Oct. 21, 1952 J. C. CURTIS 2,614,807

ROCK DRILLING APPARATUS

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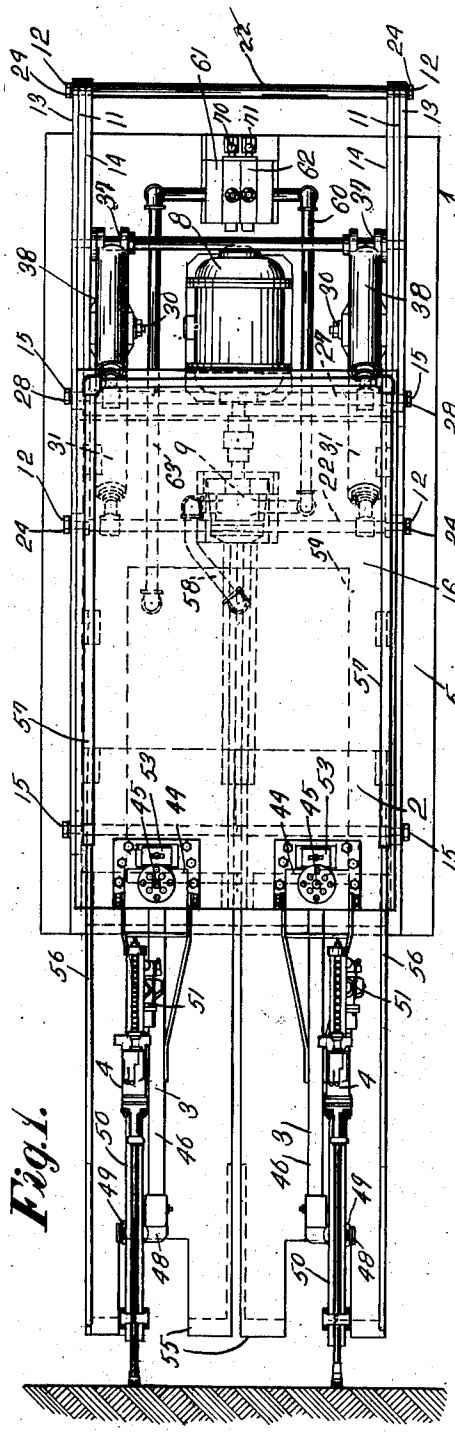


Fig. 1.

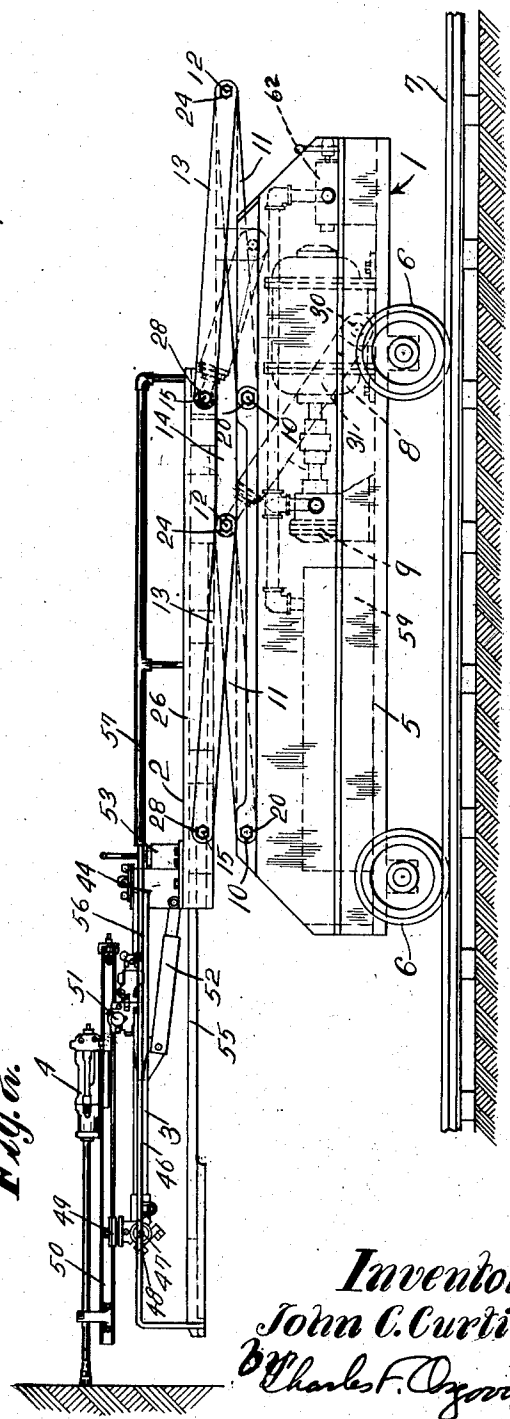


Fig. 2.

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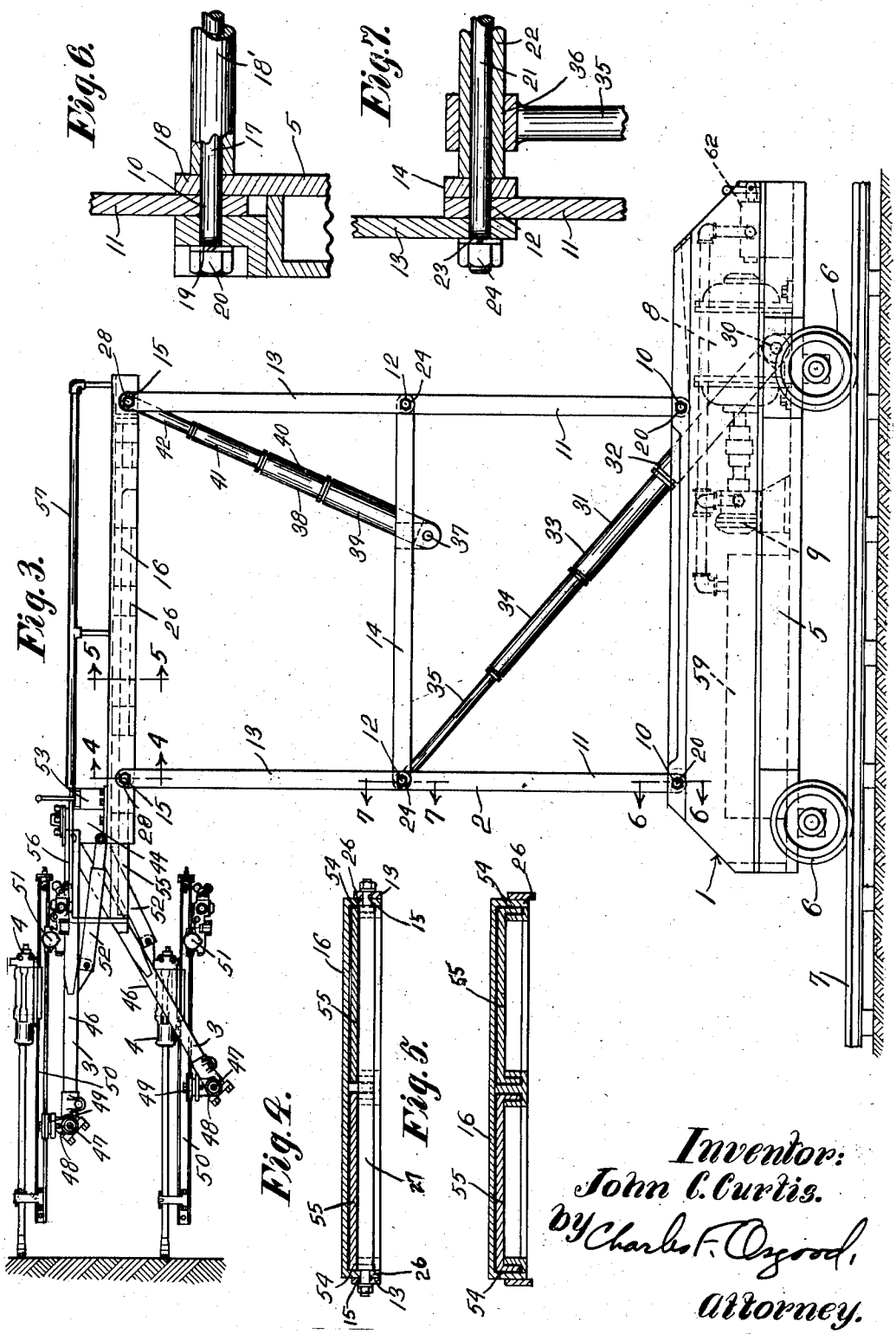


Fig. 6.

Fig. 7.

Fig. 3.

Fig. 4.

Fig. 5.

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Fig. 8.

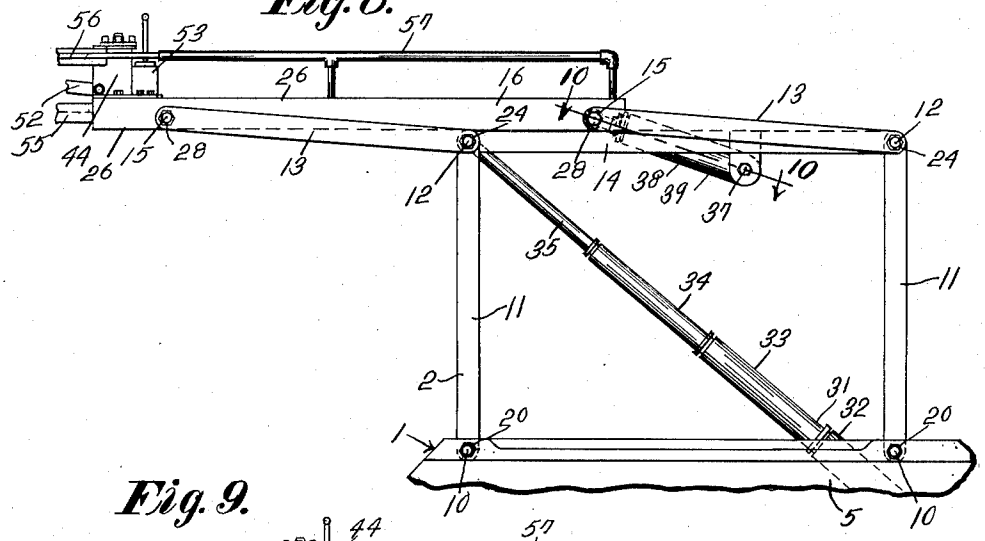


Fig. 9.

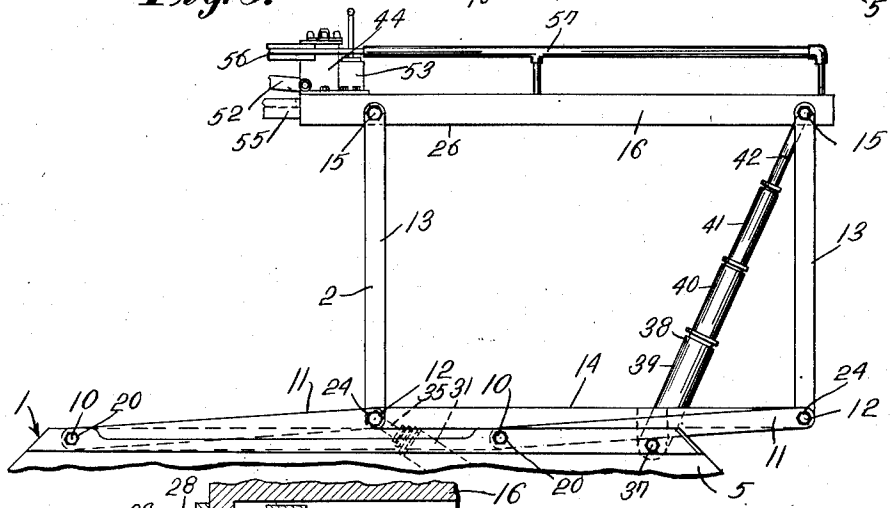
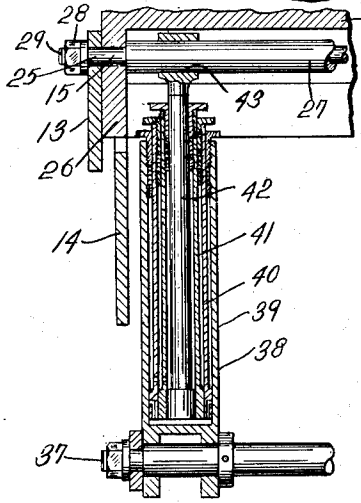


Fig. 10.



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ROCK DRILLING APPARATUS

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Fig. 11.

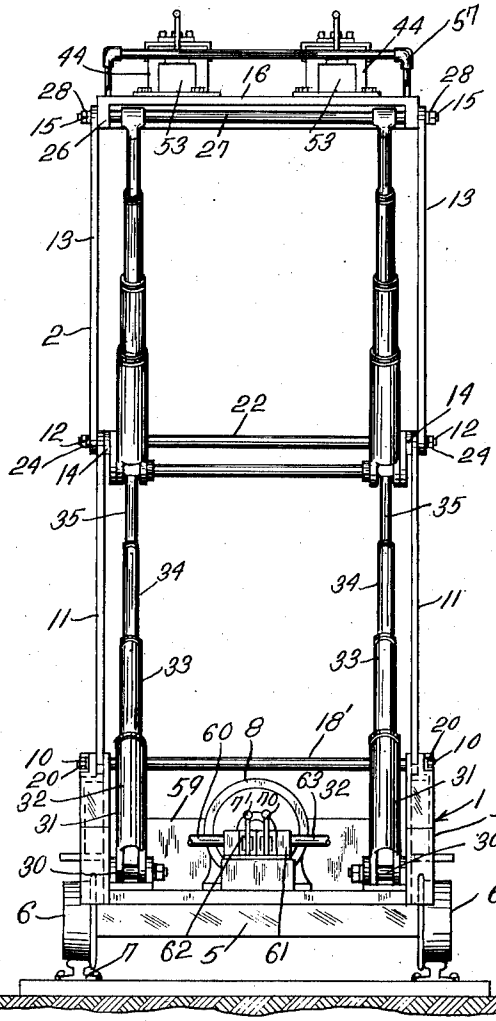
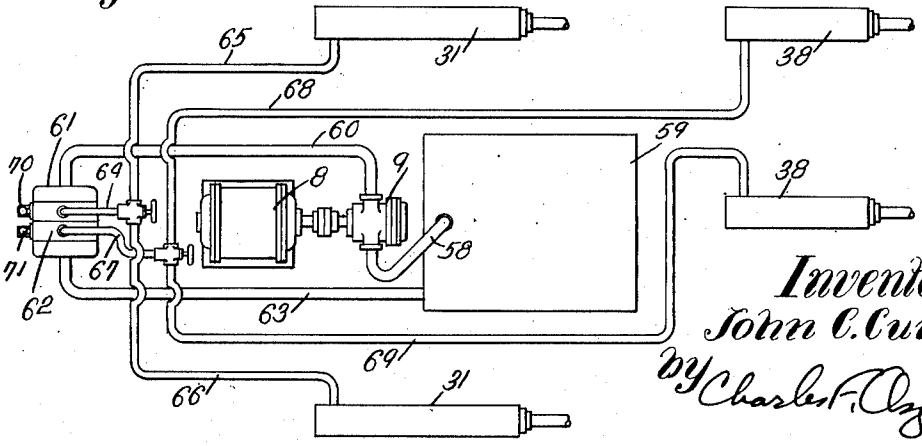


Fig. 12.



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Patented Oct. 21, 1952

2,614,807

UNITED STATES PATENT OFFICE

2,614,807

ROCK DRILLING APPARATUS

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Application October 21, 1947, Serial No. 781,149

7 Claims. (Cl. 255—51)

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This invention relates to rock drilling apparatus and more particularly to an improved adjustable supporting structure for hammer rock drills whereby the drilling tools may be supported in various positions with respect to the work.

In portable rock drilling apparatus especially designed for use in underground mines or tunnels, one or more drill mountings, such as swiveled drill jibs or booms, are mounted on a portable base and carry a drilling tool or tools for adjustment laterally and in vertical planes relative to the base, thereby to support the drilling tool or tools to drill holes at various locations with respect to the working face. Such known types of drilling apparatus, however, either have a relatively limited range of adjustment in vertical planes or have vertical guide frames of relatively great height which prevent ready transport of the apparatus through the relatively restricted spaces and sharply curved passageways such as are encountered in underground mines or tunnels. The present invention contemplates improvements over previous devices in that an extensible elevating structure is provided for the drill mountings for adjusting the latter through a relatively wide range from a relatively low position near the top of the base to a relatively high position a substantial distance above the top of the base and so arranged and constructed that it may be collapsed into a relatively compact lowered position at the top of the base so that transport of the apparatus in underground mines or tunnels is facilitated. The present invention not only provides an elevating structure which has a relatively wide range of adjustment in vertical planes but which also embodies parallel motion arms or links for maintaining the support for the swiveled drill mountings in a substantially horizontal position irrespective of the elevation thereof, thereby to maintain the swivel axes of the drill mountings always substantially vertical.

An object of this invention is to provide an improved rock drilling apparatus. Another object is to provide an improved adjustable supporting structure for hammer rock drills. A further object is to provide an improved adjustable supporting structure for an adjustable drill mounting such as a swivelled drill jib whereby the drill jib may be supported in various elevated positions with respect to the work. Yet another object is to provide an improved rock drill supporting structure having a relatively wide range of vertical adjustment. A still further object is to provide an improved hydraulically operated supporting structure for a rock drill whereby the drilling tool may be easily and quickly adjusted through a relatively wide range. Another object is to provide an improved drill supporting structure of the parallel arm or link type whereby a drilling tool may be elevated through a relatively wide range while the same is maintained in a horizontal drilling position. A still further object is to provide an improved parallel motion supporting structure for a swiveled rock drill jib whereby the swivel axis of the drill jib is always maintained vertical irrespective of the elevated position thereof. Another object to provide an improved hydraulically operated elevating mechanism for a rock drill. Yet another object is to provide an improved rock drilling apparatus having a novel arrangement and combination of parts. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

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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 top plan view of a rock drilling apparatus constructed in accordance with an illustrative embodiment of the invention.

Fig. 2 is a side elevational view of the drilling apparatus shown in Fig. 1, with the drilling tools in a lowered position.

Fig. 3 is a side elevational view showing the drilling tools in elevated positions, with one jib swung downwardly.

Figs. 4 and 5 are cross-sectional views taken respectively on lines 4—4 and 5—5 of Fig. 3, showing details of the slidable platforms and the front upper arm pivot.

Figs. 6 and 7 are enlarged detail sectional views taken respectively on lines 6—6 and 7—7 of Fig. 3, and illustrating the pivot constructions.

Fig. 8 is a side elevational view showing the lower parallel arms of the adjustable supporting structure in elevated position.

Fig. 9 is a view similar to Fig. 8, with the upper parallel arms of the supporting structure in elevated position.

Fig. 10 is an enlarged sectional view taken substantially on line 10—10 of Fig. 8, showing details of one of the telescopic jacks.

Fig. 11 is a rear end elevational view of the drilling apparatus shown in Fig. 3, with the drilling tools in an elevated position.

Fig. 12 is a diagrammatic view illustrating the hydraulic fluid system.

In this illustrative construction, as shown in the drawings, the improved rock drilling appa-

ratus, generally designated 1, is of the track wheel mounted type adapted to travel along a trackway, and includes an adjustable supporting structure 2 for a pair of adjustable drill mountings, herein a pair of swiveled drill jibs 3, 3 which support a pair of hammer drilling tools 4, 4. It will be evident, however, that the drilling apparatus may be mounted in other manners and may include only one or several drill mountings or jibs.

The rock drilling apparatus, as shown herein, comprises a truck frame 5 mounted on track wheels 6, 6 adapted to travel along a trackway 7. Carried by the truck frame is a motor 8 driving a pump 9 for a purpose to be later explained. Pivotally mounted at 10, 10 at the sides of the truck frame are pairs of parallel lower supporting arms or links 11, 11 which are pivotally connected at 12, 12 to pairs of parallel upper supporting arms or links 13, 13. The adjacent ends of the upper and lower supporting arms are connected at their pivots by parallel side links 14. The upper ends of the arms 13, 13 are pivotally connected at 15, 15 to a horizontal platform 16 which carries the swiveled drill mountings or jibs 3, 3. Thus, a double parallel motion arm structure is provided for supporting the jib carrying platform 16 so that the latter is maintained horizontal irrespective of its elevated position. As a result of this parallel motion structure, the swivel axes of the drill jibs are always maintained vertical regardless of the elevated position of the jibs.

In this improved construction, the lower supporting arms 11, 11 are pivotally mounted, as shown in Fig. 6, on horizontal bolts 17 passing through openings in vertical side plates 18 of the truck frame, and surrounding these bolts and extending between the inner sides of the side plates are spacing sleeves 18'. Threaded at 19 at the outer ends of the bolts are tightening nuts 20. The pivots 12, 12 between the upper and lower supporting arms include bolts 21 surrounded by spacing sleeves 22 extending between the inner sides of the arms, and threaded at 23 at the outer ends of the bolts are tightening nuts 24, as shown in Fig. 7. As shown in Fig. 10, the pivots 15, 15 at the upper ends of the upper arms 13 include bolts 25 passing through openings in side frames 26 of the platform 16, and surrounding these bolts and extending between the inner sides of the platform are spacing sleeves 27. Tightening nuts 28 are threaded at 29 at the ends of the bolts. The nuts of the bolts of the several pivots, when tightened, serve to clamp the arms and associated parts rigidly in adjusted position in a manner necessary in a hammer drilling apparatus wherein considerable vibration is set up within the apparatus during the drilling operation. Pivotally mounted at 30 on the truck frame just rearwardly of the rear wheel axes are telescopic hydraulic jacks 31, 31, each comprising telescopic jack sections 32, 33, 34 comprising cylinder and piston rod portions, with the cylinders thereof carrying suitable packings to prevent leakage. The outer piston rod 35 is pivotally connected at 36 to the forward bolt 21 in the manner shown in Fig. 7. Pivotally mounted at 37 on a spacing sleeve surrounding a cross bolt connected to the side links 14 are telescopic hydraulic jacks 38 each comprising a series of jack sections 39, 40, 41 including cylinder and piston rod portions, with the cylinders thereof carrying suitable packings to prevent leakage. The upper piston rod 42 is pivotally connected at 43, as shown in Fig. 10, on the rear spacing sleeve 27.

The drill mountings or jibs 3, 3 mounted on the horizontal platform 16 may be of the hydraulically operated type similar to those disclosed in my copending application, Serial No. 563,579, filed November 15, 1944, now matured into Patent No. 2,500,931, granted on March 21, 1950, and includes frames 44 swiveled on parallel upright axes 45 and having pivotally mounted thereon jibs or booms 46. Pivotally mounted at 47 at the outer ends of the jibs are supports 48 carrying clamps 49 to which guide frames 50 are secured. The drilling tools 4 are slidably guided on these guide frames and may be fed back and forth relative thereto by suitable motors 51. Hydraulic jacks 52 are pivotally connected to the swiveled frames and to the lower sides of the jibs for swinging the jibs in a vertical direction about their pivots. Suitable hand operated pumps 53 mounted on the swiveled frame serve to supply liquid under pressure to these jacks. As these drill jib structures are clearly disclosed in the application above referred to and do not per se enter into the present invention, further description thereof herein is considered unnecessary other than to state that the drilling tools may be adjusted in horizontal and vertical directions relative to the platform 16. Slidably guided in guideways 54 on the platform 16 in the manner shown in Fig. 5 are extensible platforms 55 which may be extended outwardly beneath the drill jibs in the manner shown in Fig. 3, to provide supports on which the drill operators may stand. Telescopic side frames 56, 57, attached to the outer sides of the sliding platforms 55 and to the platform 16, serve to guide the slidable platforms and to provide protective side rails for the platforms in the manner shown.

Now referring to the hydraulic fluid system shown in Fig. 10, it will be noted that the pump 9 driven by the motor 8 has its intake connected by a conduit 58 to a tank 59 carried by the truck frame, and the discharge side of the pump is connected by a conduit 60 to the pressure passage of a valve box 61 of a conventional slide valve mechanism 62, also mounted on the rear end of the truck frame. The discharge passage of the valve box is connected by a return conduit 63 back to the tank. Leading from the valve box is a conduit 64 connected through branch conduits 65 and 66 to the lower ends of the hydraulic jacks 31. A conduit 67 is connected through branch conduits 68 and 69 to the lower end of the hydraulic jacks 38. Conventional hand operated slide valves 70 and 71, contained in the valve box, are provided for controlling flow of liquid from the pressure passage of the valve box to these jacks, and these valves may be positioned to connect the jacks through the discharge passage of the valve box back to the tank. Thus the upper and lower jacks may be operated independently or concurrently, as desired, and when the valves are properly positioned, the liquid may be trapped in the jacks to lock the parts in adjusted position.

The rock drilling apparatus may be transported from place to place in any suitable manner either by suitable towing means or by its own self-contained propelling means, as desired. The truck wheels may be provided with suitable brakes, or suitable rail clamps may be employed, so that when the working place is reached, the apparatus may be secured in a stationary working position. In Figs. 1 and 2, the apparatus is shown in drilling position with respect to a working face, with the parallel arms of the adjustable supporting structure folded down onto the truck

and with the drill jibs in a horizontal position, thereby to support the drilling tools to drill holes above the floor. When desired, either or both of the drill jibs may be swung downwardly from the position shown in Fig. 3 to locate the drilling tools near the floor. When drilling at a higher level is desired, either of the pairs of jacks 31 or 38 may be operated to swing either the lower arms 11, 11, as shown in Fig. 8, or the upper arms 13, 13, as shown in Fig. 9, into an upright position. If a still higher drilling position is desired, both pairs of jacks 31 and 38 may be concurrently operated to move both the upper and lower arms into the vertical position shown in Figs. 3 and 11. Evidently, the pairs of parallel arms may be swung into any desired intermediate position between their lowered folded position shown in Fig. 2 and their raised upright position shown in Fig. 3 to locate the drill jibs in any desired intermediate position. When the arms are suitably adjusted, the liquid may be trapped in the jacks by the control valves to lock the parts in position, and the several bolts at the arm pivots may be tightened firmly to clamp the parts. It will also be evident that during transport the drill jib may be swung over the truck frame so that when the sliding platforms 55 are slid inwardly beneath the jib-supporting platform 16, extreme longitudinal compactness is attained, thereby to facilitate movement of the apparatus through relatively restricted spaces and around sharp curves such as are encountered in underground mines or tunnels.

In lieu of the telescopic hydraulic jacks disclosed, it will be evident that other forms of extensible power devices may be employed to swing the arms, and, under certain conditions, power operated jacks of the screw type may be used. Also, instead of using separate hand pumps for the drill jibs 3, 3, liquid under pressure may be supplied thereto from the pump 9.

As a result of this invention, an improved rock drilling apparatus is provided which may be easily and quickly adjusted through a relatively wide range to enable drilling at different elevations. By the provision of the parallel arm or link supporting structure, the drill supporting platform is always maintained in a substantially horizontal position irrespective of its elevation. By mounting a pair of adjustable drill mountings or jibs of the character disclosed on the adjustable platform, the drilling tools may be adjusted through a relatively wide range both vertically and laterally in any position of adjustment of the platform. The particular arrangement of the adjustable supporting structure not only provides a relatively wide range of adjustment but also extreme compactness is attained during transport. 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 the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

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

1. In a drilling apparatus, a portable base, a horizontal frame overlying said base, a drill mounting on said frame providing a support for a drilling tool, and an adjustable supporting structure mounted on said base and carrying said frame and adjustable to elevate said frame from a position lying close to the top of said base to a position a substantial distance above said base, said supporting structure comprising a pair of parallel arms pivotally connected at one end to said base, an intermediate frame connecting the opposite ends of said arms for maintaining the same in parallelism, a second pair of parallel arms pivotally connected at one end to said opposite ends of said first pair of arms, said second pair of arms pivotally connected at their opposite ends to said horizontal frame, an extensible power device connected between said base and said intermediate frame for swinging said first pair of arms about their pivots relative to said base, and an extensible power device connected between said intermediate frame and said horizontal frame for swinging said second pair of arms about their pivots relative to said first pair of arms.

2. In a drilling apparatus, a portable base, a horizontal frame overlying said base, a drill mounting on said frame providing a support for a drilling tool, and an adjustable supporting structure mounted on said base and carrying said frame and adjustable to elevate said frame from a position lying close to the top of said base to a position a substantial distance above said base, said supporting structure comprising a pair of parallel supporting elements pivotally mounted at one end on said base, an intermediate frame connecting the opposite ends of said supporting elements for maintaining the same in parallelism, a second pair of parallel supporting elements pivotally connected at one end to said opposite ends of said first parallel supporting elements, said second parallel supporting elements pivotally connected at their opposite ends to said horizontal frame, an extensible power device connected to certain of one pair of said parallel supporting elements for effecting adjustment of the latter to raise said horizontal frame through a predetermined distance, and a cooperating extensible power device connected to certain of said other pair of said parallel supporting elements for effecting adjustment of the latter to complete the elevation of said horizontal frame.

3. In a drilling apparatus, a portable base, a horizontal frame overlying said base, a drill mounting on said frame providing a support for a drilling tool, and an adjustable supporting structure mounted on said base and carrying said frame for elevating the latter from a lowered position close to the top of said base to a raised position a substantial distance above said base, said supporting structure including a lower pair of arms pivotally connected at one end to said base on parallel transverse axes, an intermediate frame connecting the opposite ends of said parallel arms, a second upper pair of arms pivotally connected at one end to said opposite ends of said first arms to swing about parallel axes which are parallel to said first mentioned axes, said upper pair of arms pivotally connected at their opposite ends to said horizontal frame, and said pairs of arms folding down close to the top of said base when said horizontal frame is lowered and said pairs of arms disposed substantially vertical with said arms of one pair in substantial alignment with the arms of said other pair when said horizontal frame is elevated, and said intermediate frame lying between said horizontal frame and said base when said horizontal frame is in lowered position close to said base, and adjusting devices connected to said pairs of arms

respectively for swinging said arms about their pivots.

4. In a drilling apparatus, a portable base, a horizontal frame overlying said base, a drill mounting on said frame providing a support for a drilling tool, and an adjustable supporting structure mounted on said base and carrying said frame for elevating the latter from its lowered position close to the top of said base to its raised position a substantial distance above said base, said supporting structure including a pair of parallel arms pivotally connected at one end to said base to swing about parallel transverse axes, an intermediate frame connecting the opposite ends of said arms, a second pair of arms pivotally connected at one end to said opposite ends of said first pair of arms to swing about parallel axes parallel to said first mentioned axes, said second pair of arms pivotally connected at their opposite ends to said horizontal frame, said pairs of arms when said horizontal frame is lowered folding down close to the base beneath said horizontal frame, a fluid operated jack connected between said base and said intermediate frame for swinging said first pair of arms about their pivots, a fluid operated jack connected between said intermediate frame and said horizontal frame for swinging said second pair of arms about their pivots, a pressure fluid source on said base, and valve means for effecting fluid supply from said source to said jacks and for venting said jacks.

5. In a drilling apparatus, a portable base, a drill mounting providing a support for a drilling tool, and an adjustable supporting structure mounted on said base and carrying said drill mounting for elevating the latter from a lowered position close to the top of said base to a raised position a substantial distance above said base, said supporting structure comprising a swingable arm structure pivotally connected to said base to swing in vertical planes, a second swingable arm structure pivotally connected to the free end of said first arm structure, to swing in vertical planes, an intermediate frame connecting the adjacent ends of said swingable arm structures, said second swingable arm structure adjustable in elevation with said first arm structure, fluid operated devices connected to said arm structures and to said base and intermediate frame respectively for respectively swinging said arm structures about their respective pivots and acting cumulatively to effect full adjustment of said supporting structure between its lowered and raised positions, a fluid source on said base, and valve means for controlling the fluid supply from said source to said devices respectively to effect operation of the latter as aforesaid.

6. In a drilling apparatus, a portable base, a drill mounting providing a support for a drilling tool, and an adjustable supporting structure mounted on said base for elevating said drill mounting from a lowered position close to the top of said base to a raised position a substantial distance above said base, said supporting structure including pairs of coacting links pivotally connected together, an intermediate frame mounted at the points of connection of the adjacent ends of said coacting links, one pair of links pivotally mounted on said base and the other pair of links pivotally connected to said drill mounting, said links arranged to fold together close to the base when said tool support is in lowered position, a power device connected to said one pair of links and to said base for swinging said one pair of links relative to the base to effect adjustment in elevation of both pairs, a power device adjustable in elevation with said one pair of links and connected to said other pair of links and said intermediate frame for swinging said other pair of links relative thereto, and control means for effecting operation of said power devices whereby the latter effect cumulatively the full adjustment of said supporting structure between its lowered and its raised positions.

7. In a drilling apparatus, a portable base, a support for a drilling tool, and an adjustable supporting structure mounted on said base and carrying said tool support and adjustable to elevate said tool support from a position lying close to the top of said base to a position a substantial distance above said base, said supporting structure comprising a pair of parallel supporting elements pivotally mounted at one end on said base to swing in vertical planes, an intermediate frame connecting opposite ends of said supporting elements for maintaining the same in parallelism, a second pair of parallel supporting elements pivotally connected at one end to said opposite ends of said first parallel supporting elements to swing in vertical planes, said second parallel supporting elements pivotally connected at their opposite ends to said tool support, said supporting elements arranged to fold together close to the base when said tool support is in lowered position, an extensible power device connected to said base and said intermediate frame for effecting adjustment of said first pair of said parallel supporting elements to raise said tool support through a predetermined distance, and a cooperating extensible power device connected to said intermediate frame and said tool support for effecting adjustment of said second pair of parallel supporting elements to complete the elevation of said tool support, and control means for said power devices whereby the latter cumulatively effect full adjustment of said supporting structure between its lowered and raised positions.

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