July 27, 1965 C. O. L. OTTOSSON ETAL 3,196,957

DRILL RIGS

Filed May 3, 1962 3 Sheets-Sheet 1

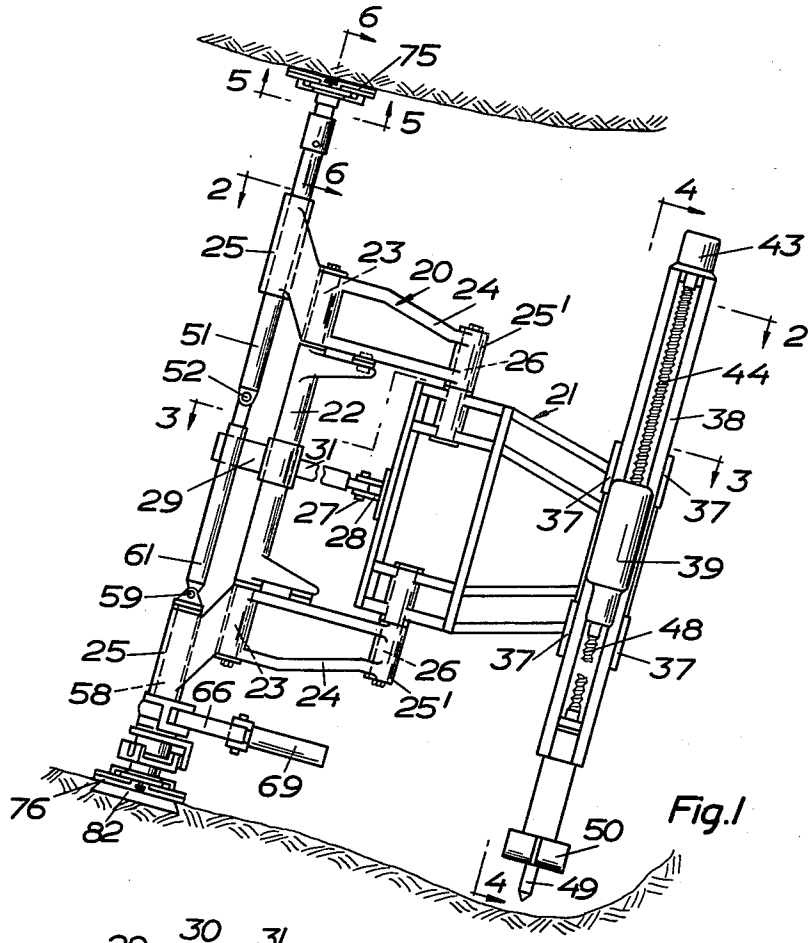

Fig.1

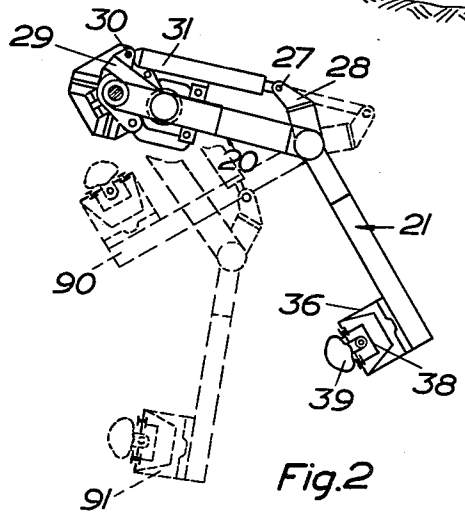

Fig.2

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DRILL RIGS

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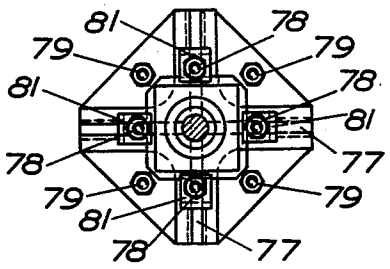

Fig.5

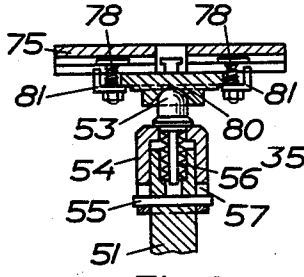

Fig.6

Fig.3

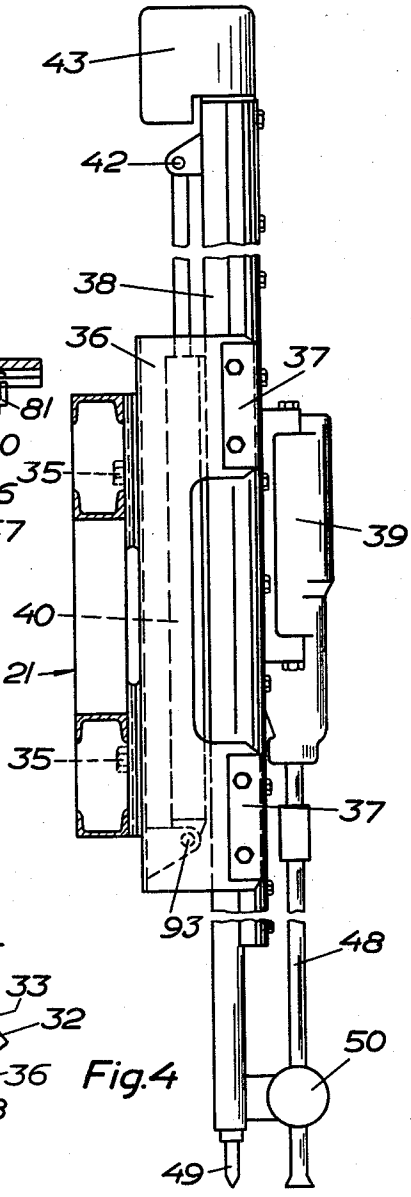

Fig.4

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DRILL RIGS

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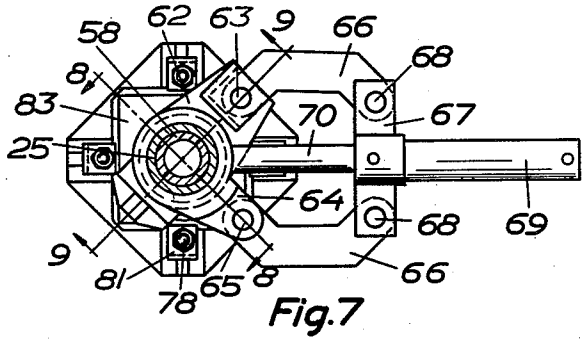

Fig.7

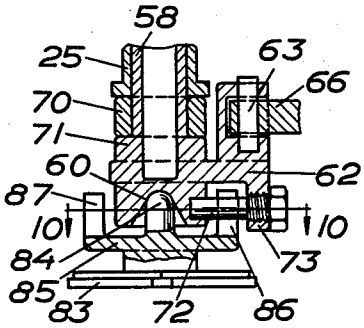

Fig.8

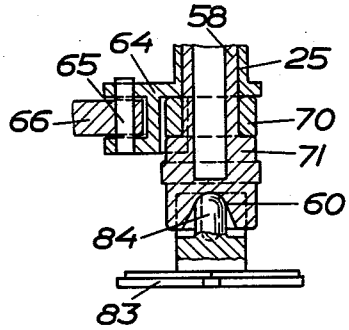

Fig.9

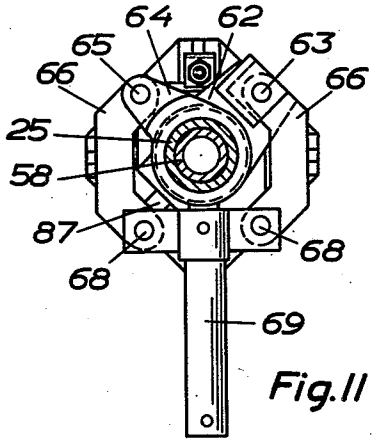

Fig.11

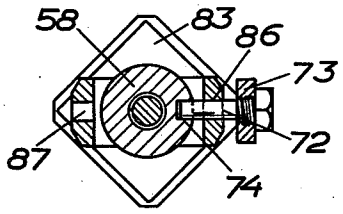

Fig.10

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DRILL RIGS

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Filed May 3, 1962, Ser. No. 192,186
11 Claims. (Cl. 173—34)

This invention relates generally to rock drill rigs and more particularly to a drill rig for percussive drilling of long holes with extension drill steel equipment intended for driving raises and extending the full length of the raise to be driven.

One primary object of the invention is to provide a drill rig for percussive drilling of groups of long holes for driving raises which safeguards a strictly parallel positioning of a drilling machine for drilling the different long holes according to a predetermined drilling pattern.

Another object of the invention is to provide a drill rig of the aforementioned character which effectively covers the full area to be provided with holes according to the drilling pattern.

Another object of the invention is to provide a drill rig of the aforementioned character which features mechanical positioning of the drilling machine in the various positions according to the drilling pattern.

Another object of the invention is to provide a drill rig of the aforementioned character having adjusting means for selecting the correct inclination of the axis of the drill rig prior to commencing the drilling of the various holes in order to drive the raise in the predetermined direction.

The above and other objects of the invention will become obvious from the following description and from the accompanying drawings in which an embodiment of the invention is illustrated by way of example. It should be understood that this embodiment is only illustrative of the invention and that various modifications may be made within the scope of the claims without departing from the scope of the invention.

In the drawings FIG. 1 shows a side view of a drill rig according to the invention and with the outer frame section turned into the central plane of the inner frame section. FIG. 2 is a view on line 2—2 in FIG. 1. FIG. 3 is an enlarged view on line 3—3 in FIG. 1 with the outer frame section turned inward. FIG. 4 is an enlarged side view and partial section on line 4—4 in FIG. 1. FIG. 5 is an enlarged view and partial section on line 5—5 in FIG. 1. FIG. 6 is a sectional enlarged view on line 6—6 in FIG. 1. FIG. 7 is a view and partial section on line 7—7 in FIG. 1. FIG. 8 is a sectional view on line 8—8 in FIG. 7. FIG. 9 is a sectional view on line 9—9 in FIG. 7. FIG. 10 is a sectional view on line 10—10 in FIG. 8, and FIG. 11 is a view corresponding to FIG. 7 but showing the power jack therein turned through 90°.

The drill rig illustrated in the drawings consists of an articulated frame composed of an inner frame section 20 and outer frame section 21. The inner frame section 20 is composed of a central body member 22 carrying at its opposed end shafts 23. Firmly secured to the shafts 23 and bolted to the central body member 22 are end frames 24 carrying coaxial widely spaced apart pairs of strictly parallel bearings 25 and 25^1 at their inner and outer ends. The outer frame 21 carries opposed coaxially disposed trunnions 26 and is mounted with said trunnions 26 pivotally between and on said outer bearings 25^1. A pivot 27 is provided on a bracket 28 on the inner portion of the outer frame section 21. A rearwardly pointing bracket arm 29 is fixedly connected

to the central portion of the body member 22 and carries a pivot 30. To the pivots 27 and 30 there is pivotally joined a power jack, preferably a double acting hydraulic power jack 31. By manipulating the power jack 31 the outer frame section 21 may be swung one way or the other on the trunnions 26 relative to the inner frame section 20.

On the outer end of the outer frame section 21 there are provided spaced apart plane connecting surfaces 32 provided with centering grooves 33 extending in strict parallelism with the axis of the trunnions 26. Against the grooves 33 and surfaces 32 are bolted by means of bolts 35 cooperating guides 33^1 and plane surfaces 34 on a guide frame 36 which is brought into parallel position relative to the trunnions 26 by means of the grooves 33 and guides 31^1. Reciprocably arranged on guide members 37 along said guide frame 36 is a feed bar 38 for a drill 39. A power cylinder 40 is pivotally connected at one end 93 to the guide frame 36 and at the outer end 42 to the feed bar 38 and serves to move the feed bar 38 longitudinally of itself relative to the guide frame 36. 43 indicates diagrammatically a drill feed motor which for example over a feed screw 44 or in other ways serves to feed the drill 39 together with an extension drill steel equipment 48 towards a rock face. The drill 39, which preferably is a pneumatically driven percussive drill, is guided for reciprocation on the feed bar 38 along suitable guideways 46 for example formed by pairs of elongated steel bars bolted to the feed bar 38 and also forming guide ways 47, which extend oppositely to the guide ways 46 the length of the fed bar 38 and are intended for cooperation with the guide members 37 fixedly carried by the elongated guide frame 36 for making reciprocation of the feed bar 38 with respect to the guide frame 36 possible. The feed bar 38 may carry at its forward end a spur 49 and a suitable power operated drill steel guide 50 for guiding the drill steel 48. The details of the drill, the extension drill steel equipment, the feed bar, the feed motor, and the drill steel guide are not illustrated in detail since they may be carried out in any conventional manner suitable for the drilling of long holes and well-known to those familiar with the art.

Rotatably journalled and reciprocally arranged in the upper bearing 25 of the inner frame section 20 there is an upper column section 51 which is provided with a pivot 52 at its inner end and carries the convex member of a ball joint 53, FIG. 6, at its outer end. The ball joint member 53 is provided on a sleeve 54 which is slidably retained on the column section 51 by means of a transverse pin 55 extending therethrough and through axial slots 57 on the sleeve 54. Between the column section 51 and the sleeve 54 there is provided a series of axially grouped Belleville springs 56. Rotatably journalled in the lower bearing 25 of the inner frame section 20 is a lower column section 58 carrying a pivot 59 at its inner end and being provided with the concave portion 60 of an axial ball joint, FIG. 8. Between the pivots 52 and 59 of the column sections 51 and 58 there is provided a preferably hydraulically actuated double acting power jack 61. By manipulating the power jack 61 the upper column section 51 may be extended axially outward through the upper bearing 25.

The lower column section 58 is provided with a radially protruding arm 62, FIG. 8, carrying at its end a pivot 63 extending in parallel and spaced apart relation with respect to the axis of the column section 58. A radially protruding arm 64, FIG. 9, is also provided on the lowermost portion of the lower bearing 25, the arm 64 carrying a pivot 65 also in parallel and spaced apart relation with respect to the axis of the column section 58. Links 66 are connected to the pivots 63, 65 and

are also joined to pivots 68 at the opposed portion of a yoke 67. The yoke 67 forms the inner end of the cylinder portion of a hydraulically actuated double-acting power jack 69. The stem end 70 of the power jack 69 is rotatably arranged and journalled on the lower column section 58 and extends in a common central plane together with the links 66 and the pivots 65, 63. The stem end 70 is also interposed between an axial shoulder 71 on the column section 58 and the lower bearing 25 of the inner frame section 20. As will be described in greater detail further on the arm 64 may, by extending or contracting the power jack 69, be turned one way or the other with respect to the arm 62 i.e. the inner frame section 20 may be swung with respect to the column sections 51, 58. For the fixation of the arm 62 there is provided a radially extending bolt 72 which is threadedly received in an ear 73 and the axis of which points through the center of the radius defining the concave ball joint portion 60. The inner end of the bolt 72 is for strengthening purposes received in a bore 74 adjacent the ball joint member 60.

For supporting the drill rig there are provided ground supported mounting means comprising upper and lower rock engaging members 75, 76. The upper rock engaging member 75 consists of a quadrangular plate provided with diagonally extending T-grooves 77 along which lock bolts 78 are slidably arranged. The plate 75 may be bolted to the drift roof by means of conventional expansion bolts 79, not shown in detail. Resting against the plate 75 is a concave ball joint portion 80 intended for cooperation with the ball joint member 53. The ball joint portion 80 is formed quadrangular and may be locked by means of the lock bolts 78 and angular lock pieces 81 in any suitable transversely adjusted position on the plate 75.

The lower rock engaging member 76 may be firmly affixed to a suitable steel plate 82 by means of bolts, not shown, which steel plate 82 may be affixed to the floor of the drift for example by pouring concrete on the floor for purposes of embedding the steel plate 82. The rock engaging member 76 proper is analogous in construction with the upper rock engaging member 75 and carries identical lock bolts and lock pieces and also a quadrangular footplate 83 which by means of the lock bolts may be adjusted transversely in any suitable position on the lower rock engaging member 76. The footplate 83 carries centrally thereon an upwardly protruding convex ball joint member 84 intended for cooperation with the concave ball joint portion 60 of the lower column section 58. The footplate 83 also carries a U-shaped yoke 85 provided with opposed grooves 86 and 87 intended for cooperation with the radially extending bolt 72 on the lowermost portion of the column section 58. The arrangement is such that the bolt 72, by turning the column sections 51, 58 on the axis defined by the ball joints 84, 60 and 53, 80, may be selectively coupled with the groove 86 or 87, respectively, thereby firmly joining the column sections to the surrounding rock in two alternative positions offset angularly by 180 degrees.

The pressure fluid for operation of the different power cylinders, the feed motor, the drill steel guide and the drill of the illustrated drill rig is supplied from suitable sources not illustrated and the various hoses for conveying pressure fluid have been omitted since they would make the drawing rather congested and since the provision of such hoses or conduits is obvious to those skilled in the art.

In FIGS. 1 and 2 the drill rig is illustrated in position for drilling holes vertically downwards. Due to the parallel arrangement of the trunnions 26 and the axis of the drill steel equipment 48 it is obvious that swinging of the outer frame 21 in clockwise direction as viewed in FIG. 2 by means of the power jack 31 moves the drill steel parallel to itself sideways on the axis of the trunnions 26 along an arc of a circle. This enables the operator to drill a number of strictly parallel holes between the full line position of FIG. 2 and the position 90 illustrated by dotted lines in FIG. 2. Additionally the operator may, by manipulating the power jack 69, turn the entire articulated support 20, 21 with the axis of the drill steel parallel to itself and parallel to the axis of the column sections 51, 58 from the full line position of FIG. 2 over the intermediate position 91, illustrated by dotted lines in FIG. 2, to any selected position within reach around the axis of the column sections 51, 58. To explain this in greater detail, let it be assumed that the power jack 69 occupies the position of FIG. 7 and that the radial bolt 72 of the column section 58 is inserted in the groove 86 of the U-shaped yoke 85 on the footplate 83. By contracting the power jack 69 the operator forces the power jack 69 to rotate in clockwise direction turning one link 66 on the stationary pivot 63 and forcing by the other link 66 the pivot 65 to move in a clockwise direction. The movement of the pivot 65 causes via the arm 64 and the lower bearing 25 a corresponding turning movement of the entire articulated support on the axis of the column sections 58 and 51. Such turning movement may be continued until the power jack 69 reaches the position of FIG.11, which is 90 degrees offset with respect to FIG. 7 and in which position the arm 64 has received an angular displacement of about 180 degrees. If the operator wishes to continue the turning movement over the remaining 180 degrees of a full circle, he may contract the power cylinder 40 on the elongated guide frame member 36 in order to bring the spur 49 of the feed bar 38 in contact with the floor of the drift thereby preventing the articulated support 20, 21 from turning. Thereupon the bolt 72 is removed from the column section 58. By extending the power jack 69, FIG. 11, it is now possible to rotate the column sections 51, 58 on the ball joints 53, 80 and 84, 60 since during such extension the pivot 65 now is kept stationary by the spur 49 while the pivot 63 is turned in a clockwise direction 180 degrees until the arm 62 is brought in a position over the groove 87 in FIG. 11. The bolt 72 may now be reinserted and brought into engagement with the groove 87, whereupon after elevation of the spur from the ground the operator is able to continue turning of the articulated support the remaining 180 degrees of a full circle by again contracting the power jack 69. Thus it is readily seen that the operator is able to position the drill steel in strict parallelism with the axis of the column sections in any selected position according to the drilling pattern between the full line position and the dotted line position 90 of FIG. 2 through an angle of 360 degrees and to keep the steel in any such position by means of the power jacks 69 and 31.

By removal of the bolts 35 it is obviously possible to remove the elongated guide frame 36 together with the entire drilling apparatus and to reposition the guide frame 36 on the surfaces 32 with the drill pointing in upward direction for drilling of long holes upwardly.

In order to mount the drill rig in a selected position the steel plate 82 is firstly attached to the floor of the drift at a suitable location and firmly connected thereto by pouring concrete around the plate 82. Thereupon the rock engaging member 76 is bolted to the steel plate 82. Taking into account the inclination of the raise to be driven, the rock engaging member 75 is bolted to the roof of the drift by means of the expansion bolts 79 in approximately the correct inclination with respect to the rock engaging member 76. Thereupon the footplate 83 on the rock engaging member 76 and the ball joint portion 80 on the rock engaging member 75 are adjusted by means of the lock bolts 78 and the angular lock pieces 81 with respect to each other in a position defining an axis of the ball joint members 80, 84 strictly equal to the inclination of the raise to be driven. The articulated frame 20, 21 is then raised with the lower column section 58 resting with its concave ball joint portion 60 against the ball joint member 84 of the footplate 83. By

expanding the power jack 61 connected to the column sections 58 and 51 the ball joint member 53 of the column section 51 is brought firmly in contact with the concave ball joint portion 80 simultaneously compressing the Belleville springs 56 for giving the column sections an additional axial precompression. The articulated frame is now turned so that the arm 62 of the lower column section 58 is brought over one of the recesses 86 or 87, for example 87, whereupon the bolt 72 is screwed into the ear 73 of the arm 62 thereby coupling the column section 58 to the footplate 83. Finally the elongated guide frame member 36 is bolted by means of the bolts 35 to the surfaces 32 of the outer frame section 21 with the drill pointing in the direction of the raise to be driven, for example downwardly, whereupon the drill rig after connection to the respective power sources is ready for operation.

The embodiment of the invention above described and illustrated in the drawings should only be considered as an example and the invention may be modified in several different ways within the scope of the following claims.

What we claim is:

1. In apparatus of the character described for movably supporting a drill rig frame with a drill disposed thereon in a plurality of positions, the combination which comprises a substantially vertically disposed pressure fluid operated extensible and retractible power jack having pivots on each end thereof, a column section extending from each end of said power jack and connected to the said pivots and forming with said power jack a supporting column for said drill rig frame, a surface engaging member disposed on each of said column sections at the end thereof opposite said pivots for engaging respectively opposing surfaces of the place where the said drill rig frame is to be supported, bearing members rotatably disposed respectively on each said column sections for engaging said drill rig frame, one of said column sections being axially slidable in its respective bearing for providing extending or contracting movement of said supporting column for the engagement or disengagement of said surface engaging members, and means connected to one of said column sections and its respective bearing for selectively moving a drill rig frame disposed thereon in different angular positions with respect to said supporting column.

2. Apparatus as recited in claim 1 in which spring means are disposed between one of said column sections and its respective surface engaging member for providing axial compressibility to said supporting column.

3. Apparatus as recited in claim 1 and which includes a ball joint between each said surface engaging member and the adjacent said column section with said ball joints defining a turning axis for said column section, T-groove and lock nut means disposed around said ball joints for adjusting said column sections on the said adjacent surface engaging members in directions transverse to said column sections, means for selectively intercoupling one of said column sections and one of said surface engaging members in different angularly offset positions around said turning axis defined by said ball joints, and in which said moving means is a second pressure fluid operated extensible and retractible power jack.

4. In apparatus of the character described for positioning and supporting a drilling apparatus in a plurality of drilling positions all parallel to each other and having a ground supported mounting means, the combination which comprises coaxial spaced apart pivot providing elements disposed on the said mounting means and defining a first axis, an articulated frame including a first and second section with the inner end portion of said first section disposed on said pivot-providing elements for providing swinging movement of said frame on the said first axis, spaced apart pivotally connected means between the outer end portion of said first and the inner end portion of said second frame section for swinging movement therebetween on a second axis parallel with said first axis, elongated feeding means slidably disposed on said second frame section at the end thereof opposite said second axis, the axis thereof being parallel to said first and second axes, a first hydraulic power jack between said frame sections for swinging and angularly positioning said second frame section with respect to said first frame section, a second hydraulic power jack between said mounting means and said first frame section for swinging and angularly positioning said articulated frame with respect to said mounting means, and a third hydraulic jack between said second frame section and said feeding means for the movement thereof along said second frame section in a direction parallel to said first and second axes.

5. In apparatus of the character described for simultaneously supporting and moving a drill rig through a plurality of selective drilling positions all parallel to each other and to a single supporting column from which said apparatus depends and having a supporting column with surface engaging members at opposite ends thereof and extending means for clamping said column and said members between opposed surfaces, the combination which comprises a first pair of spaced apart coaxial pivots disposed on said column and parallel therewith, an articulated frame with first and second sections disposed on said pivots for swinging movement of said frame on said column, a second pair of spaced apart coaxial pivots disposed on said frame between said first and second sections and parallel with said first pair of pivots for providing swinging movement between said first and second sections of said frame, an elongated feed bar slidably disposed on said second section on the end thereof opposite said second pair of pivots with the sliding movement of said feed bar being parallel to the axes of said first and second pair of pivots and said column and defining therefor a drill axis for a drill disposed thereon parallel to said supporting column, a first hydraulic power jack between said frame sections for swinging and angularly positioning said second frame section relative to said first frame section, a second hydraulic power jack between said column and said first frame section for swinging and angularly positioning said articulated frame with respect to said supporting column, spur means on the forward end of said feed bar, a third hydraulic power jack between said second frame section and said feed bar for the sliding movement thereof whereby said spur means are moved respectively into and out of engagement with the rock face to be drilled, and said articulated support and spur means forming the sole support for said feed bar in said plurality of said drilling positions during the drilling operation.

6. Apparatus as recited in claim 5 in which said surface engaging members are turnably arranged on the opposite ends of said column and means are provided for selectively intercoupling said column and one of said surface engaging members in different angularly offset positions around said column.

7. Apparatus as recited in claim 5 in which T-groove and lock-nut means are provided between the ends of the said supporting column and the said adjacent surface engaging members for adjusting the said column on the adjacent surface engaging members in directions transverse to the said supporting column.

8. Apparatus as recited in claim 5 which also includes a ball joint between each said surface engaging member and the adjacent end of said supporting column with said ball joints defining a turning axis for the said supporting column, and means for selectively intercoupling said column and one of said surface engaging members in different angularly offset positions around said turning axis defined by said ball joints.

9. In apparatus of the character described for simultaneously supporting and moving a drill rig through a plurality of selected drilling positions all parallel to each other and to a single supporting column from which said apparatus depends and having a supporting column with

surface engaging members at opposite ends thereof and extending means for clamping said column and said members between opposed surfaces, the combination which comprises a first pair of spaced apart coaxial pivots disposed on said column and parallel therewith a composite frame of closed generally quadrangular shape including opposed parallel girders rigidly affixed thereto and disposed on said pivots for swinging movement of said frame on said column, an elongated feed bar slidably disposed on said frame on the end thereof opposite said pair of pivots with the sliding movement of said feed bar being parallel to the axis of said pivots and said column and defining therefor a drill axis for a drill disposed thereon parallel to said supporting column, a first hydraulic power jack between said column and said frame for swinging and angularly positioning said frame with respect to said supporting column, spur means at the forward end of said feed bar, a second hydraulic power jack between said frame and said feed bar for the sliding movement thereof toward and away from the surface to be drilled whereby said spur means is moved into and out of engagement with the said surface to be drilled, said supporting column and said spur means forming the sole support of said feed bar in said plurality of drilling positions during the drilling operation.

10. Apparatus as recited in claim 9 which includes a ball joint between each said surface engaging member at the adjacent end of the said supporting column with the said ball joint defining a turning axis for the said supporting column, T-groove and lock-nut means disposed around said ball joints for adjusting said supporting column on the adjacent surface engaging members in directions transverse to the said supporting column.

11. In apparatus of the character described for simultaneously supporting and moving a drill rig through a plurality of selective drilling positions all parallel to each other and to a single supporting column from which said apparatus depends, the combination which comprises a substantially vertically disposed pressure fluid operated extensible and contractible power jack having pivots on each end thereof, a column section extending from each end of said power jack and connected to said pivots and forming with said power jack a supporting column for said drill rig, a surface engaging member disposed on each of said column sections at the ends thereof opposite said pivots for engaging respectively the opposing surfaces of the place where said drill rig is to be supported, a first pair of spaced apart co-axial pivots rotatably disposed respectively on each of said column sections for engaging said drill rig, one of said column sections being axially slidable in its respective pivot for providing extending or contracting movement of said supporting column for the engagement or disengagement of said surface engaging members, an articulated frame with first and second sections disposed on said pivots for swinging movement of said frame on said supporting column, a second pair of spaced apart coaxial pivots disposed on said frame between said first and second sections and parallel with said first pair of pivots for providing swinging movement between said first and second sections of said frame, an elongated feed bar slidably disposed on said second section on the end thereof opposite said second pair of pivots with the sliding movement of said feed bar being parallel to the axes of said first and second pair of pivots and said supporting column and defining therefor a drill axis for a drill disposed thereon parallel to said supporting column, a second pressure fluid operated extensible and contractible power jack connected to one of said column sections and its respective pivot for selectively moving the frame disposed thereon in different angular positions with respect to said supporting column, a third pressure fluid operated extensible and contractible power jack between said frame sections for swinging and angularly positioning said second frame section with respect to said first frame section, spur means at the forward end of said feed bar, a fourth pressure fluid operated extensible and contractible power jack between said second frame section and said feed bar for the sliding movement of said feed bar on said second frame section whereby said spur means are moved respectively into and out of engagement with a surface to be drilled, and said articulated frame and spur means forming the sole support for the said feed bar in the said plurality of drilling positions during the drilling operation.

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