This invention relates to adjustable tool supports and more particularly to an adjustable jib mounting for a hammer rock drill.

In modern rock drilling equipment it has become common practice to mount the drilling tools on adjustable supports whereby the tools may be quickly positioned in any desired manner and rigidly supported with respect to the work with a minimum of effort on the part of the operator. In such adjustable supports it is desirable that the drilling tools are not only easily and quickly adjustable into the desired drilling position but also to provide for rigidity in support so that the severe vibratory action inherent in such apparatus may be reduced to a minimum. The present invention contemplates improvements over known types of adjustable drill supports in that flexibility and facility in adjustment, and extreme rigidity of support, are attained.

An object of the present invention is to provide an improved adjustable tool support. Another object is to provide an improved adjustable support for a hammer rock drill. A further object is to provide an improved adjustable drill jib mounting for a hammer drilling tool together with power operated means for swinging the jib both vertically and horizontally. Yet another object is to provide an improved drill jib mounting having improved lift and swing cylinders or jacks connected with the jib whereby the drilling tool may be quickly and easily adjusted and rigidly held in adjusted position. A still further object is to provide an improved adjustable tool support having improved adjustable supporting means whereby the drilling tool may be adjusted through a wide range of positions including a position close to the ground as is especially desirable in flat hole drilling. These and other objects and advantages of the invention will, however, hereinafter more fully appear in the course of the ensuing description.

In the accompanying drawings there is shown for purposes of illustration one form which the invention may assume in practice.

In these drawings:
Fig. 1 is a plan view of a drilling apparatus embodying a preferred illustrative form of the invention.
Fig. 2 is a side elevational view of the drilling apparatus shown in Fig. 1.
Fig. 3 is an enlarged longitudinal vertical section taken on line 3—3 of Fig. 1, showing the improved drill jib mounting.
Fig. 4 is a horizontal section taken on line 4—4 of Fig. 3.
Fig. 5 and 6 are enlarged detail views, one in plan and the other in side elevation, showing the improved swiveled-arm mounting at the outer extremity of the drill jib.
Fig. 7 is a detail section taken on line 7—7 of Fig. 5.
Fig. 8 is a detail section taken on line 8—8 of Fig. 6.
Fig. 9 is a cross section taken on line 9—9 of Fig. 6, showing the arm clamp.

Fig. 10 is a diagrammatic view illustrating the hydraulic fluid system.

The improved adjustable tool support or drill jib mounting is herein shown associated with a mobile base although it will be evident that the adjustable support may be mounted in various other manners also. While the drilling tool carried by the support herein assumes the form of a conventional hammer rock drill, evidently, other types of tools, such as rotary drills or wrenches, may be supported thereby.

The drilling apparatus, as shown in the drawings, is of the mobile, dual jib type comprising a self-propelled, mobile base 1 having a truck frame 2 mounted on rubber-tired wheels 3 adapted to travel over the ground. Mounted on the forward portion of the truck frame is a pair of identical adjustable drill jib mountings, generally designated 4, for supporting drilling tools. The drilling tools, as previously stated, are of a conventional design and each embodies a fluid actuated hammer motor 6 for percussively actuating a drill steel 7 carrying a drill bit 8.

The drill jib mountings, as also stated above, are identical in design and therefore a detailed description of one will suffice for both. Carried by a horizontal plate 10 suitably mounted on the forward portion of the truck frame is an upstanding bracket 11 having top and bottom lateral ears 12 which support vertical pivot shafts 13, the latter spaced equidistantly from the center of the circular bracket base which is rigidly secured to the plate. Swivelly mounted on the pivot shafts respectively are supports 14 and 15 swingable in horizontal planes.

The outer swiveled support 14 has pivotally mounted thereon at 16, near its upper end, the rear end of an elongated boom frame or jib 17 which extends outwardly in advance of the mobile base. This boom frame may swing horizontally with the swiveled support 14 and may swing in a vertical plane relative to the swiveled support. Also, pivotally mounted at 18 on the swiveled support 14, near its lower end, is an extensible power operated adjusting device or elevating jack 19 having its outer end pivotally connected at 20 to the lower portion of the boom frame or jib 17 as shown in Fig. 3. This extensible device 19 comprises a fluid cylinder 21 having lugs 22 on its rear head pivotally engaging a horizontal pivot pin 23 in turn supported by lugs 24 integral with the lower portion of the swiveled support 14. Contained in the cylinder 21 is a reciprocable piston 25 having its piston rod 26 extending forwardly outwardly through a packed front cylinder head 27, and the piston rod is pivotally connected to a horizontal pivot pin 28 carried by a split outer sleeve 29, the latter surrounding and fixed to the outer end portion of the boom frame 17. A collapsible bellows type housing 30 encloses a portion of the piston rod to prevent access of dirt to the slidingly engaging surfaces of the piston rod and the front cylinder head.

As shown in Fig. 4, pivotally mounted at 32 at the upper end of the swiveled support 15 is an extensible power operated adjusting device or swing jack 33 having its outer end universally pivotally connected at 34 to the outer end of the boom frame 17. This adjusting device comprises a fluid cylinder 35 having a rearward lug 36 pivotally engaging a horizontal pivot bolt 37 carried by lugs 38 integral with the upper portion of the support 15. Contained in this cylinder is a reciprocable piston 39 having its piston rod 40 extending forwardly through a packed front cylinder head 41 and pivotally engaging a horizontal pivot bolt 42 carried by a horizontally swingable member 43 in turn pivotally engaging a vertical pivot pin 44, the latter carried by lugs 45 integral with the sleeve 29. Thus, universal pivotal connections are provided at both ends of the swing cylinder.

Fig. 5 is an enlarged longitudinal vertical section taken on line 5—5 of Fig. 4, showing the improved adjustable drill jib support 46.
A collapsible bellows-type housing 45, similar to the hous ing 30, serves to protect the piston rod surface from dirt.

The boom frame and the extensible adjusting devices cooperate to provide a trippodlike, three-armed supporting structure for the drilling tool, thus, not only rendering it rigid in rigidity, but also in flexibility of adjustment, as will hereinafter become apparent.

When fluid under pressure is properly supplied to the cylinders 21 and 35, the boom frame may be swung either in a vertical plane or horizontally, as desired, and by tripping or lifting the fluid in the cylinders, the boom frame may be rigidly held in adjusted position. Rigidity of support is provided by the trippodlike or three-armed arrangement of the boom frame and the cylinder and piston devices, the cylinder and piston device constituting armlike members which are adjustable in effective length thereby to affect swinging of the boom frame.

The boom frame or jib 17 is desirably of elongated, tubular, cylindrical form and telescopically arranged within the boom frame is an elongated cylindrical support 47 which may be adjusted axially relative to the boom frame to vary the distance of overhang of the adjustable support with respect to the base. For adjusting the support axially, the latter has a rack 48 secured thereto and a spur pinion 49 suitably mounted within the sleeve 29 engages the rack teeth and is rotatable in any appropriate manner. Evidently, if desired, the support 47 which projects rearwardly from the boom frame may be rigidly secured to the boom frame, and the telescopic adjustable mounting of the support may be omitted since it does not per se enter into the present invention.

The outer end portion of the support 47 in advance of the boom has a sleeve-like member or tubular support 50 rotating about the longitudinal axis A of the boom frame (Figs. 5, 6, 7 and 8) and a screw 51 projects into an annular groove 52 at the outer end of the support 47 to hold the rotatable support against outward axial displacement. The sleeve portion of the support member 50 is split or otherwise formed at 53 to provide for a clamp and a bolt 54 is provided to tighten the clamp firmly to grip the support thereby to hold the support member against rotation.

The rotatable support member 50 has a transverse bore 55 located outwardly in advance of the boom frame and wherein serially a cylindrical portion 56 of an outer support 57 swiveling about a pivot axis B disposed at right angles to the longitudinal boom axis A (Figs. 5, 6, 7 and 8), and a clamp 58, when tightened by bolts 59, grips the tubular portion 56 to hold the swiveling support 57 firmly in adjusted position. The outer portion of the support 57 has a clamp 60 which receives a transverse cylindrical portion 61 of a lateral swingable arm 62 whereby the latter may swing about an axis C arranged at right angles to a line parallel with the pivot axis B of the support member 57 (Figs. 5, 6, 7 and 8). The clamp 60 is adapted to be tightened by a bolt 63 and is adapted to grip the cylindrical portion 61 to hold the arm 62 firmly in adjusted position. The outer portion of the arm 62 carries an adjustable clamp 64 which is adjusted by bolts 65 and which is adjustable into engagement with lateral flanges 66 of an elongated drill guide frame 67 longitudinally along which the hammer drilling tool 5 is guided for movement. A conventional pneumatic feed motor 68 carried by the guide frame 67 serves to effect feed of the drilling tool in a well-known manner. By releasing the clamp 64 the guide frame may be adjusted endwise relative to the arm 62, as desired.

Referring to the hydraulic fluid system shown diagrammatically in Fig. 10, it will be noted that a conventional motor driven hydraulic pump 70 has its suction side connected by a conduit 71 to a tank or reservoir 72 which herein desirably contains a liquid such as a light oil. The pump discharge is connected by conduit 73 and branch conduits 73' to conventional rotary four-way valves 74 and 75. These valves are connected by branch conduits 71 of a discharge conduit 71' leading back to the tank, and connected in the discharge conduit is a relief valve 76 set to open at a predetermined pressure in the system. Conventionally, the conduits 77 and 14 connect the valve 74 to the opposite ends of the lift cylinder 21 and conduits 78 and 79 connect the valve 75 to the opposite ends of the swing cylinder 35. Thus, by suitably manipulating the rotary control valves 74 and 75 either drill jib 17 may be swung horizontally or vertically about its pivots as desired, and by closing the valves to trap liquid in the cylinders 21 and 35 the jib may be rigidly held in adjusted position. The hydraulic system and control valve arrangement for the other jib mounting is identical to that above described.

The general mode of use of the improved drill jib mounting is as follows: The drilling apparatus may be propelled over the ground from one working place to another by the self-propelled mobile base and when the drilling tools are located in adjacency to the work the valves 74 and 75 may be properly positioned by the operator to effect swinging of the drill jibs either horizontally or vertically to locate the drilling tools as desired with respect to the work, in the manner shown in full and dotted lines in Figs. 1 and 2. By loosening the clamp 53 for the rotatable support 59 the swingable arm 62 of either jib may be located in any desired position along the longitudinal axis A of the boom frame 17, and when the arm 62 is located in a downward position beneath the boom frame, as shown in Fig. 5, the drill guide frame 67 may be disposed in close relation to the ground to enable flat hole drilling, and, in tunnel work, the adjustable arm enables positioning of the drilling tools close to the corners at either the roof or the floor level. The several swivelled supports 50, 57 and 62 may be adjusted about the axes A, B and C with respect to the boom frame to locate the guide frames not only in different horizontal positions but also in positions at substantial angles with respect to the horizontal, and even in vertical positions. Moreover, by loosening the clamp 64 the guide frame may have endwise adjustment with respect to its mounting structure further to increase the range of adjustment of the drilling tools. Thus, by proper adjustment of the lift and swing cylinders 21 and 35 and the swiveled supporting structure 59, 57 and 62, the drilling tools may be located in practically any position with respect to the working face. By tightening the several clamps for the swiveled supports the guide frame may be rigidly locked in adjusted position with respect to its respective boom frame.

As a result of this invention, an improved adjustable drill jib mounting is provided whereby the pivotal boom of the jib may be adjusted by power operated devices either vertically or horizontally and firmly held in adjusted position. The extensible adjusting devices connected to the outer end of the boom of each jib not only enables ready adjustment of the jib boom but also provides an extremely rigid, tripod-like support for the drill whereby vibration set up within the apparatus during drilling is maintained at a minimum. The extremely flexible arrangement of the several swiveled supports at the outer extremity of each jib enables adjustment of the drilling tools into various angular positions with respect to the jib booms, thus enabling positioning of the tools close to the ground, and, in tunnel work, in the corners either at the roof of floor level. The jib mounting is simple and rugged in design, well adapted to meet the severe conditions of service. These and other advantages of the invention will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration and that the invention may be modified and embodied in various other forms with-
out departing from its spirit or the scope of the appended claims.

What we claim as new and desire to secure by Letters Patent is:

1. In an adjustable tool supporting structure, the combination comprising a support carrying an upstanding bracket, parallel upright pivot shafts carried at the opposite sides of said bracket, frame structures independently swivelly mounted on said pivot shafts respectively, a boom frame pivotally mounted at its rear end on the upper portion of one of said swiveled frame structures to swing in vertical planes, a fluid operated cylinder and piston device connected between the lower portion of said one swiveled frame structure and the outer end of said boom frame for swinging the latter in vertical planes, and a fluid operated cylinder and piston device pivotally connected to the upper portion of said other swiveled frame structure and to said outer end of said boom frame for swinging the latter in horizontal planes.

2. In an adjustable tool support, the combination comprising an upstanding support member, parallel upright pivot elements carried at the opposite sides of said support member, frame structures independently swivelly mounted on said pivot elements respectively, a boom frame pivotally mounted at its rear end on the upper portion of one of said swiveled frame structures to swing in vertical planes, an extensible power device connected between the lower portion of said one swiveled frame structure and the outer end of said boom frame for swinging the latter in vertical planes, and an extensible power device pivotally connected to the upper portion of said other swiveled frame structure and to the outer end of said boom frame for swinging the latter in horizontal planes.

3. In an adjustable support for a drilling tool, the combination comprising a frame, an elongated support of tripodlike, three-armed construction mounted on and overhanging said frame and carrying supporting means at its outer extremity adapted to carry a drilling tool, said support comprising three boomlike arms, means for pivotally mounting the inner extremities of said arms of said support on said frame to swing both in horizontal and vertical planes relative to said frame, one of said arms being rigid and the other two being adjustable in length, and the vertical pivot of said rigid arm and one of said adjustable arms lying in a common vertical plane, and the vertical pivot for said other adjustable arm disposed in parallelism with said vertical pivots, said support including a common support member which is swiveled on said frame to turn about a vertical axis and providing said vertical pivots for said rigid arm and said one of said adjustable arms, and means for differently adjusting said adjustable arms of said support to vary their effective lengths to effect swing of said elongated support either in horizontal or vertical planes, the adjustment of one of said adjustable arms effecting swing of said support in said one direction and the adjustment of said other adjustable arm effecting swing of said support in said other direction.

4. An adjustable tool support as set forth in claim 3 wherein said frame has upper and lower horizontal projections supporting a vertical pivot element and said support which is swiveled on said frame is pivotally mounted on said vertical pivot element between said projections.

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