fluid in a strict sense but also generally pneumatic fluid as well. By common connection to a given hydraulic flow source, simultaneous actuation of both piston-cylinder means will be attained in accordance with the invention such that at the end of the stroke of the

advancing means, the stroke of the stabilizer means will be completed as well, whereby the minimum and maximum effective lengths of the stabilizer means will be attained depending upon whether the advancing means has been actuated to advance one frame with respect to the other (see the phantom portion of the figure) from a position where both frames are precisely side-by-side or one frame behind the other and thus brought up to the position where both are precisely side-by-side (e.g., as shown in the figure). It is of decisive importance that the proportional stroke relationship between the advancing piston-cylinder means and the stabilizer piston-cylinder means of the invention be maintained in terms of the triangular linear distance involved, especially in the case of remotely controlled and remotely energized hydraulic prop frame arrangements of the type in question, since here the sensitivity of the operator is not a factor and the stabilizing of the frames without tilt or divergence must be attained in the automatic advance of the arrangement and without special attention, as would be the case with manual operation and/or with an operator located adjacent the particular frame arrangement to be readjusted by trial and error method.

In connection with a particular feature of the invention, each frame is provided with its own control block in the prior art manner, as the artisan will appreciate, such control block containing valve control means for achieving the simultaneous actuation of both piston-cylinder means whereby the operator in the vicinity may perform each advancing step. Nevertheless, if desired, the entire automatic advancing cycle may be attained, including not only the energizing of the advancing cylinder and of the stabilizer cylinder in the desired reciprocating manner, but also the appropriate energizing of the props in each frame in the known manner to release from and engage in supporting disposition with the mine roof the particular prop frame in question. Automatic means for achieving sequence cycle controlled advance is covered in a copending application, U.S. Ser. No. 523,502, filed Jan. 19, 1966, (corresponding to German applications G 42622 and G 42952), having the same assignee as the present application, the content of which copending application is hereby incorporated herein by reference.

Of course, a control block containing valve control means separately for the advance piston-cylinder means may be provided independently of the control block containing valve control means for controlling the stabilizer piston-cylinder means of the invention, so long as such means may be operatively interconnected for simultaneous energizing and so long as the operator manually or otherwise may initiate the valve control in both instances to attain the simultaneous reciprocal energizing of the advancing piston-cylinder means and the stabilizer piston-cylinder means. While it is of advantage to couple the hydraulic flow to the cylinder of the advancing means and to the cylinder of the stabilizer means for simultaneous energizing thereof, whereby proportionate increments of advancement will be attained concomitantly such that both reciprocating strokes will attain their terminal positions at the same time, the use of a separate control block for the advancing means and for the stabilizer means is of advantage, at least if such valve control means are provided as an auxiliary means, since in this manner after the completion of the stroke in question of the advancing means, any slight adjustments of the stabilizer means may be carried out manually by the operator to attain precise vertical parallel alignment of the frames with a minimum of danger. The auxiliary control means for the stabilizer means may be, of course, disposed in the same control block as that containing the main valve control means for achieving the simultaneous flow of hydraulic fluid to the advancing piston-cylinder means and the stabilizer piston-cylinder means, the purpose of the auxiliary valve control means being, as aforesaid, to correct deviations from the normal desired parallel relationship of the frames.

It will be appreciated by the artisan that some slight deviation may occur, depending upon the unevenness in the mine floor and of the slope of the bedding, during the normal advancement of the frame arrangement, whereupon one or the other frame may be straightened, by changing the effective length of the stabilizer means after the completion of the advancing means. For such purposes, generally, one frame will be in engagement with the mine roof and mine floor and such frame will be used for bracing the other frame by means of the stabilizer means until such other frame is set, straightened up by the stabilizer means, and then extended into engagement with the mine roof and mine floor. If in such instance the first frame is considered at an undesired angle with respect to the mine floor and mine ceiling, then such first frame can be set in the same way, whereupon both frames will be disposed in the desired relation with respect to one another and with respect to the mine roof and mine floor. The artisan, of course, will appreciate that such minor adjustments by separate actuation of the stabilizer means as compared with the simultaneous actuation of the stabilizer means with the advancing means, is only necessary in exceptional cases.

As may be seen from the foregoing, the expense involved in providing stabilizer means in the form of correcting cylinders in accordance with the present invention is relatively slight since stepwise means, e.g., reciprocal operating small correcting piston-cylinder means, may be used having a stroke which is adaptable to the size of the advancing step indigenous to the particular advancing piston-cylinder means stroke utilized. Experience has shown that such correcting cylinders, including the necessary valve control system, are less expensive than corresponding compensating devices employed in the past with regard to rigid links, or the like, interconnecting adjacent props of a pair of frames for stabilizing purposes.

By means of the present invention, it is now possible without difficulty to maintain the frames, for example, of a hydraulically energized mining prop system, perpendicular to the mine floor even in steep bedding, and to straighten them up again if, in exceptional cases, they drift out of the perpendicular. Such versatility has not been possible with the use of prior art constructions.

It will be appreciated that in connection with mining prop frame arrangements, where used in steep bedding areas of a mineway, such arrangements are normally maintained perpendicular to the mine roof and mine floor, though the mine roof and mine floor may deviate from the true horizontal. The relationship of vertical and horizontal planes and transverse planes under the concept of the present invention must be considered oriented in terms of the particular mine roof and mine floor rather than in terms of the true horizontal, and, therefore, under practical mining conditions, the vertical disposition of the prop frames will be vertical as compared with the horizontal disposition of the mine roof and mine floor, although such vertical and horizontal relationships may deviate from the true vertical and horizontal.

It will be seen from the drawing that an appropriate further stabilizer means, shown in the form of a piston-cylinder means **24**, may be provided for more accurate stabilizing control of vertical disposition of the prop frames, both the stabilizer means **17** and the stabilizer means **24** being preferably positioned halfway up the frame, i.e., at about midheight, or at the upper end portions of the particular props of the frame to which the stabilizer means in question is connected. The connection of the stabilizer means to the props will be by way of a swinging connection or swivel connection to permit the parallelogram disposition of the arrangement to be achieved with respect to the horizontal. The stabilizer means, as aforesaid, in the starting position, i.e., prior to the advancing stroke of the advancing piston-cylinder means, will be disposed at right angles to the prop frames and the prop frames themselves will be disposed in precise side-by-side relation with

neither substantially extending past the appropriate end of the other.

Appropriate control blocks are shown schematically at **22** and **23** on prop frames **2** and **3**, respectively. These control blocks may house control valve means for the hydraulic flow to the advancing piston-cylinder means **10** and the stabilizer piston-cylinder means **17**, as well as the stabilizer piston-cylinder means **24** which may be optionally provided. Such control blocks may also house control means for energizing the hydraulic props **4**, **5** and **6**, **7**, whereby to permit extension and retraction of the prop frames for the desired roof support. While the source of hydraulic fluid and the specific flow lines therefor are not shown, these are conventional, as the artisan will appreciate, the present invention being directed to the dimensional relationships of reciprocal strokes of the advancing means and the stabilizer means for the desired purposes. Naturally, the stabilizer piston-cylinder means must be so designed that at the maximum advance **10'** of the advancing means, the stabilizer means must have executed the longest stroke possible and the maximum length attained thereby must be equal the hypotenuse of the right triangle indigenous to the prop alignments of the prop frames in the manner of the invention. If for some reason the props of the frames are not arranged at equal height, as for example, in a mineway in which the mine roof and the mine floor converge toward one another, the connection of the stabilizer means to the appropriate props will be correspondingly offset, yet the stabilizer means in the starting position will remain at right angles to the frames while the frames themselves will be disposed in exactly side-by-side relation. To the extent of any deviation from such positional arrangement, the prop frames will correspondingly deviate from their desired substantially parallel and substantially vertical disposition with respect to one another.

Accordingly, the present invention represents an improvement in an advanceable mining prop arrangement including a first prop frame and a second prop frame disposed in substantially parallel vertical longitudinal planes, each said frame having a pair of spaced apart extensible and retractable upright mining props interconnected at their upper end portions by a roof cap and at their lower end portions by a base skid, piston-cylinder advancing means having a predeterimned amplitude maximum stroke including an advancing piston connected to one said frame and an advancing cylinder connected to the other said frame, said advancing piston and cylinder being operatively interconnected for relative advance with respect to one another a given distance corresponding to said maximum stroke in the longitudinal direction of said parallel planes to advance in turn the corresponding prop frame connected thereto with respect to the remaining prop frame, and adjustable length stabilizer means interconnecting a prop on one said frame with a correspondingly adjacent prop on the other said frame at a level spaced above the level of connection of said advancing means with said prop frames. Such improvement specifically comprises providing said stabilizer means in the form of a stabilizer piston-cylinder means having a predetermined minimum effective length when said props to which said stabilizer means is connected and said stabilizer piston-cylinder means are disposed in a transverse substantially vertical plane normal to said frames and in turn said parallel planes and a predetermined maximum effective length when said props to which said stabilizer means is connected and said stabilizer piston-cylinder means are disposed in a transverse substantially vertical plane at an angle to said frames and in turn said parallel planes upon one said frame being correspondingly advanced with respect to the remaining frame said given distance corresponding to said advancing means maximum stroke, the maximum stroke of said stabilizer piston-cylinder means being proportional to the maximum stroke of said advancing piston-cylinder means, and said stabilizer means and said advancing piston-cylinder means being simultaneously energized, such that the maximum stroke of said advancing means will cause advance of one said prop frame with respect to the remaining prop frame said given distance while the maximum stroke of said stabilizer means simultaneously carried out therewith will cause corresponding parallel vertical alignment of said prop frames with respect to one another in said parallel planes to be maintained throughout the advance and at the termination thereof substantially independently of unevenness in the mine floor.

Accordingly, the present invention relates to an advanceable mining prop arrangement which comprises first prop means, including a normally upright first prop, and second prop means, including a normally upright second prop, disposed correspondingly in substantially vertical and substantially parallel planes extending in a given longitudinal direction; energizable reciprocal advancing means having a maximum stroke of predetermined amplitude, including a first motive part and a second motive part, said motive parts being operatively interconnected and energizable for linear displacement with respect to each other in the longitudinal direction of said planes in dependence upon said stroke of predetermined amplitude, said first prop means being connected, at a point thereon remote from the upper end portion of said first prop, to said first motive part for linear displacement therewith and said second prop means being connected, at a point thereon remote from the upper end portion of said second prop, to said second motive means for linear displacement therewith; and energizable adjustable length stabilizer means having a predeterimned minimum and maximum effective length relative to the amplitude of said advancing means, including a first linear part and a second linear part, said first linear part being swingably connected at one end thereof to the upper end portion of said first prop and correspondingly said second linear part being swingably connected at one end thereof to the upper end portion of said second prop, said linear parts being operatively interconnected at their correspondingly adjacent other ends and energizable for linear displacement with respect to each other to change the effective length of said stabilizer means, said stabilizer means having a minimum effective triangle base length when disposed in a substantially vertical transverse base plane extending in a direction substantially normal to the longitudinal direction of said parallel planes prior to energizing of said advancing means to attain said maximum stroke of predetermined amplitude and having a maximum effective triangle hypotenuse length when disposed in a substantially vertical transverse hypotenuse plane extending in a direction at an angle to the longitudinal direction of said parallel planes upon energizing said advancing means to linearly displace said first motive part and correspondingly said first prop means with respect to said second motive part and said second prop means to attain said maximum stroke of predetermined amplitude, said stabilizer means being operatively connected with said advancing means for simultaneous concordant energizing to achieve relative length linear displacement of the corresponding parts, such that the distance of linear displacement of said first prop means with respect to said second prop means upon energizing said advancing means to attain said maximum amplitude stroke corresponds to the portion of the particular vertical plane in said longitudinal direction, in which said first prop means is disposed, which is subtended by said base plane and said hypotenuse plane to form thereby the dependent effective triangle height length plane ascribed to the resultant proportional planar triangle, for maintaining said first and second props in substantially aligned upright parallel disposition with respect to one another in said parallel planes substantially throughout advancement of one such prop with respect to the other and substantially independently of unevenness in the mine floor.

Specifically, in accordance with a preferred embodiment of the invention, the advancing means includes a

hydraulically energized advancing piston-cylinder means in which said first motive part is an advancing piston rod carrying an advancing piston thereon and said second motive part is an advancing cylinder slidably receiving therein said advancing piston whereby to change the effective length of said advancing piston-cylinder means, and wherein said stabilizer means includes a hydraulically energized stabilizer piston-cylinder means in which said first linear part is a stabilizer piston rod carrying a stabilizer piston thereon and said second linear part is a stabilizer cylinder slidably receiving therein said stabilizer piston whereby to change the effective length of said stabilizer piston-cylinder means, said advancing piston-cylinder means and said stabilizer piston-cylinder means being concordantly energizable simultaneously to achieve infinitely incremental proportional changes in length thereof whereby to maintain in any position thereof the inherent relation of base, height and hypotenuse of said planar triangle up to the maximum stroke of said advancing means.

In such arrangement, preferably valve control means for hydraulic energizing of said advancing means and said stabilizer means are disposed on one of said prop means.

In particular, the first prop means includes a first prop frame having a first roof cap and a first base skid as well as a first pair of spaced apart props including said first prop and a third prop extending between said first cap and skid, and said second prop means includes a second prop frame having a second roof cap and a second base skid as well as a second pair of spaced apart props including said second prop and a fourth prop extending between said second cap and skid, all of said props being extensible and retractable to change the effective supporting height of said frames, said frames being disposed correspondingly within said parallel planes, said advancing cylinder being connected to said first prop means, said advancing piston rod being connected to said second prop means, said first and second props being disposed at the same corresponding ends of said frames, and said stabilizer means being connected pivotally at one end to said first prop and at the other end to said second prop at connecting points upwardly spaced from said skids and said advancing means.

In connection with the advancement in question, preferably hydraulic fluid is used for energizing said advancing means and said stabilizer means and common valve means are provided to conduct said fluid from a common source simultaneously to both said advancing means and said stabilizer means to achieve proportionate concordant energizing thereof. In this regard, optional auxiliary control means may be provided to conduct hydraulic fluid separately to said stabilizer means to energize said stabilizer means independently of the energizing of said advancing means, for achieving minor correction of the disposition of said prop frames in exceptional cases.

In connection with the foregoing, as the artisan will appreciate, where the mine floor and mine roof converge with respect to one another, one prop frame will be extended to a lesser height than the other whereby to achieve support of the mine roof. Thus, where hydraulic jacks, including a stationary base part and an extendable and retractable upper part telescopingly received in said base part, are used as the mining props to which the stabilizer means of the invention is connected, if the level of connection is such that the stabilizer means is disposed on the base part of the particular hydraulic jack, then the relative horizontal disposition with respect to the mine floor will be maintained, despite any discrepancy in extendable length of the upper parts of the two props or jacks in question. On the other hand, in those instances where the stabilizer means is connected to the upper parts of the adjacent props of the prop means or prop frames, then any discrepancy in the distance of extension of the upper part of one prop or jack with respect to the other will be meaningful, and in this instance, assuming the distance between the props and/or the prop frames and/or the parallel planes thereof, is not changed, then adjustment means may be provided to change the minimum and maximum effective length of the stabilizers. In this way, linear compensation may be made for the change with respect to the horizontal, i.e., the mine floor in the angular disposition of the stabilizer means caused by the discrepancy in extended distance as between the two props. Such adjustment means may take the form of infinite or incremental variations in effective length of piston rod **21** and/or link arm **19**, such as where either or both of these parts are provided as telescoping sub-parts or overlapping sub-parts interconnected by set screws, bolts, or otherwise, as the artisan will appreciate, whereby manual adjustments may be made in the effective length of piston rod **21** and/or link arm **19** by simply changing the set screw or bolt setting interconnecting the sub-parts. Alternatively, cylinder **18** may be fashioned with an auxiliary cylinder chamber on the opposite end from the main cylinder chamber within which piston **20** is received. In this instance, link arm **19** may be provided with an auxiliary piston at the end thereof slidably and operatively received within the auxiliary chamber, with separate adjustable actuation of the resulting auxiliary piston-cylinder means to vary in increments the over-all effective length of the stabilizer means in question. In any of these instances, it will be realized, the change in effective length of the stabilizer means is undertaken in order to adjust to particular mining conditions and/or to adjust to a change in the maximum stroke of the advancing means utilized consonant therewith. A single adjustment in the change of effective length of the stabilizer means is contemplated rather than a constant or continuous adjustment, and where such adjustment is occasioned by a bedding condition in which the mine roof and the mine floor converge toward one another, such adjustment will compensate for the deviation from the theoretical horizontal position at which the stabilizer means is normally disposed, caused by differences in extended length of the props in question. As noted hereinabove, an alternate manner of compensation may be undertaken by actually changing the axial position of connection of the appropriate portion of the stabilizer means to the particular prop upper part in question. The latter may take place, for example, where the connection is by way of a collar mounted fixedly on the prop upper part, permitting rotation about the axis thereof for swinging the stabilizer means as desired yet preventing axial displacement thereof. Accordingly, although the resulting planar triangle may deviate from the normal horizontal plane of the mine floor, in such an instance, the proportional relationship of the planar triangle dimensions will be maintained, assuming that the difference in extended length of the upper parts of the props in question will be constant. However, any changes in this regard may be compensated for by the discussed modification constructions, i.e., changing the axial position of the collar connection on the particular upper part or parts and/or changing the effective length of the stabilizer means by the use of sub-parts, and the like. While the last mentioned constructional modifications are not illustrated, their configuration and arrangement are well known and their presence is contemplated herein in terms only of the combination of the constructional elements noted, whereby to achieve the stabilized vertical disposition of the props in question in the reciprocal advancing of one prop with respect to another under adverse conditions in the mineway, such as unevenness in the mine floor caused by the disposition of the mine seam, i.e., sloped, slanted, etc., and/or by the presence of encumbrances such as lumps of mineral or rock situated in the path of the mining arrangement.

While the arrangement of the present invention is particularly useful for disposition in mineways where coal is to be extracted, the construction of the present invention is versatile and thus usable in any instance where

roof support is desired and where the vertical disposition of a pair of adjacent props for achieving such support is important, before, during and after the selfpropelled advancement of the props.

Naturally, where various constructional parts have been defined in terms of "means" in the instant specification, such means have been illustrated in the accompanying drawing as specific elements, but such means contemplate any and all elements usable to achieve the combination arrangement of the invention so long as the triangular disposition of the parts in question is maintained and any and all such constructional elements are contemplated herein just as if prolix enumeration thereof were set forth in detail herein.

It will be appreciated that the instant specification and drawing are set forth by way of illustration and not limitation, and that various modifications and changes may be made without departing from the spirit and scope of the present invention which is to be limited only by the scope of the appended claims.

What is claimed is:

1. Advanceable mining prop arrangement for supporting a mine roof which comprises a first prop unit and a second prop unit substantially parallel with respect to said first prop unit, said prop units being arranged in a first supporting position side by side in a direction normal to the direction of advance, guiding and energizable advancing means for shifting said first and said second prop units, one with respect to the other, along a linear path in the direction of advance to a second supporting position, said advancing means including motive parts operatively interconnected and connected with said prop units, energizable stabilizer means including at least one piston-cylinder device for supporting said first and second prop units in substantially aligned upright parallel disposition with respect to one another in the first and second supporting positions, the piston rod of said piston-cylinder device being pivotally connected with a part of said first prop unit and the cylinder thereof being pivotally connected with a part of said second prop unit so that the piston-cylinder device may swing when the first and second prop units are successively shifted along said linear path in the direction of advance, said stabilizer piston-cylinder device being connected with the first and second prop units in such a manner that in said first supporting position said cylinder is arranged with the longitudinal axis thereof substantially normal to the direction of advance and in said second supporting position said piston-cylinder device is arranged with said longitudinal axis situated at an acute angle to said direction of advance, the stroke of said piston-cylinder device being such that in the first supporting position said piston-cylinder device has a minimum effective length which is determined by the maximum incursion of said piston rod within said cylinder and in the second supporting position said piston-cylinder device has a maximum effective length which is determined by the maximum excursion of said piston rod with respect to said cylinder, and control means for controlling the supply of pressure medium to said piston-cylinder device of said stabilizer means.

2. Arrangement according to claim 1 wherein said advancing means include a double-acting hydraulic piston-cylinder unit and said stabilizer means include a hydraulic piston-cylinder device, and said control means include valve control means common to said piston-cylinder unit and said piston-cylinder device to control the supply of hydraulic fluid under pressure from a common source to said piston-cylinder device and said piston-cylinder unit.

3. Arrangement according to claim 2 wherein said valve control means for hydraulic energizing of said advancing means of said stabilizer means are disposed on one of said prop units.

4. Arrangement according to claim 2 wherein auxiliary valve control means are provided to conduct hydraulic fluid separately to said stabilizer means to energize said stabilizer means independently of the energizing of said advancing means.

5. Arrangement according to claim 1 wherein hydraulic fluid is used for energizing said advancing means and said stabilizer means and common valve means are provided to conduct said fluid from a common source simultaneously to both said advancing means and said stabilizer means to achieve proportionate concordant energizing thereof.

6. Advanceable mining prop arrangement which comprises first prop means and second prop means disposed in substantially upright parallel relation and advanceable in a longitudinal direction from a first substantially side by side coadjacent position to a second substantially staggered longitudinally offset position, energizable advancing means operatively interconnecting said first and second prop means for advancing said first and second prop means with respect to one another in said longitudinal direction alternately between said first and second positions, energizable stabilizer means having a predetermined minimum and maximum effective length including a piston-cylinder means having cooperating cylinder and piston parts with a stroke corresponding to said minimum and maximum effective lengths and operatively swingably interconnecting said first and second prop means apart from the operative connection thereof by said advancing means, said piston-cylinder means being arranged in said first position with the longitudinal axis thereof substantially normal to said longitudinal direction of advance and with said stabilizer means having said minimum effective length and in said second position with said longitudinal axis at an acute angle to said direction of advance and with said stabilizer means having said maximum effective length whereby to maintain said first and second prop means in substantially aligned upright parallel disposition with respect to one another in said first and second positions while permitting said cylinder and piston parts to alternate in stroke between said minimum and maximum effective lengths and correspondingly to swing with respect to said first and second prop means upon successive alternate advance of said first and second prop means between said first and second positions.

7. Advanceable mining prop arrangement which comprises first prop means and second prop means disposed correspondingly in substantially vertical and substantially parallel planes extending in a given longitudinal direction; energizable reciprocal advancing means having a maximum stroke of predetermined amplitude, including a first motive part and a second motive part, said motive parts being operatively interconnected and energizable for linear displacement with respect to each other in the longitudinal direction of said planes in dependence upon said stroke of predetermined amplitude, said first prop means being connected, at a point thereon remote from the upper end portion thereof, to said first motive part for linear displacement therewith and said second prop means being connected, at a point thereon remote from the upper end portion thereof, to said second motive means for linear displacement therewith; and energizable adjustable length stabilizer means having a predetermined minimum and maximum effective length relative to the amplitude of said advancing means, including a first linear part and a second linear part, said first linear part being swingably connected at one end thereof to said first prop means at a point thereon remote from the lower end portion thereof and correspondingly said second linear part being swingably connected at one end thereof to said second prop means at a point thereon remote from the lower end portion thereof, said linear parts being operatively interconnected at their correspondingly adjacent other ends and energizable for linear displacement with respect to each other to change the effective length of said stabilizer means, said stabilizer means having a minimum effective triangle base length when disposed in a substantially vertical transverse base plane extending in a direc-

tion substantially normal to the longitudinal direction of said parallel planes prior to energizing of said advancing means to attain said maximum stroke of predetermined amplitude and having a maximum effective triangle hypotenuse length when disposed in a substantially vertical transverse hypotenuse plane extending in a direction at an angle to the longitudinal direction of said parallel planes upon energizing said advancing means to linearly displace said first motive part and correspondingly said first prop means with respect to said second motive part and said second prop means to attain said maximum stroke of predetermined amplitude, said stabilizer means and said advancing means being energizable to achieve relative length linear displacement of the corresponding parts, such that the distance of linear displacement of said first prop means with respect to said second prop means upon energizing said advancing means to attain said maximum amplitude stroke corresponds to the portion of the particular vertical plane in said longitudinal direction, in which said first prop means is disposed, which is subtended by said base plane and said hypotenuse plane to form thereby the dependent effective triangle height length plane ascribed to the resultant proportional planar triangle, for maintaining said first and second prop means in substantially aligned upright parallel disposition with respect to one another in said parallel planes before and after advancement of one such prop means with respect to the other and substantially independently of unevenness in the mine floor.

8. Arrangement according to claim **7** wherein said advancing means includes a hydraulically energized advancing piston-cylinder means in which said first motive part is an advancing piston rod carrying an advancing piston thereon and said second motive part is an advancing cylinder slidably receiving therein said advancing piston whereby to change the effective length of said advancing piston-cylinder means, and wherein said stabilizer means includes a hydraulically energized stabilizer piston-cylinder means in which said first linear part is a stabilizer piston rod carrying a stabilizer piston thereon and said second linear part is a stabilizer cylinder slidably receiving therein said stabilizer piston whereby to change the effective length of said stabilizer piston-cylinder means, said advancing piston-cylinder means and said stabilizer piston-cylinder means being concordantly energizable simultaneously to achieve infinitely incremental proportional changes in length thereof whereby to maintain in any position thereof the inherent relation of base, height and hypotenuse of said planar triangle up to the maximum stroke of said advancing means.

9. Arrangement according to claim **8** wherein valve control means for hydraulic energizing of said advancing means and said stabilizer means are disposed on one of said prop means.

10. Arrangement according to claim **8** wherein said first prop means includes a first prop frame having a first roof cap and a first base skid as well as a first pair of spaced apart props including a first prop and a third prop extending between said first cap and skid, and said second prop means includes a second prop frame having a second roof cap and a second base skid as well as a second pair of spaced apart props including a second prop and a fourth prop extending between said second cap and skid, all of said props being extensible and retractable to change the effective supporting height of said frames, said frames being disposed correspondingly within said parallel planes, said advancing cylinder being connected to said first prop means, said advancing piston rod being connected to said second prop means said first and second props being disposed at the same corresponding ends of said frames, and said stabilizer means being connected pivotally at one end to said first prop and at the other end to said second prop at connecting points upwardly spaced from said skids and said advancing means.

11. Arrangement according to claim **8** wherein hydraulic fluid is used for energizing said advancing means and said stabilizer means and common valve means are provided to conduct said fluid from a common source simultaneously to both said advancing means and said stabilizer means to achieve proportionate concordant energizing thereof.

12. Arrangement according to claim **11** wherein auxiliary valve control means are provided to conduct hydaulic fluid separately to said stabilizer means to energize said stabilizer means independently of the energizing of said advancing means.

13. In an advanceable mining prop arrangement including a first prop frame and a second prop frame disposed in substantially parallel vertical longitudinal planes, each said frame having a pair of spaced apart extensible and retractable upright mining props interconnected at their upper end portions by a roof cap and at their lower end portions by a base skid, piston-cylinder advancing means having a predetermined amplitude maximum stroke including an advancing piston connected to one said frame and an advancing cylinder connected to the other said frame, said advancing piston and cylinder being operatively interconnected for relative advance with respect to one another a given distance corresponding to said maximum stroke in the longitudinal direction of said parallel planes to advance in turn the corresponding prop frame connected thereto with respect to the remaining prop frame, and adjustable length stabilizer means interconnecting a prop on one said frame with a correspondingly adjacent prop on the other said frame at a level spaced above the level of connection of said advancing means with said prop frames, the improvement which comprises providing said stabilizer means in the form of a stabilizer piston-cylinder means having a predetermined minimum effective length when said props to which said stabilizer means is connected and said stabilizer piston-cylinder means are disposed in a transverse substantially vertical plane normal to said frames and in turn said parallel planes and a predetermined maximum effective length when said props to which said stabilizer means is connected and said stabilizer piston-cylinder means are disposed in a transverse substantially vertical plane at an angle to said frames and in turn said parallel planes upon one said frame being correspondingly advanced with respect to the remaining frame said given distance corresponding to said advancing means maximum stroke, the maximum stroke of said stabilizer piston-cylinder means being proportional to the maximum stroke of said advancing piston-cylinder means, and said stabilizer means and said advancing piston-cylinder means being simultaneously energized, such that the maximum stroke of said advancing means will cause advance of one said prop frame with respect to the remaining prop frame said given distance while the maximum stroke of said stabilizer means simultaneously carried out therewith will cause corresponding parallel vertical alignment of said prop frames with respect to one another in said parallel planes to be maintained throughout the advance and at the termination thereof substantially independently of unevenness in the mine floor.

References Cited

FOREIGN PATENTS

1,161,834	1/1964	Germany.
947,252	1/1964	Great Britain.

JACOB SHAPIRO, *Primary Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,415,065 December 10, 1968

Alfons Heider

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 15, line 71, "of said stabilizer" should read -- and said stabilizer --. Column 17, line 69, "means" should read -- means, --.

Signed and sealed this 17th day of March 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents