

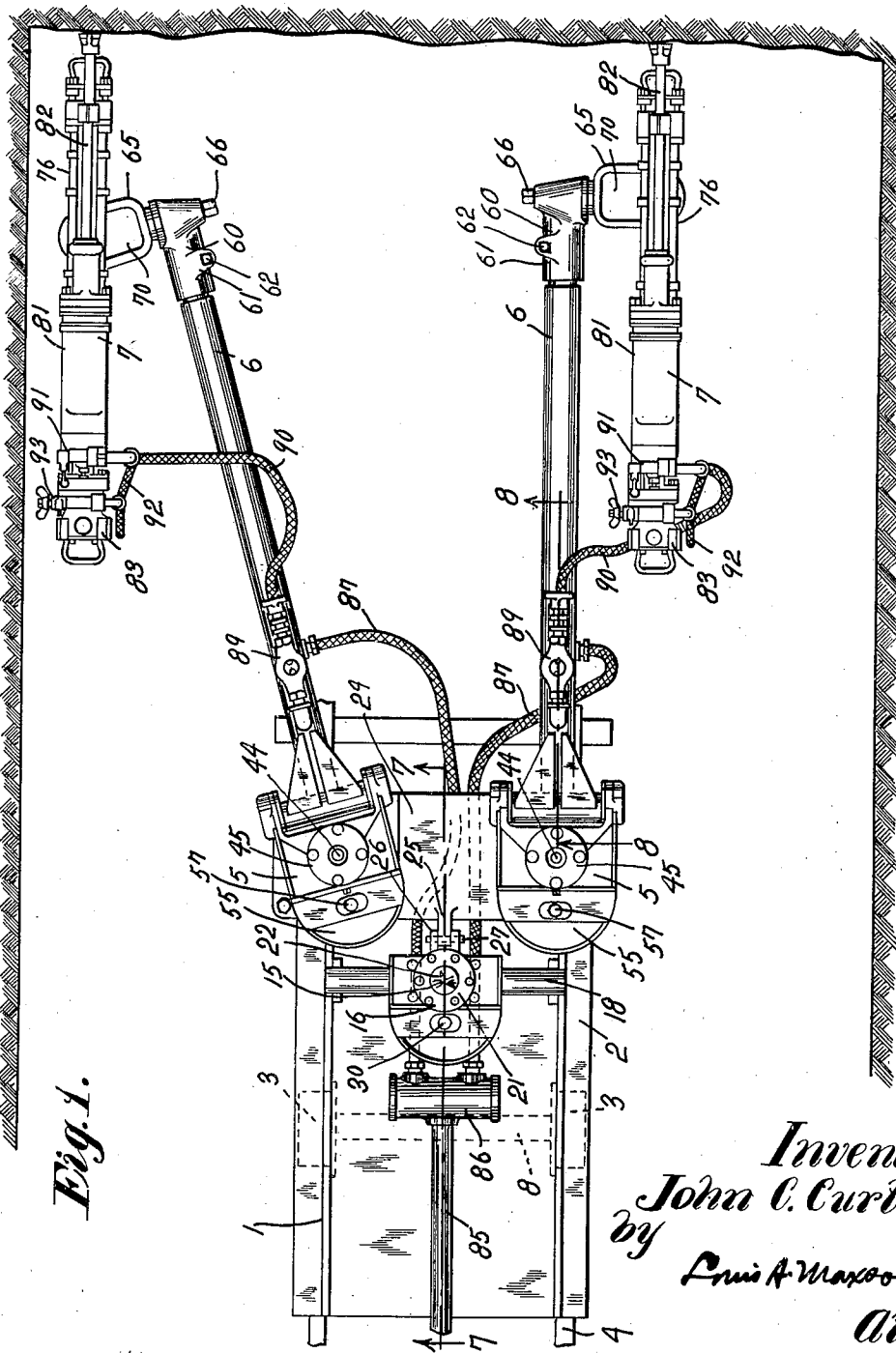
March 21, 1950

J. C. CURTIS
DRILLING APPARATUS

2,500,931

Filed Nov. 15, 1944

5 Sheets-Sheet 1



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Fig. 2a.

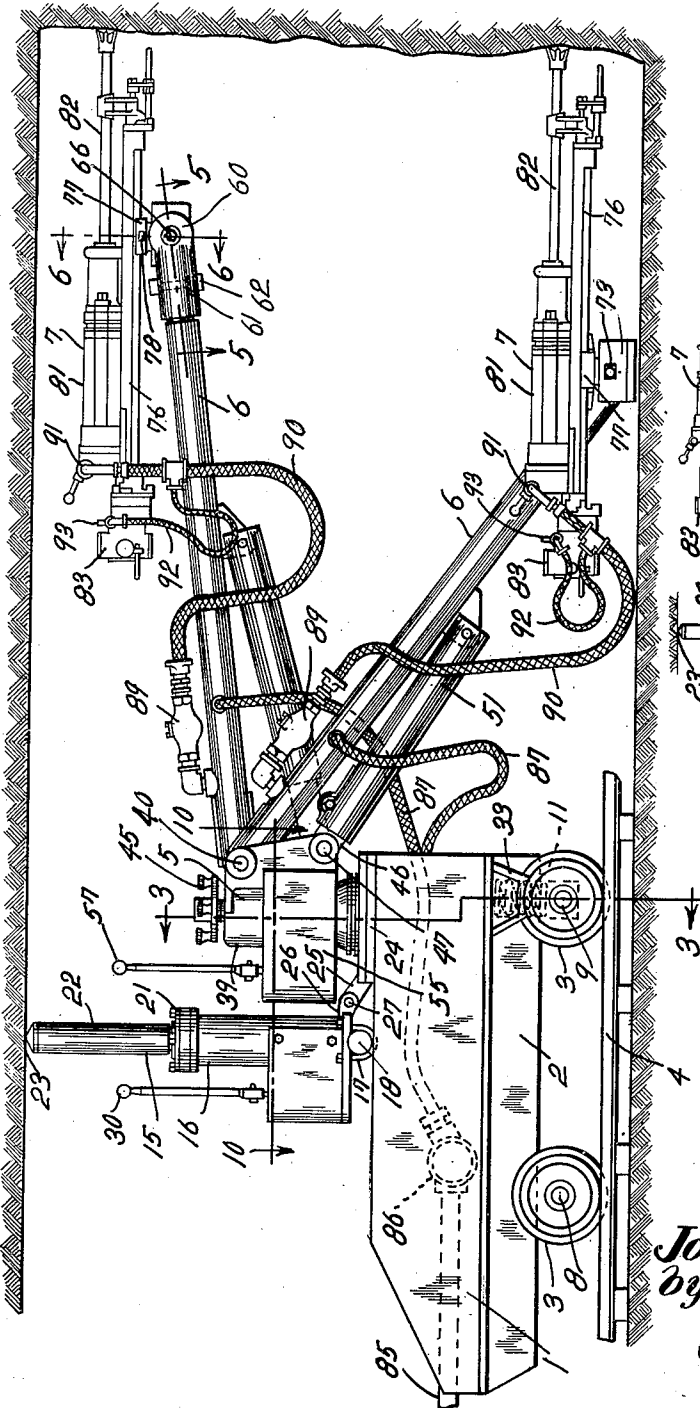
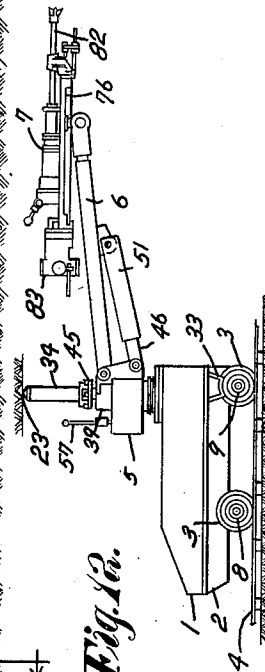


Fig. 2b.



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Fig. 3.

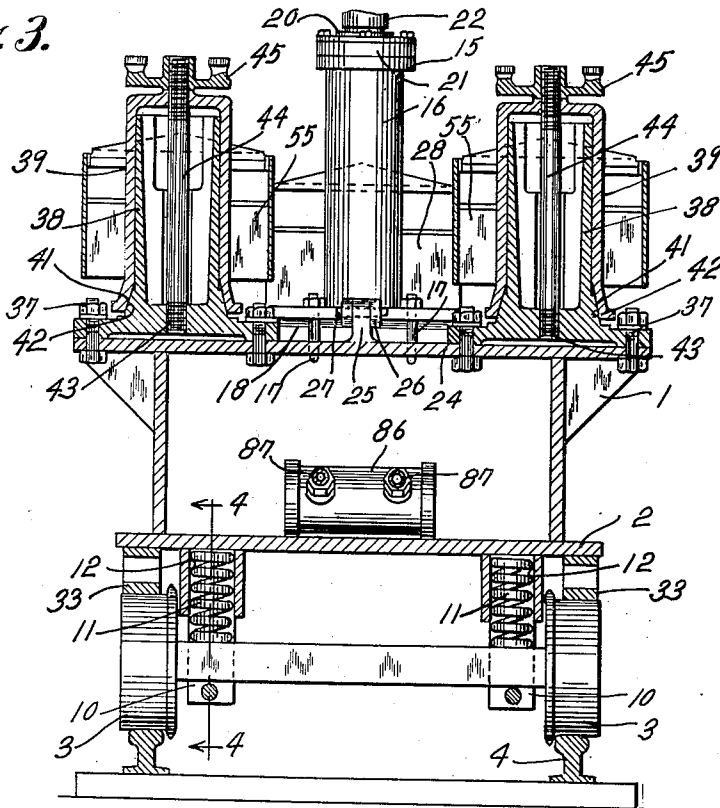


Fig. 4.

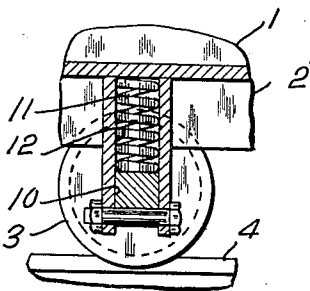


Fig. 5.

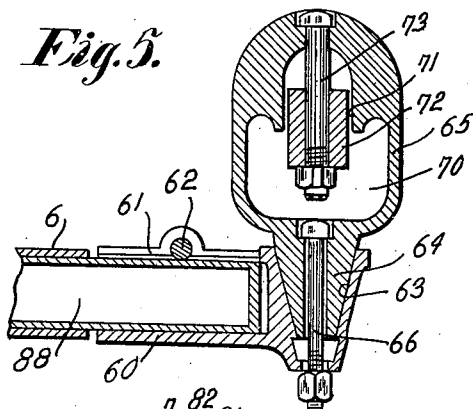
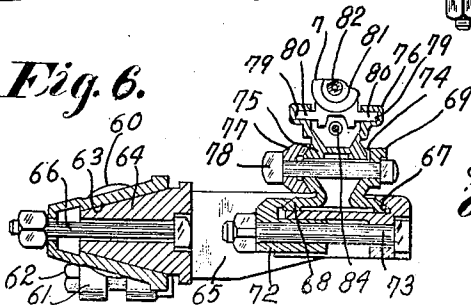


Fig. 6.



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Fig. 9.

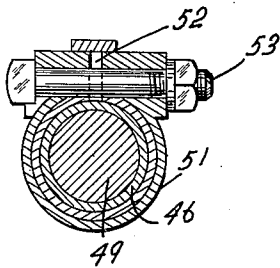


Fig. 7.

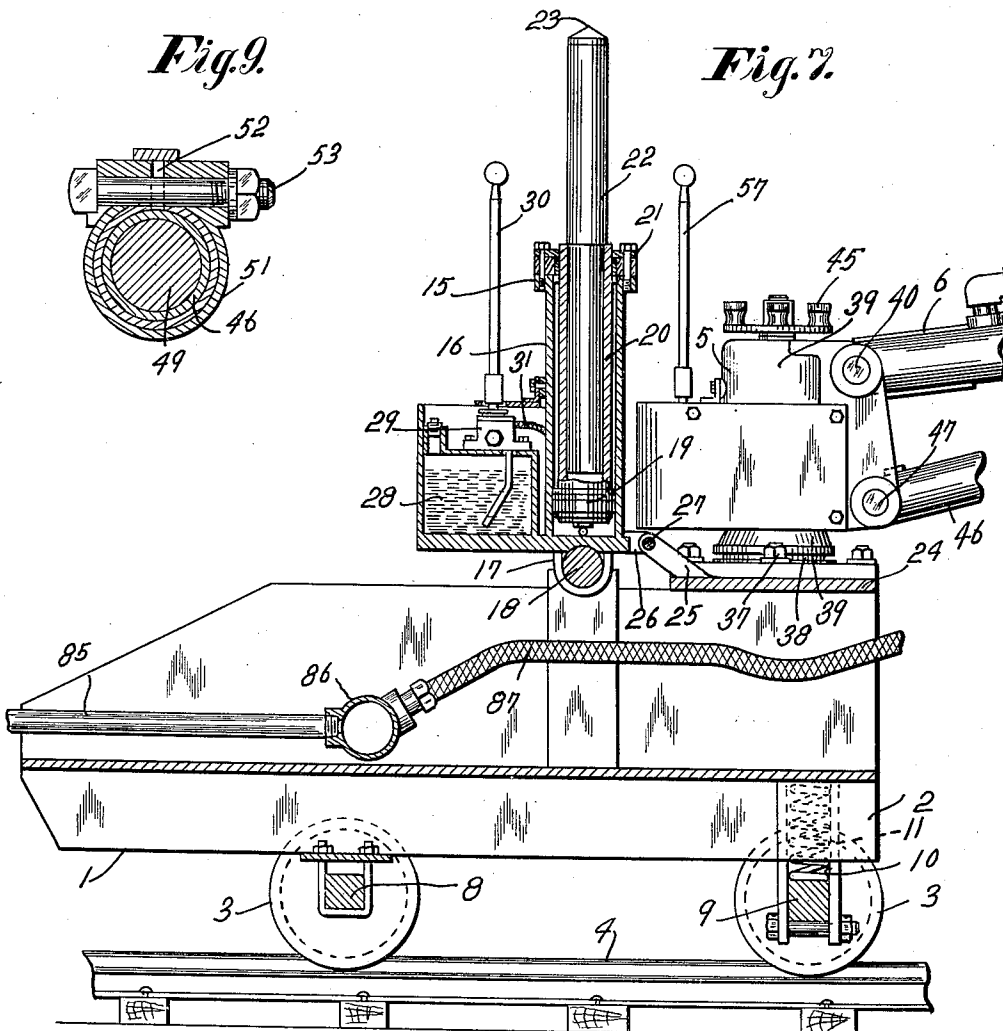
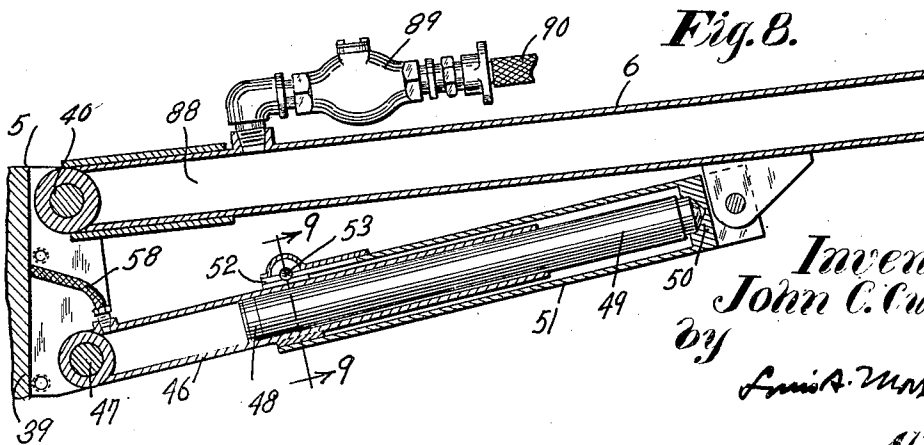


Fig. 8.



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Fig. 10.

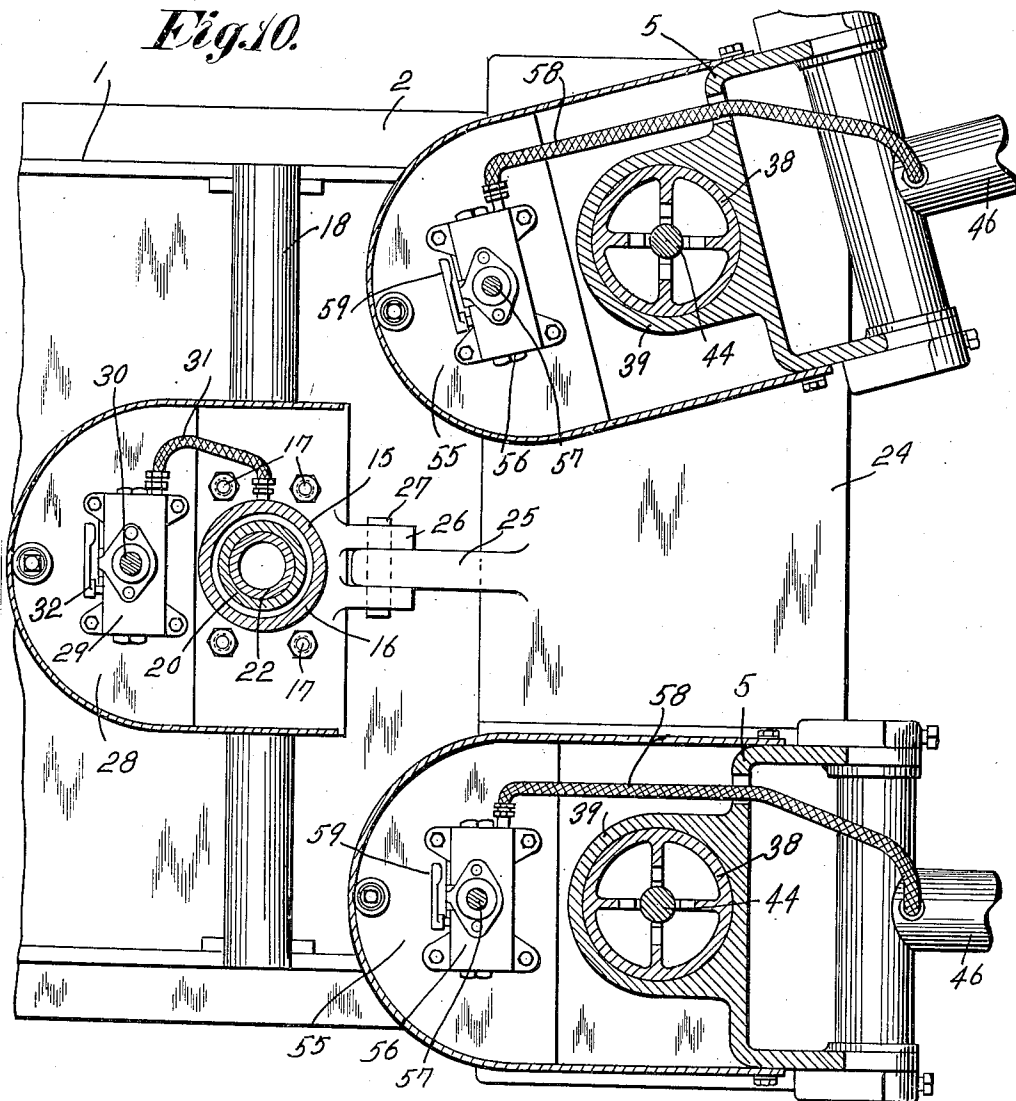
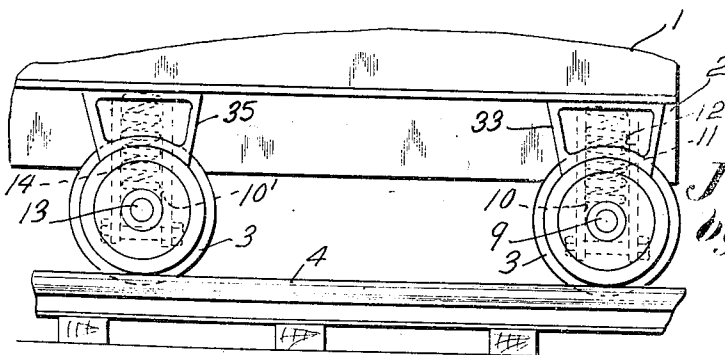


Fig. 11.



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UNITED STATES PATENT OFFICE

2,500,931

DRILLING APPARATUS

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Application November 15, 1944, Serial No. 563,579

15 Claims. (Cl. 255—51)

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This invention relates to drilling apparatus and more particularly to an improved portable supporting structure for a rock drill, especially designed for use in tunnel work for supporting the rock drill in various positions with respect to the tunnel face.

In a portable rock drill such as is employed in tunnel work, there is usually provided an adjustable support for supporting the drill in the desired position with respect to the face of the tunnel. Such supporting apparatus is commonly known as a rock drill "jumbo" and usually embodies adjustable armlike supports by each of which a drill is supported. In such apparatus it is desirable rigidly to hold the same in position between the tunnel roof and floor during the drilling operation. It is also desirable that the apparatus may be readily moved as the tunnel face advances and may be quickly and easily adjusted into the desired supporting position. In such apparatus it is also a desired feature to enable location of the rock drill relatively close to the tunnel walls and the roof and floor of the tunnel. When the apparatus is held in drill supporting position stability and comparative freedom from vibration are necessities. Also the laborious task of manually lifting relatively heavy parts into the desired position must be avoided.

It is an object of the present invention to provide an improved portable drill supporting apparatus of the type commonly known as a rock drill "jumbo." Another object is to provide an improved drill supporting apparatus having improved means for adjustably supporting a rock drill with respect to the work. A further object is to provide an improved rock drill "jumbo" especially designed for use in tunnel work having improved means for rigidly securing the same with respect to the working face of the tunnel during the drilling operation. Still another object is to provide an improved wheeled support for a rock drill adapted to run along a trackway and having novel means engageable with the roof for locking the truck wheels in a stationary position with respect to the trackway. A still further object is to provide improved means engageable with the roof for effecting braking of the wheels rigidly to hold the same in position on the trackway. A still further object is to provide an improved adjustable drill supporting apparatus embodying a swivelled boom frame on which a rock drill is universally mounted in a novel manner, whereby the drill may be located relatively close to the tunnel side walls

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and the roof and floor of the tunnel. Yet another object is to provide an improved adjustable boom frame structure embodying improved means for locking the same in adjusted position. Still another object is to provide an improved wheel braking system operated by the roof engaging jack, for holding the truck of the apparatus in a stationary position on the track rails. A further object is to provide an improved swivel mounting structure for the rock drill at the outer extremity of the adjustable supporting boom of the apparatus. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

In the accompanying drawings there are shown for purposes of illustration one form and two modifications which the invention may assume in practice.

In these drawings:

Fig. 1 is a plan view of a drilling apparatus constructed in accordance with an illustrative embodiment of the invention.

Fig. 2 is a side elevational view of the drilling apparatus of Fig. 1.

Fig. 3 is an enlarged cross-sectional view taken substantially on line 3—3 of Fig. 2.

Fig. 4 is a detail vertical sectional view taken on line 4—4 of Fig. 3.

Fig. 5 is a detail sectional view taken on line 5—5 of Fig. 2.

Fig. 6 is a detail vertical sectional view taken on line 6—6 of Fig. 2.

Fig. 7 is an enlarged view in longitudinal vertical section taken substantially on line 7—7 of Fig. 1.

Fig. 8 is an enlarged longitudinal sectional view taken substantially on line 8—8 of Fig. 1.

Fig. 9 is an enlarged cross-sectional view taken on line 9—9 of Fig. 8.

Fig. 10 is an enlarged horizontal sectional view taken substantially on line 10—10 of Fig. 2.

Fig. 11 is a fragmentary side elevational view showing a modified construction.

Fig. 12 is a side elevational view on a reduced scale illustrating another modified construction.

In the illustrative embodiment of the invention the improved drilling apparatus is of the type known as a rock drill "jumbo" especially designed for use in tunnel work, and embodies an improved portable supporting structure for a rock drill for supporting the latter at various locations with respect to the working face of the tunnel. It will be evident, however, that the features of the invention may be embodied in other types of apparatus.

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The improved drilling apparatus or so-called rock drill "jumbo," as shown in Figs. 1 and 2, comprises a portable base 1 desirably in the form of a truck frame 2 mounted on wheels 3 adapted to travel along the rails of a trackway 4 laid on the tunnel floor. The "jumbo" disclosed herein is of the twin or dual drill type, although if desired, but a single or more than two drills may be used. Carried by the truck frame at its forward portion is a pair of swivel frames or turntables 5 mounted to turn about parallel upright axes at opposite sides of the longitudinal vertical center of the base. Pivotaly mounted on these swivel frames or turntables to swing in a vertical direction relative thereto are elongated supports or boom frames 6 respectively in turn having swivelly mounted at their outer ends rock drills 7 of the conventional mounted drifter type. By adjusting the boom frames horizontally about the swivel frame axes and vertically about their pivots relative to the swivel frames, the rock drills may be located at any desired position with respect to the tunnel face.

The truck frame 2 has secured thereto a stationary rear axle 8 for the rear wheels and a front axle 9 for the front wheels, mounted in vertical guides 10 secured to the truck frame (Figs. 3, 4 and 7). Arranged between the bottom of the truck frame and the front axle are coil springs 11 arranged in recesses 12. Thus a yieldable front axle mounting is afforded for the truck. In the modification shown in Fig. 11 a rear axle 13 is mounted in similar guides 16' and similar springs 14 are arranged between the bottom of the truck frame and the axle so that yieldable mountings are provided for both axles. The purpose of the yieldable axle mounting will later be explained.

Carried on the truck frame rearwardly of the swivelled boom supporting frames 5 at the longitudinal vertical center of the truck midway between the swivelled frame axes is a vertical jack mechanism 15. This jack mechanism is fluid operated and includes a hydraulic cylinder 16 secured by U-bolts 17 (Figs. 3 and 7) to a cylindrical cross bar 18 fixed as by welding at its ends to the sides of the truck frame. The U-bolts on the bar 18 provide a pivotal mounting for the jack mechanism. The hydraulic cylinder contains a reciprocable piston 19 having a tubular piston rod 20 extending upwardly through the packed top head 21 of the cylinder. Received in the hollow piston rod is a pointer bar 22 having a shoulder abutting the upper end of the piston rod and terminating at its upper end in the point 23 engageable with an extraneous abutment such as the tunnel roof. When the jack mechanism is swung downwardly about its pivotal mounting on the cross bar 18, the pointer bar may be withdrawn from the piston rod to reduce the overall height of the apparatus during transport. The swivelled boom supporting frames 5 are mounted on a horizontal cross plate 24 secured as by welding to the sides of the truck frame, and on this cross plate is a rearward apertured lug 25 (Fig. 7) for limiting upward swing of the jack mechanism 15 and to lock the latter in a substantial upright position. The base of the jack cylinder has spaced apertured lugs 26 between which the lug 25 is receivable, and a pin 27 is receivable in the registering lug apertures for securing the jack mechanism in upright position. When the pin is released, the jack mechanism may be swung downwardly on the cross bar 18 to permit removal of the pointer

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bar as above mentioned. If desired, during transport, the jack mechanism may be laid down on the truck in an out-of-the-way position in an obvious manner. Embodied in the jack cylinder base is a liquid reservoir 28 and a conventional pump 29 operated by a hand lever 30 so that liquid may be manually pumped through the conduit 31 into the jack cylinder 16 below the piston 19 to move the latter upwardly to adjust the bar point 23 into engagement with the tunnel roof. A valve mechanism 32 is associated with the pump for controlling flow of liquid to or to trap fluid in the jack cylinder and is positionable to connect the conduit 31 to the reservoir so that liquid may be discharged from the jack cylinder to effect lowering of the pointer bar. When the jack mechanism is operated and a suitable pressure is applied to the truck frame, the latter is swung downwardly about the rear wheel axes thereby compressing the springs of the front axle to bring brake shoes 33 on the truck frame into braking engagement with the treads of the front wheels so that the truck is held in a stationary position on the trackway, in the manner disclosed and claimed in my copending application Ser. No. 38,045, filed July 10, 1948. In the modification shown in Fig. 12, a jack mechanism 34 is arranged approximately in a transverse vertical plane which includes the front wheel axes so that the jacking pressures are applied directly through the front wheels to the trackway thereby rigidly to hold the apparatus in position between the tunnel roof and floor in a manner functionally simulating a conventional mine column. In the modification shown in Fig. 11 brake shoes 35 secured to the truck frame engage the treads of the rear wheels so that all four wheels are braked when the jack mechanism is operated.

The horizontal plate 24 for the swivelled boom supporting frames 5 has attached thereto by screws 37, the bottom flanges (Fig. 3) of a pair of tubular pedestals 38 on which cylindrical portions 39 of the swivel frames 5 are respectively rotatably mounted. The rear ends of the boom frames 6 are pivoted at 40 on the swivel frames 5 respectively to swing in a vertical direction with respect thereto. There are locks for holding the swivel frames 5 against rotation with respect to the stationary pedestals comprising tapered surfaces 41 (Fig. 3) on the lower portions of the pedestals with which conical surfaces 42 on the swivel frames are engageable. The operating means for the locks may assume various forms but are herein, for illustrative purposes, shown similar to those disclosed and claimed in a copending joint application of Curtis and Gartin, Serial No. 566,056, filed December 1, 1944. Arranged centrally within the pedestals and secured thereto at 43 are screw shafts 44 on the upper ends of which are threaded hand nuts 45. These hand nuts engage the top surfaces of the swivelled boom supporting frames 5, and, when the nuts are turned in the proper direction, the boom supporting frames are moved downwardly to force the conical surfaces thereon into frictional locking engagement with the stationary conical portions 41.

Fluid operated jacks are desirably employed to swing the boom frames 6 about their pivots, these comprising hydraulic cylinders 46 (Fig. 8) pivotally connected at 47 to the swivelled boom frames 5 at points below the boom pivots 40. Reciprocable in these cylinders are pistons 48 each having its piston rod 49 engaging at 50 the

outer end of a tubular sleeve 51 which encloses and has telescopic relation with the feed cylinder. The rearward portions of each sleeve 51 is split at 52 to provide a clamp adjusted by a bolt 53. By tightening the clamp bolts, the sleeves and the cylinders are locked together to hold the boom frames in adjusted position about their pivots.

Carried by each of the swivelled boom supporting frames 5 is a liquid reservoir 55 (Fig. 10) and a conventional pump 56 operated by a hand lever 57. The pump has its discharge connected by a conduit 58 to the inner end of the cylinder 46, and valve means 59 is associated with the pump for connecting the conduit 58 back to the reservoir so that liquid can be discharged from the cylinder. By manually operating the pumps, the hydraulic jacks may be operated to lift the boom frames, and, by discharging liquid from the lower ends of the cylinders, the boom frames may be lowered. When the valve means 59 is closed liquid may be trapped in the jack cylinders.

Now referring to the improved universal swivel mountings for the rock drills at the outer extremities of the boom frames, it will be noted that mounted on the outer end of each boom frame to turn about the longitudinal axis of the boom frame is a rotatable support 60 (Fig. 5) held in adjusted position by a split clamp 61 having an adjusting bolt 62. Arranged in the rotatable support 60 in advance of the boom frame is a conical socket 63 for receiving the tapered portion 64 of a lateral arm 65. An adjusting device in the form of a bolt 66 is provided for securing the tapered portion 64 tightly within the socket to lock the arm 65 in position, and, when this bolt is released, the lateral arm 65 may be turned relative to the support 60 about an axis at right angles to the longitudinal axis of the boom frame. The locking means for the arms 65 may assume various forms but, as herein described, they are for illustrative purposes, shown similar to those described in claims in the joint Curtis and Gartin application mentioned above. Formed in the arm 65 is a socket 67 (Fig. 6) for receiving a circular swivel plate 68 on a support 69. The arm 65 has an opening 70, and the arm beneath the socket has a guideway 71 which enters the opening 70. Arranged in this guideway and held against rotation therein is a clamp 72 for engaging the swivel plate 68. When this clamp is tightened by its adjusting bolt 73, the swivel plate is secured in its adjusted position. When released, the swivel plate may be turned relative to the arm 65 about an axis at right angles to both the arm axis and the longitudinal axis of the boom frame. The swivel support 69 has guideways 74 for slidably receiving flanges 75 formed on a guide shell 76. The guide shell may be slid longitudinally in the guideways of the support 69, and a clamp 77 adjusted by a bolt 78 may be tightened to clamp the guide shell in adjusted position. The guide shell has longitudinal guideways 79 for receiving guides 80 on the motor cylinder 81 of the rock drill 7. Reciprocable in the motor cylinders of the rock drills are hammer pistons (not shown) for striking blows on usual drill steels 82, the latter suitably supported within the rock drill chucks. Each rock drill has a feed motor 83 for rotating a usual feed screw 84 for feeding the rock drills back and forth along the shell guideways. Each rock drill is of a well-known design and may be generally similar to that disclosed in my Patent No. 2,320,571,

patented June 1, 1943. Of course, other rock drills of the mounted drifter or any other suitable type may be used with my improved "jumbo" if desired.

The rock drills 7 and the drill feed motors 83 are operated by pressure fluid which is supplied to the apparatus through a supply hose 85 on the truck frame, connected to a manifold 86. Leading from the manifold are fluid conducting hoses 87 connected to constant pressure chambers 88 in the boom frames 6 respectively (Fig. 8). Leading from the boom frame chambers 88 through line oilers 89 are hoses 90 connected to throttle valve mechanisms 91 of the rock drills. Branch hose connections 92 are connected to the intakes of the feed motors 83 under the control of valve mechanisms 93.

The general mode of operation of the improved drilling apparatus is as follows. The apparatus may be moved along the trackway in any suitable manner and when located at the tunnel face, the jack mechanism 15 may be swung into upright position and locked therein. The operator may then oscillate the hand lever 30 of the pump 29 to force liquid under pressure from the reservoir through conduit 31 to the lower end of the jack cylinder 16 to move the piston 19 upwardly thereby raising the point 23 of the pointer bar into contact with the tunnel roof. As the pointer bar is forced into contact with the roof, the truck frame 2 is swung downwardly compressing the springs to bring the brake shoes 33 into engagement with the front wheel treads to brake the wheels and to hold rigidly the wheels in engagement with the rails of the trackway. The liquid may be trapped in the jack cylinder under the control of the valve mechanism 32 to hold the jack mechanism in this position. The operator may then oscillate the hand lever 57 of the pump 56 to force liquid under pressure from the reservoir through the conduit 58 to the inner end of the hydraulic lifting cylinder 46 to move the piston 48 outwardly, thereby to effect raising of the boom frame. The boom frame may be lowered by discharging liquid from the hydraulic lifting cylinder back to the reservoir under control of the valve mechanism 59. When the boom frames are in the desired adjusted position the clamps 52, 53 may be tightened to lock the sleeves 51 and cylinders 46 together to hold firmly the booms in position. By loosening the friction locks 41, 42, 44 for the swivelled boom supporting frames 5, the boom frames may be swung laterally into the desired position about the upright axes and thereafter firmly locked in position. By adjusting the several clamps, the drill guide shell 76 may be adjusted into the desired position at the outer end of the boom frame, and, by tightening these clamps, the guide shell may be rigidly held in adjusted position. By loosening the clamps 61, 62 for the rotatable supports 60, the drills may be adjusted relative to the boom frames about the longitudinal axes of the boom frames, and, by loosening the clamps 63, 64, 66, the drills may be swung about axes at right angles to the longitudinal axes of the boom frames. Fluid under pressure may be supplied through the hose connections 87, 90, and 92 to the motors of the drills 7 and the feeding motors 83 under control of the valve mechanisms 91 and 93. In the modification shown in Fig. 11, all four wheels of the truck are braked and held stationary with respect to the trackway, and in the modification shown in Fig. 12, the jack mechanism 34 applies

the clamping pressure directly through the front wheels to the trackway.

As a result of this invention, an improved drilling apparatus of the type known as a rock drill "jumbo" especially designed for use in tunnel work, is provided in which desirable improvements are incorporated resulting in improved operation. The apparatus may be held rigidly in position between the tunnel roof and floor during the drilling operation and the same may be expeditiously moved from place to place. By the provision of the horizontally and vertically swingable boom frames and the improved swivel mountings at the outer extremities of the boom frames, the rock drills may be adjusted into any desired position with respect to the face of the tunnel. The novel locks for the boom supporting and boom frames enable firm holding of the boom frames in their adjusted position and the locks may be quickly released when desired. These and other uses and advantages of the improved drilling apparatus will be clearly apparent to those skilled in the art.

While there are in this application specifically described one form and two modifications which the invention may assume in practice, it will be understood that this form and two modifications of the same are shown for purposes of illustration and the invention may be further 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 support having a pedestal thereon, a drill supporting frame having a bore receiving said pedestal with an upper portion of said frame closing said bore above said pedestal, means for mounting said frame on said pedestal to turn relative thereto and to slide a limited amount longitudinally thereof, and means for locking said frame against turning movement relative to said pedestal including cooperating locking elements on said frame and pedestal, and adjusting means engaging said upper frame portion above said pedestal for sliding said frame axially downwardly relative to said pedestal to bring said locking elements into coacting locking engagement.

2. In a drilling apparatus, a support having a pedestal thereon, a drill supporting frame having a bore receiving said pedestal with an upper portion of said frame closing said bore above said pedestal, means for mounting said frame on said pedestal to turn relative thereto and to slide a limited amount longitudinally thereof, means for locking said frame against turning movement relative to said pedestal including cooperating locking elements on said frame and pedestal, and adjusting means engaging said upper frame portion above said pedestal for sliding said frame axially downwardly relative to said pedestal to bring said locking elements into coacting locking engagement, said adjusting means arranged coaxially with said pedestal and including a rotatable adjusting element engaging said upper frame portion, and coacting means secured to said pedestal.

3. In a drilling apparatus, a support, a drill supporting frame pivotally mounted on said support to swing relative thereto, and an extensible power device extending between said support and said frame for swinging the latter including relatively reciprocable power operated elements, a tubular member surrounding one of said elements

in telescopic relation therewith, said tubular member moving relative to the element which it surrounds during frame swing, and a clamping device for securing said tubular member and the element which it surrounds together to lock said elements in adjusted position.

4. In a drilling apparatus, a support, a drill supporting frame pivotally mounted on said support to swing relative thereto, and a fluid operated device for swinging said frame relative to said support including a fluid cylinder pivotally connected to said support and containing a reciprocable piston operatively connected to said frame, a tubular member surrounding said cylinder in telescopic relation therewith and arranged to move with said piston relative to said cylinder, and a clamping device for securing said tubular member and said cylinder together to lock said piston in adjusted position.

5. In a drilling apparatus, an armlike member having an outer end portion formed with an open center and a guideway extending lengthwise of said member within the open center of said end portion, said member having a socket for receiving a swivel plate of a drill support, and a clamp guided in said guideway for outward rectilinear movement and projecting into said open center into clamping engagement with the swivel plate.

6. In a drilling apparatus, a base, a boom frame pivotally mounted on said base to swing in a vertical direction relative thereto and adapted to support a drill at its outer extremity, a fluid operated device for swinging said boom frame upwardly about its pivot and for permitting controlled lowering of said boom frame by gravity including relatively reciprocable fluid operated elements, and associated clamping means for locking said elements against relative movement to hold said boom frame in adjusted position irrespective of the fluid in said device including a tubular clamp-carrying element coaxial with said device and housing one of said elements and reciprocably receiving said other element, and means on said tubular element and engageable with said element reciprocably received therein for clamping the parts against movement.

7. In a drilling apparatus, a base frame having an upstanding pedestal thereon, a drill supporting frame swivelly mounted on and surrounding said pedestal and having limited movement longitudinally thereof, and means for locking said frame against movement on its swivel mounting on said pedestal including a conical locking portion on the base of said pedestal, a conical locking surface on the lower portion of said frame, and means engaging said frame and said pedestal for moving said frame longitudinally of said pedestal in a downward direction to bring said conical surface into frictional locking engagement with said conical portion.

8. In a drilling apparatus, an armlike member having an outer end portion formed with an open center and a guideway extending transversely partially across the open center of said end portion, said member having a socket for receiving a swivel plate of a drill support and opening laterally at its inner side toward said open center so that one side of the swivel plate is exposed, and a clamp guided in said guideway and projecting into said open center at the open side of said socket and adjustable into clamping engagement with the exposed side of the swivel plate.

9. In a drilling apparatus, a base, a boom frame pivotally mounted on said base to swing in a vertical direction relative thereto and adapted to

support a drill at its outer extremity, a fluid operated device for swinging said boom frame upwardly about its pivot and for permitting controlled lowering of said boom frame by gravity including relatively reciprocable cylinder and piston elements, and associated clamping means for locking said elements against relative movement to hold said boom frame in adjusted position irrespective of the fluid in said device including a tubular clamp-carrying element housing said piston element and reciprocably receiving said cylinder element, and a clamp carried by said tubular element for frictionally engaging the exterior periphery of said cylinder element to lock the parts in position.

10. In a drilling apparatus, a base having a pedestal thereon, said pedestal having a free upper end, a drill supporting frame having a bore receiving said pedestal, said frame having an upper portion closing the upper end of said bore above said pedestal, means for swivelly mounting said frame on said pedestal to turn horizontally relative thereto about the longitudinal axis of said pedestal, said mounting means permitting limited sliding movement of said frame axially relative to said pedestal, a lock for holding said frame against turning movement on its swivel mounting including coacting locking elements one rotatable with said frame and the other stationary with respect to said pedestal, and an adjusting device arranged coaxial with said swivel and engaging said upper frame portion for sliding said frame axially relative to said pedestal to bring said locking elements into coacting locking relation.

11. In a drilling apparatus, a portable base, a drill supporting frame swivelly mounted on said base to swing laterally and upwardly relative thereto, a jack device engageable with an extraneous abutment for securing said base in a stationary position during the drilling operation, fluid operated means for swinging said drill supporting frame in one of aforesaid directions on its swivel mounting, and fluid operated means for extending said jack device, each of said fluid operated means including a fluid reservoir, one reservoir on said frame and the other on said jack device, and a pump associated with each of said reservoirs, each pump having its intake connected with a reservoir and its discharge connected to a fluid operated means.

12. In a drilling apparatus, a portable base, a pair of pedestals mounted on said base near its forward end and spaced equidistantly from the longitudinal vertical center of said base, frames swivelly mounted on said pedestals respectively to turn horizontally relative thereto, boom frames pivotally mounted on said swivel frames respectively to swing in a vertical direction relative thereto and each adapted to carry a drill at its outer extremity, fluid operated means for independently swinging said boom frames in a vertical direction about their pivots, a jack device arranged with its longitudinal axis lying in the central longitudinal vertical plane of said base and engageable with an extraneous abutment for securing said base in a stationary position during the drilling operation, and fluid operated means for extending said jack device, and means for supplying fluid under pressure individually to said fluid operated means including fluid reservoirs, one mounted on said jack device and others mounted one on each of said swiveled frames, and a pump associated with each fluid reservoir, each pump having its intake connected

to a reservoir and its discharge connected to a fluid operated means.

13. In a drilling apparatus, an armlike member having an outer end portion formed with an open center and a guideway extending from the outer side of said portion transversely within said open center and partially thereacross, said outer end portion having a socket for receiving the swivel plate of a drill support with the swivel plate lying within said outer end portion, said socket opening laterally toward the open center of said end portion so that the inner side of the swivel plate is exposed, and a clamp guided for rectilinear movement along said guideway within said open center at the open side of said socket and adjustable outwardly into clamping engagement with the exposed side of said swivel plate.

14. In a drilling apparatus, a support, a frame swivelled on said support to turn relative thereto about an upright axis, said frame having parallel, forwardly extending, vertical side projections supporting parallel horizontal pivot-shafts arranged in vertically spaced relation, an elongated boom frame pivotally mounted at its rear end between said spaced projections on the upper pivot shaft, said boom frame being swingable horizontally with said swivelled frame about the swivel axis thereof and swingable in vertical planes relative to said swivelled frame, an extensible jack pivotally mounted between said spaced projections on the lower pivot shaft and pivotally connected to said boom frame beneath the latter at a point spaced outwardly from the boom frame pivot, said jack upon extension thereof effecting swinging of said boom frame upwardly about its pivot and upon retraction thereof permitting lowering of said boom frame, and a support for a rock drill swivelly mounted at the outer end of said boom frame.

15. In a drilling apparatus, a portable base, frames swivelly mounted on said base to turn horizontally relative thereto about parallel vertical axes spaced equidistantly from the longitudinal vertical center of said base, boom frames pivotally mounted on said swivelled frames respectively to swing in a vertical direction relative thereto and each having at its outer extremity means for supporting a drill, fluid operated means for independently swinging said boom frames in a vertical direction about their pivots, a jack device arranged with its longitudinal axis lying in the central longitudinal vertical plane of said base and engageable with an extraneous abutment for steadying said base during the drilling operation, fluid operated means for extending said jack device, and means for supplying fluid under pressure individually to said fluid operated means including fluid reservoirs, one mounted on said jack device and others mounted one on each of said swivelled frames, and a pump associated with each fluid reservoir, each pump having its intake connected to a reservoir and its discharge connected to a fluid operated means.

JOHN C. CURTIS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
150,886	Pattison	May 12, 1874
268,426	Moreau	Dec. 5, 1882

(Other references on following page)

2,500,931

11

UNITED STATES PATENTS

Number	Name	Date	Number
326,667	Taaffe -----	Sept. 22, 1885	2,123,897
801,851	Clark -----	Oct. 17, 1905	2,149,141
876,542	Haight -----	Jan. 14, 1908	2,233,994
1,098,014	Carter -----	May 26, 1914	2,284,958
1,561,348	Mugford -----	Nov. 10, 1925	2,318,595
1,724,775	Pieper et al. -----	Aug. 13, 1929	
1,885,295	Robinson -----	Nov. 1, 1932	
1,972,072	Angell -----	Sept. 4, 1934	
2,031,700	Fiedler -----	Feb. 25, 1936	
2,060,814	Lewis -----	Nov. 17, 1936	

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Name	Date
Holmes -----	July 19, 1938
Hunsicker -----	Feb. 28, 1939
Cook -----	Mar. 4, 1941
Grime -----	June 2, 1942
Curtis -----	May 11, 1943

FOREIGN PATENTS

Country	Date
Great Britain -----	May 17, 1906
Great Britain -----	Oct. 14, 1902