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J. G. WALLACE
HYDRAULIC CORE DRILL

2,969,121

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2 Sheets-Sheet 1

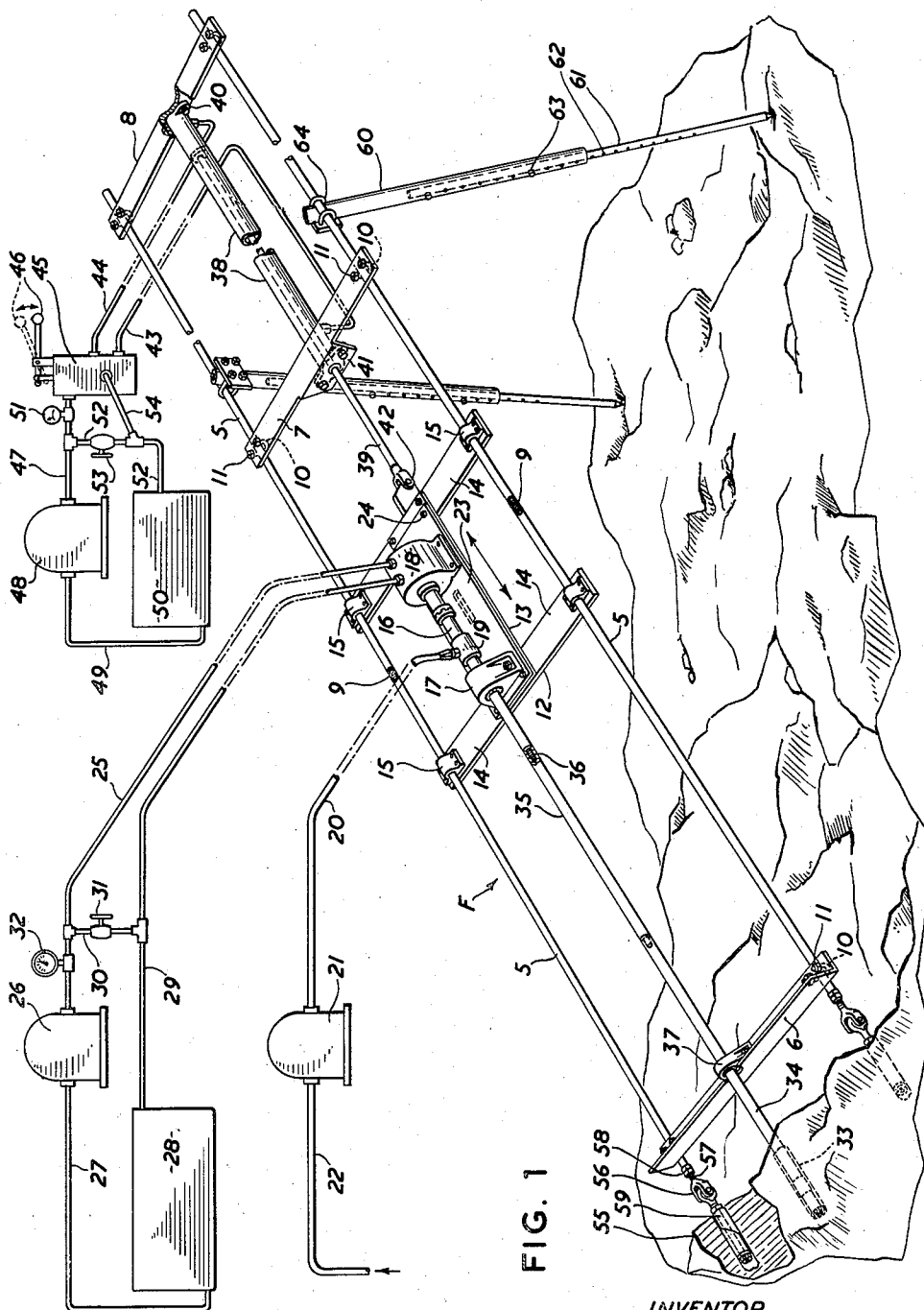


FIG. 1

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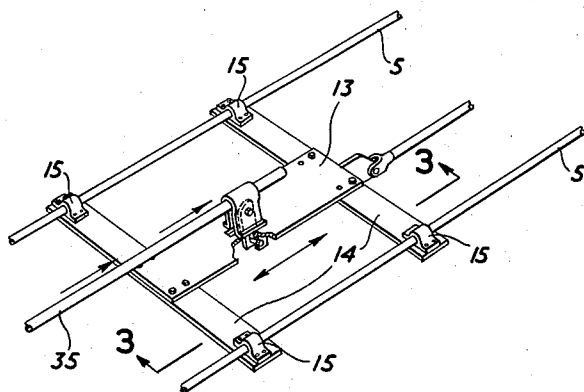


FIG. 2

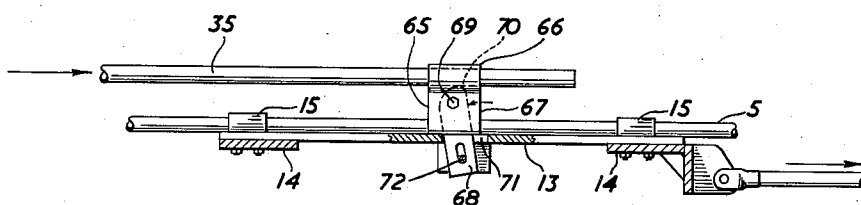


FIG. 3

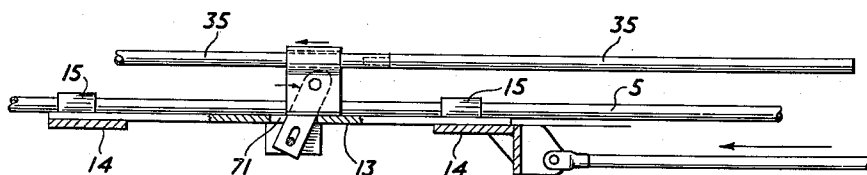


FIG. 4

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HYDRAULIC CORE DRILL

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10 Claims. (Cl. 175—129)

My invention relates to improvements in drilling apparatus and particularly to rock drills and has for its general object to provide an improved core drill of the kind employed for obtaining cores as in rock drilling. A further object of my invention is to provide a more efficient and serviceable core drill for mining work and one which not only provides an increased rate of drilling, but which also gives a more flexible control in the drilling of holes.

Still another important object of my invention is to provide a drill apparatus of the kind referred to which is hydraulically operated and which is comparatively light in weight and can be operated by one man.

Still another object of my invention is to provide a portable drill of the kind referred to which can be transported in units and carried to the drilling site or hauled according to conditions dealing with problems of transportation. A salient feature of my invention resides in the novel frame structure comprising way-forming side members for support of a carriage and each supplied with anchoring devices at the forward end of the frame whereby the frame is secured to a supporting structure such as rock by means of a two-point connection which obviates vibration in the drilling process and enables the drill bit to be run at a greater speed with higher efficiency and attendant less wear and tear on the bit. Moreover, the anchoring devices for the frame enable the frame to be tilted to the desired drilling angle and supported in set position for sinking a hole at the desired angle irrespective of conditions of the terrain.

The hydraulic drill of the construction of my invention has been observed to prolong the life of a diamond bit and at the same time to obtain an increased drilling speed with greater flexibility of control.

A selected embodiment of the invention is illustrated in the accompanying drawings, in which:

Fig. 1 is a general perspective view of a core drill set up for drilling a hole in bed rock and illustrating the hydraulic systems in a more or less schematic manner, with portions broken away for purposes of clarity;

Fig. 2 is a fragmentary detail perspective view showing how a clutching device is used on the carriage to retract the drill rod at the end of a boring operation or at any time during the drilling of a hole as need may arise, with portions broken away for clarity;

Fig. 3 is an enlarged longitudinal sectional view taken on line 3—3 of Fig. 2; and

Fig. 4 is a similar view to Fig. 3, but showing the clutching device reversed for use in pushing the drill rod into a hole as in continuing a drilling operation after an interruption.

The embodiment of the invention as shown comprises an elongated frame of a portable character which involves a knock-down structure whereby it may be taken apart for transportation which is an important feature of drills of this kind. The frame is denoted as a whole by the reference designation F and has a front anchoring end and a rear supported end. The frame is com-

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posed of way-forming side members 5, 5, which are spaced in parallel relation and rigidly connected together at intervals throughout their length by means of the cross members 6, 7 and 8, for example. The side members 5 are desirably tubular rods and owing to their length are preferably each made up of two lengths of tubing joined together as at 9 by an ordinary screw connection which enables sections of each rod to be taken apart for transportation and storage.

The cross member 6 is a front element of the frame and is shown as made up of a length of angle iron, but of course, it may be of any approved shape. The cross members 7 and 8 are of an approved cross sectional shape and are both located at the rear of the frame, one at the extreme rear and the other spaced somewhat forwardly thereof. The tubular bars 5, 5, are rigidly fastened to the cross bars 6, 7 and 8 by clamp devices and these clamp devices preferably consist of U-clamps as at 10, which embrace the tubular bars and are lodged in holes in the cross members and secured by nuts 11.

Accordingly the tubular bars and the cross bars are detachably secured together to form a rigid frame unit. This frame unit is not only light in weight but has the facility of being dismantled for transportation.

A carriage denoted at 12 is reciprocally disposed on the frame and has way-engaging bearings attaching it to the side members 5. The carriage comprises a center plate 13 rigid with wings 14 which wings are in the form of cross plates which project beyond the side members 5 and carry the way-engaging bearings 15. These bearings are secured to the wings as by fastening elements such as screws or bolts and are a slide fit on the tubular rods 5. The rods thus constitute ways for the carriage which is free to move longitudinally of the frame between the front crossbar 6 and the rearwardly disposed crossbar 7. The length of travel is sufficient for the purpose of using the regular drill rods and feeding them in a drilling operation as is well known in the art.

The carriage carries the boring contrivance which is in the form of a conventional diamond bit connected to a standard core barrel which in turn is connected to one or more drill rods carried by a drive shaft. The drive shaft is denoted at 16 and is of the regular type used in core drills. This shaft which is hollow for the feeding of water to the diamond bit, is journaled at one end in a bearing 17 and at its other end is connected to a hydraulic motor 18 which revolves the drive shaft at desired speeds under the control of the operator. The shaft 16 has the usual coupling connection 19 with a water supply line 20, a part of the length thereof at least is of a flexible character to accommodate the travel of the carriage. The water line is connected to a pump indicated at 21 which receives water from a suitable supply as by the pipe line indicated at 22. Pump 21 is not carried by the frame but is disposed at an approved location according to the dictates of use of such equipment as will be understood by those skilled in the art.

The bearing 17 and motor 18 which mount the hollow shaft 16 are attached to a mounting plate 23 and this mounting plate is detachably secured on the center plate 13 of the carriage as by fastening elements such as screws 24. From this it will be understood that the mounting plate may be removed from the carriage along with the drive shaft 16, bearing 17 and motor 18.

The hydraulic motor 18 is operated by a standard system including a line 25 for delivery of fluid under pressure, part of which line is flexible in character to accommodate travel of the carriage and this line is connected to a suitable motor driven pump 26 which receives its supply of liquid through a line 27 connected to a tank 28. The return line between the motor 18 and tank 28 is indicated at 29 and a by-pass line is denoted at 30

which is controlled by a valve 31. A pressure gauge 32 is interposed in the delivery line 25. When valve 31 is open the water or other liquid is by-passed to the tank or at least a portion is by-passed to the tank so that the degree to which the valve is open determines the motivating force acting on the motor 18. Motor 18 is therefore fully controllable by the use of valve 31 and it will be understood that this system is common to the art.

The diamond bit is indicated at 33 and is attached to the core barrel 34 which in turn is connected to length of drill rod indicated at 35. The drill rod has the usual screw connection indicated at 36 and one end of a drill rod is attached to the drive shaft 16. The drilling of a hole is performed in the usual way by first using a single length of drill rod to connect the core barrel to the drive shaft and then adding another section of drill rod as called for by the progress made in the drilling of the hole. A supply of drill rod sections is carried at hand and stored convenient for use. The operator merely unscrews a joint when the carriage is fed up to the front end of the frame and retracts the carriage to allow of the insertion of another drill section and so on as is common practice in drilling.

The front cross member 6 is used as a steady rest for the core barrel and the drill rods. To this end it is provided with a bearing 37 through which the core barrel and the drill rods are inserted and allowed to turn and slide longitudinally. This bearing gives highly desirable support in the drilling operation and functions to reduce vibration.

It has been mentioned that the carriage feeds the drill rod along with the core barrel and diamond bit. Travel of the carriage is motivated by a hydraulic cylinder 38 and a double-acting ram 39 operably disposed therein. The cylinder and its ram are disposed at the rear of the frame and arranged longitudinally thereof. The cylinder has its rear end secured as at 40 to the cross member 8 and its front end secured as at 41 to the cross member 7. The ram is secured as at 42 to the carriage. Fluid lines 43 and 44 extend to the front and rear ends of cylinder 38 respectively and are connected to a four-way valve indicated at 45 of the manually controlled type having an operating handle 46. The valve has a delivery line 47 connected to power-driven pump 48 which in turn is connected by a line 49 to a supply tank 50. Line 47 has a pressure valve 51 and has a by-pass connection 52 extending to the tank 50 and is equipped with a needle valve 53. Line connection 52 is at a point beyond the needle valve 53 and has a return line connection 54 with valve 45. This control system provides for flexible operation of the carriage in that it is only necessary to manipulate the needle valve 53 in order to obtain the required hydraulic pressure at any phase in the operation of the carriage. The needle valve should not be fully closed any time as when it is left open at least to some extent it precludes damage to the diamond bit. By use of the handle 46 the operator can cause the carriage to be fed forwardly for feeding the bit into the ground and can control the pressure and regulate it to suit conditions encountered in the drilling operation. The carriage can be retracted at any time and a desirable feature is that by the use of the valve the bit can be backed off at any stage in the drilling operation to facilitate clearing of sludge. In backing away the bit the water will rapidly clear away sludge to facilitate drilling. When drilling deep holes the valve can be manipulated to relieve the weight of the bars on the bit. The hydraulic system is highly flexible and has many advantages over the conventional operating mechanism.

A salient feature of the construction is that the side members 5, 5, have frontal connecting termini at the front end of the frame and this connecting termini is supplied with individual anchoring means for attachment to a relatively fixed support which may be a bed of rock for instance as indicated at 55 in Fig. 1. The anchoring

means functions to severally connect the side members to the relatively fixed support and to permit of angular adjustment of the frame whereby it may be set for the drilling of a hole at a desired predetermined angle. The anchoring means for each side member 5 comprises a yoke 56 having a threaded shank 57 by which it is screw threaded in the bore of the respective side member 5. The threaded connection enables the yoke to be screwed in or out of the member 5 and when set in required position is locked by nuts 58. An eye bolt 59 is pivoted in the yoke 56 and in the form shown in the drawing is a rock bolt of the standard expanding type which is adapted to be locked in a hole bored in the rock. The rock is bored to receive the bolt 59 at a desired location and the two-point connection afforded by the co-acting rock bolts serves to connect the frame securely to the rock bed in order to preclude undesirable vibration which has been ascertained to be detrimental to rock drilling operations. The anchoring devices enable the frame to be securely anchored at its front end against skewing action and vibration. Consequently a drilling operation may be performed more expeditiously and with greater ease. Particular attention is directed to the fact that the substantially aligned pivots which connect the related eye bolts and yokes 59, 56 lie in a plane which approximately contains the axes of the drill rod 35 and drill bit 33. This is important as it obviates the tendency of drill thrust to rock the frame 5, 5 etc. about the eye bolt and yoke-connecting pivot pins, with resultant drill bit binding in the drill hole. Moreover the operation of drilling a hole may be carried out by a single operator. The pivotal connection of the anchoring devices enables the frame to be swung and set at any angle. It can be tilted acutely to meet the needs of a contemplated drill hole. When the drill is to be used at a site at which there is no rock bed the rock bolts may be replaced by anchoring bolts or other fastening elements such as for fastening to a support of timber or a bed of concrete provided for the purpose.

The rear end of the frame may be suitably supported and to this end there is shown adjustable legs of the telescopic type. These propping legs may and will be disposed at the rear end of the frame and connected to side members 5, 5, thereof. Each leg comprises an outer member 60 and an inner member 61 telescopically arranged and provided with means for locking them in set position at a desired adjustment. The locking means may consist of longitudinal series of holes as at 62 and a locking pin 63 inserted in registering holes. The outer section 60 of a leg is secured to the respective side member 5 as by clamping device indicated at 64 which permits of the leg to be adjusted laterally of the frame to a desired angle and clamped in set position. The clamp device may also serve to enable the leg to be shifted along the side member 5 and provides a generally universal adjustment.

According to this arrangement when the front end of the frame has been securely attached to a relatively fixed support the rear end of the frame may be angularly adjusted and properly supported by the legs. When the rock drill is to be dismantled the legs can be readily removed.

The carriage functions to withdraw drill rod from a hole and also to push drill rod into a hole that has been drilled at any depth. To use the carriage for retracting drill rod the mounting plate 23 together with the shaft 16, bearing 17 and motor 18 is removed from the carriage. These parts are then replaced by a bar clutching device depicted in Figs. 2, 3 and 4. This clutching device comprises a U-plate 65 having a circular bight portion 66 for loosely receiving and fitting on the rods 35. Between the legs 67 of the clutch device there is provided a depending jamming lever 68 which is pivoted at 69 and has a cam end 70 which is brought into jamming contact with the pipe extending therethrough when the

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jamming lever is pulled backwardly in a retractile movement of the carriage. The jamming lever is in a position to loosely depend in a slot 71 provided in the center plate 13 and may be pinned loosely therein as indicated at 72. When the carriage is fed forwardly the clutching plate merely slides on a rod 35 on which it is sleeved loosely. However when the carriage is operated with a retractile movement the jamming lever 68 is forced into jamming contact with the drill rod and exerts a withdrawal movement on the same as the carriage moves backwardly. Subsequent forward movement of the carriage results in automatic disengagement of the lever 68 from the rod 35 to permit free forward movement of the carriage with respect to the drill rod. A further rearward movement of the carriage again brings the jamming lever into clutching engagement with the drill rod for exerting a further pulling action on the rod. In this way the drill rod sections can be unscrewed as they are pulled clear of the hole and removed one by one until the core barrel with the bit is reached. This way the carriage operates to remove the drill rod from the hole when desired so that it can be dismantled before recovery of the core in the core barrel, etc. It will be observed that in Fig. 3 the carriage is shown in the act of moving backwardly and pulling the drill rod 35 with it by means of the engagement of the jamming lever with the drill rod. In Fig. 4 the carriage is shown in the act of moving forwardly with the jamming lever disengaged from the drill rod 35 whereby the clutch plate merely slides on the drill rod ready for a reverse working stroke on the part of the carriage. By reversing the jamming lever 68 in the clutch plate 67 the clutch device may be used to push drill rod into a hole after it has been removed therefrom and it is believed that the operation in this respect will be clear from what has been related earlier.

From the preceding description it will be manifest that my invention provides a highly versatile hydraulic drill and one which is light in weight and can be knocked down and shipped in units. Its adaptability for transportation is an important feature and another salient feature lies in the adjustability of the frame with respect to the support to which it is anchored by means of the anchoring devices. The adjustment enables the frame to be levelled and straightened for drilling a hole at a desired angle. Moreover the frame can be inclined to any desired degree for drilling and at the same time a rigid anchorage is maintained which is a most important feature as it serves to eliminate vibration, bouncing and shifting common to present method of drilling. The construction and arrangement of this drilling machine obviates the dangerous practice of a man having to climb up a tripod and moreover enables stable anchorage to be obtained for the frame which not only precludes vibration, but also obviates any tendency for the frame to skew in the drilling process and to exert any binding force on the drill rod. Drilling may be accomplished at any desired angle and the machine is suited to operate for "uphole" drilling. It has been demonstrated that the machine will drill faster than conventional drilling machinery and moreover the life of the bit is prolonged. Power plants employed for pumping may be internal combustion engines or electric motors. The control of the operating elements of the hydraulic drill is simple and the manually operated needle valve on the delivery line between the pump and the ram cylinder makes it simple to control the feed of the bit and especially since the pressure gauge indicates the required pressure in different phases of the drilling operation. The hydraulic drill may be put up in units for transportation so that two or three men can carry it over any kind of terrain and set it up for operation.

Having described a selected embodiment of the invention, it will be understood that various changes and modifications may be resorted to as fairly come within the scope of the appended claims.

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What I claim is:

1. A hydraulic core drill comprising a portable frame having a front end and a rear end and including a pair of spaced longitudinal way-forming side members and cross members securing said side members to each other at intervals along their length, said side members having frontal connecting termini at the front end of said frame, yokes having shanks threadedly engaged with said frontal termini of said side members and extending longitudinally therefrom and capable of adjustment, rock bolts having eye parts pivoted in said yokes, a carriage reciprocally disposed on said frame and having way-engaging bearings attaching it to said side members for permitting said reciprocable movement thereof, a shaft journaled on said carriage and arranged parallel to said side members, drill rod connected to said shaft and extending forwardly thereof and terminating in a core barrel having a hole-boring element, a hydraulic motor on said carriage having a driving connection with said shaft, a remote hydraulic pump system for operating said motor and connected thereto, a hydraulic cylinder mounted on the rear end of said frame and having a forwardly extending double-acting ram connected to said carriage for reciprocal movement thereof, fluid lines extending from said hydraulic cylinder for connection to a manually controlled pumping system, and adjustable legs supporting the rear end of said frame.

2. A hydraulic core drill comprising a portable frame having a front end and a rear end and including a pair of spaced longitudinal way-forming side members and cross members securing said side members to each other at intervals along their length, said side members having frontal connecting termini at the front end of said frame, yokes having shanks threadedly engaged with said frontal termini of said side members and extending longitudinally therefrom and capable of adjustment, rock bolts having eye parts pivoted in said yokes, a carriage reciprocally disposed on said frame and having way-engaging bearings attaching it to said side members for permitting said reciprocable movement thereof, a shaft journaled on said carriage and arranged parallel to said side members, drill rod connected to said shaft and extending forwardly thereof and terminating in a core barrel having a hole-boring element, a hydraulic motor on said carriage having a driving connection with said shaft, a remote hydraulic pump system for operating said motor and connected thereto, a hydraulic cylinder mounted on the rear end of said frame and having a forwardly extending double-acting ram connected to said carriage for reciprocal movement thereof, and fluid lines extending from said hydraulic cylinder for connection to a manually-controlled hydraulic pumping system.

3. The structure of claim 2, wherein one of the cross members is disposed at the front end of the frame and provided with a bearing for guiding and supporting the drill rod.

4. The structure of claim 1, in which the adjustable legs are telescopic and each has a lower section and an upper section, a clamp device securing said upper section to a side member of the frame and enabling it to be adjusted in at least one direction.

5. The structure of claim 2, wherein the side members and the cross members of the frame are detachably secured together, and wherein the bearings of the carriage detachably secure it to the side members, the aforesaid detachable connections enabling the carriage to be removed and the frame to be dismantled for transportation.

6. The structure of claim 2, wherein the side members and the cross members of the frame are detachably secured together.

7. The structure of claim 2, wherein the side members of the frame each comprise tubular bars detachably fitted together by a screw connection.

8. A hydraulic core drill comprising a portable frame

having a front end and a rear end and spaced longitudinal way-forming side members and cross members securing said side members to each other at intervals along their length, said side members having frontal connecting termini at the front end of said frame and having distal termini at the rear end thereof, yokes having shanks threadedly engaged with said frontal termini of said side members and extending longitudinally therefrom and capable of screw adjustment, rock bolts having eye parts pivoted in said yokes, a carriage reciprocally disposed on said frame and having way-engaging bearings attaching it to said side members for permitting said reciprocable movement thereof, a shaft journalled on said carriage and arranged parallel to said side members, drill rod connected to said shaft and extending forwardly thereof and terminating in a core barrel having a hole-boring element, a hydraulic motor on said carriage having a driving connection with said shaft, a remote hydraulic pump system for operating said motor and connected thereto, a hydraulic cylinder mounted on the rear end of said frame and having a forwardly extending double-acting ram connected to said carriage for reciprocal movement thereof, fluid lines extending from said hydraulic cylinder for connection to a manually controlled pumping system, and adjustable supporting means attached to the rear end of said frame.

9. A hydraulic core drill comprising a portable frame having a front end and a rear end and including a pair of spaced longitudinal way-forming side members and cross members securing said side members to each other at intervals along their length, said side members having frontal connecting termini at the front end of said frame, yokes having shanks threadedly engaged with said frontal termini of said side members and extending longitudinally therefrom and capable of adjustment, rock bolts having eye parts pivoted in said yokes, a carriage reciprocally disposed on said frame and having way-engaging bearings attaching it to said side members for permitting said reciprocable movement thereof, a shaft journalled on said carriage and arranged parallel to said side members, drill rod connected to said shaft and extending forwardly thereof and terminating in a core barrel having a hole-boring element, a motor on said carriage having a driving connection with said shaft, a remote power system for operating said motor and connected thereto, force trans-

mitting power means mounted on the rear end of said frame and having a forwardly extending portion connected to said carriage for reciprocal movement thereof, means connected to said force transmitting power means for operating the same, and adjustable legs supporting the rear end of said frame.

10. A hydraulic core drill comprising a portable frame having a front end and a rear end and including a pair of spaced longitudinal way-forming side members and cross members securing said side members to each other at intervals along their length, said side members having frontal connecting termini at the front end of said frame, yokes having shanks engaged with said frontal termini of said side members and extending longitudinally therefrom and capable of adjustment, rock bolts having eye parts pivoted in said yokes, a carriage reciprocally disposed on said frame and having way-engaging bearings attaching it to said side members for permitting said reciprocable movement thereof, a shaft journalled on said carriage and arranged parallel to said side members, drill rod connected to said shaft and extending forwardly thereof and terminating in a core barrel having a hole boring element, a motor on said carriage having a driving connection with said shaft, a power system for operating said motor and connected thereto, force transmitting power means mounted on the rear end of said frame and having a forwardly extending portion connected to said carriage for reciprocal movement thereof, and means connected to said force transmitting power means for operating the same.

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