Dec. 14, 1926. 1,610,372

C. C. HANSEN

SUBMARINE HAMMER DRILL UNIT

Filed August 24, 1925 3 Sheets-Sheet 1

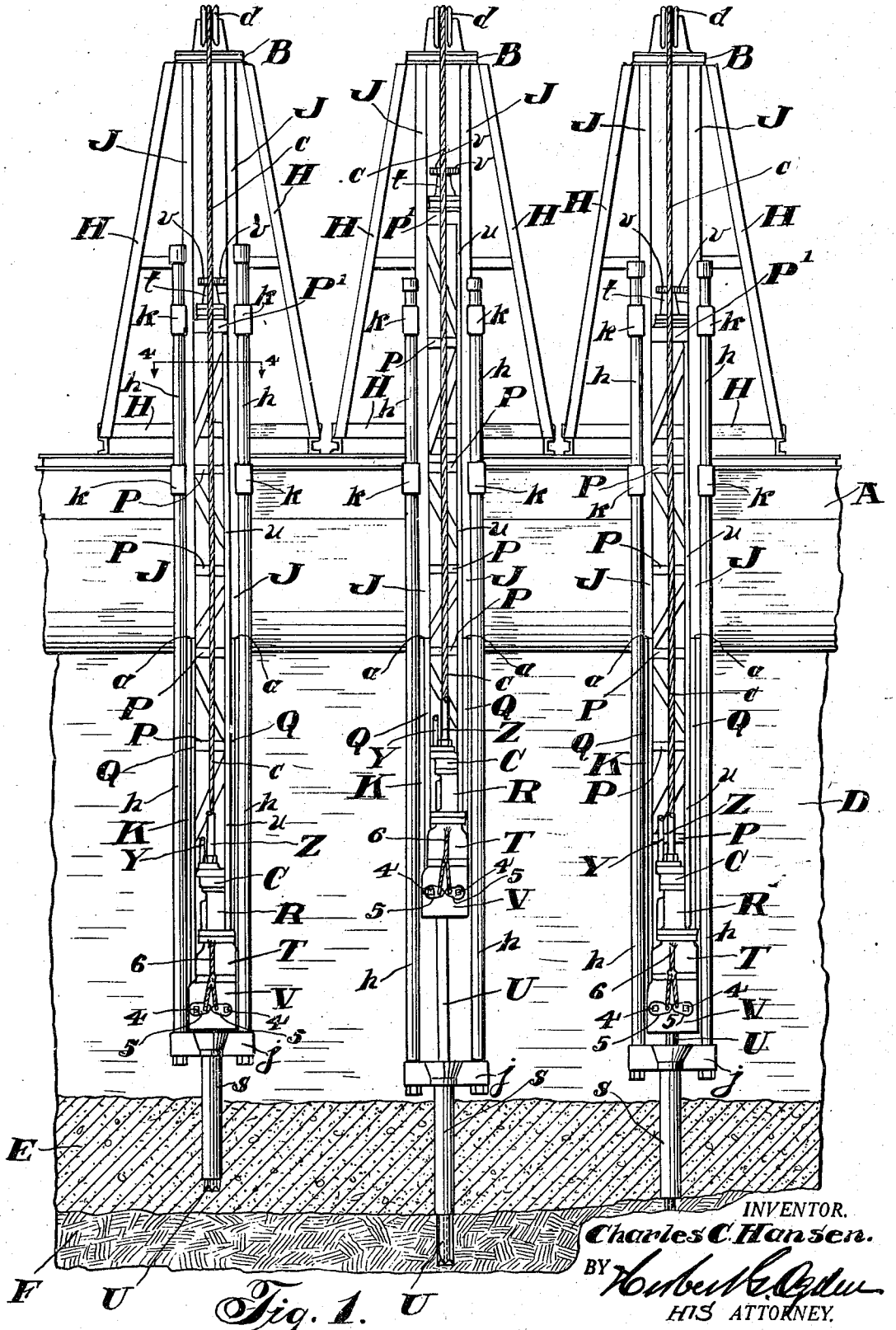


Fig. 1.

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SUBMARINE HAMMER DRILL UNIT

Filed August 24, 1925 3 Sheets-Sheet 2

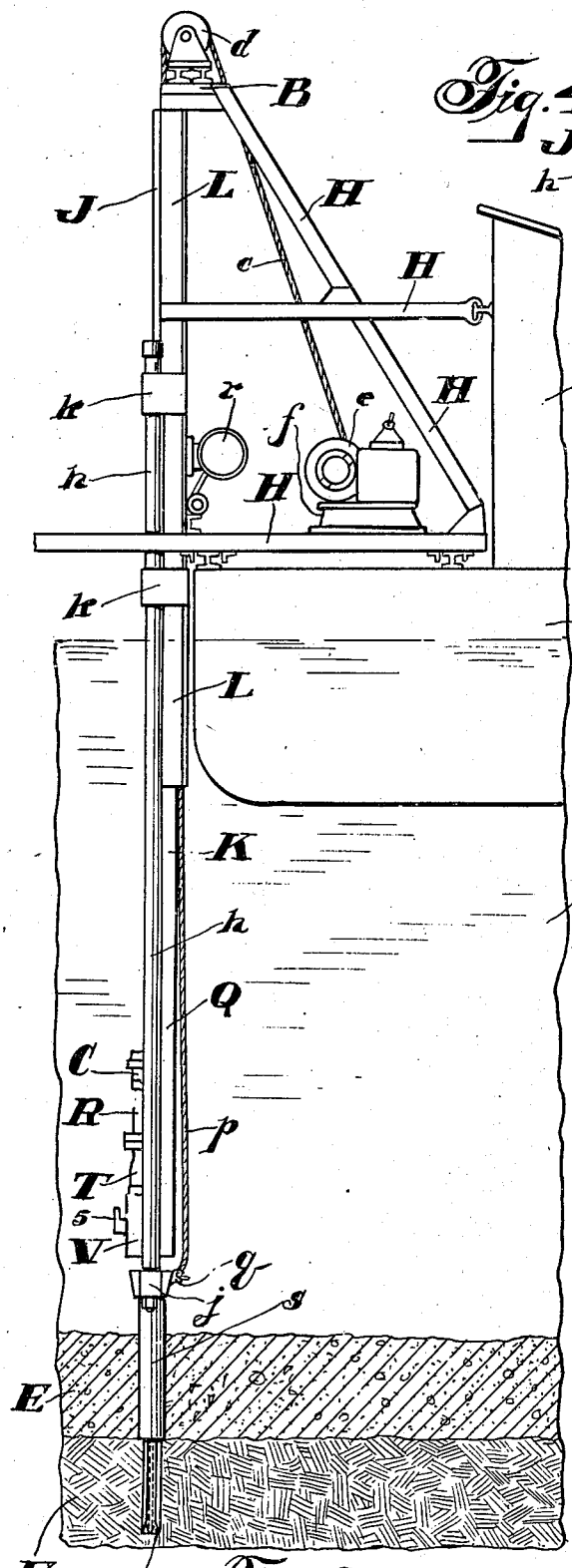


Fig. 2.

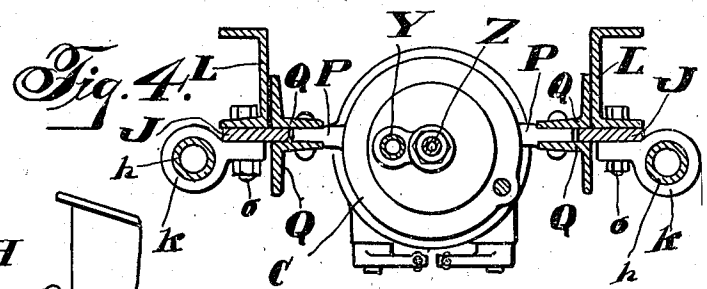


Fig. 4.

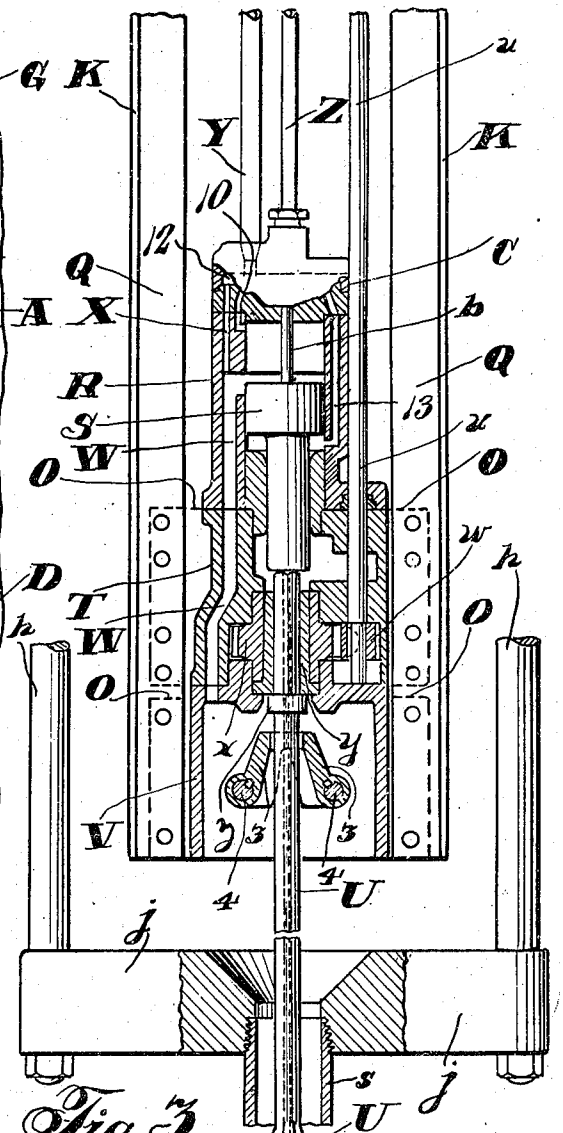


Fig. 3.

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SUBMARINE HAMMER DRILL UNIT

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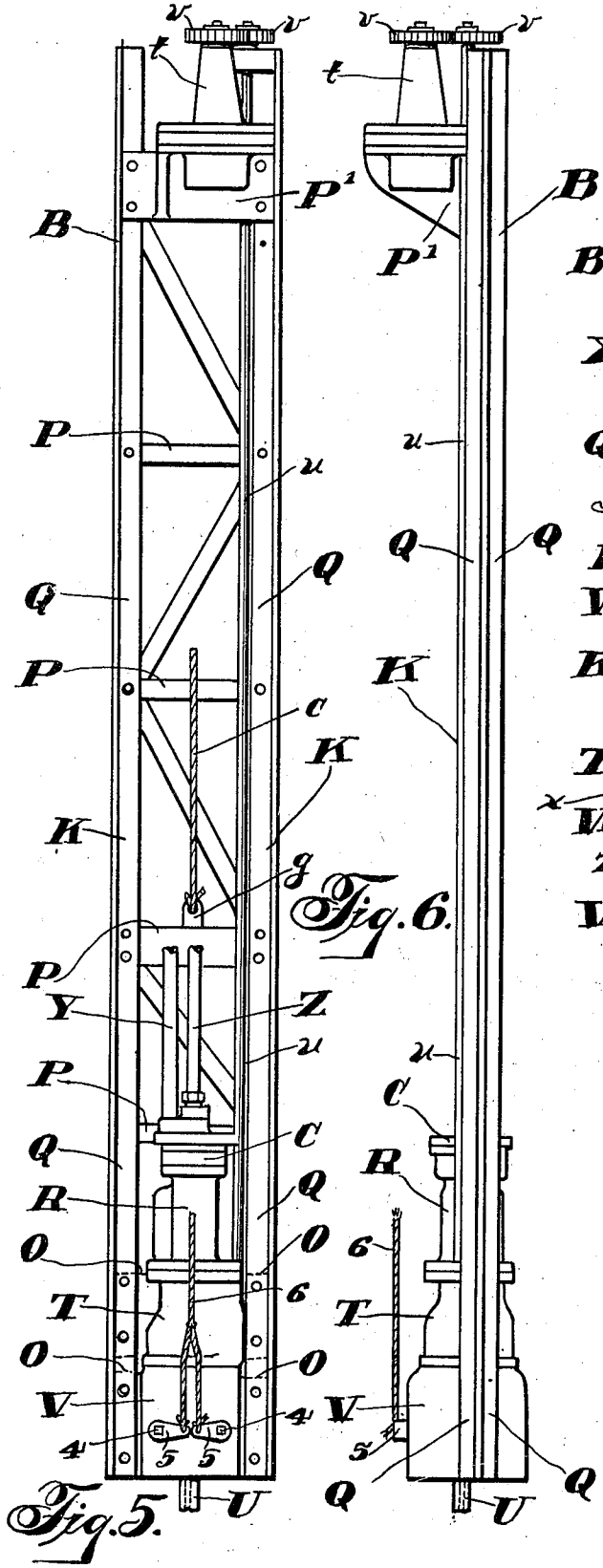


Fig. 5.

Fig. 6.

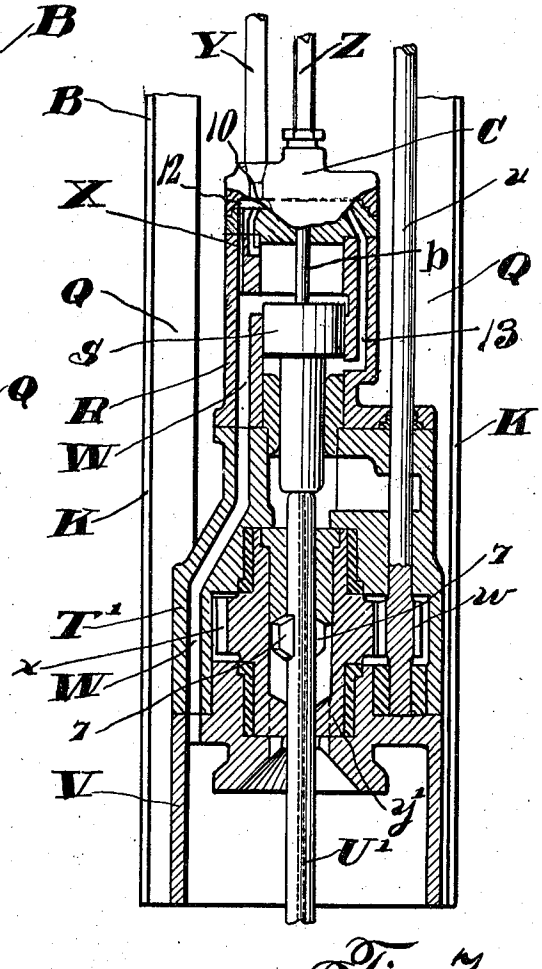


Fig. 7.

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UNITED STATES PATENT OFFICE.

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SUBMARINE HAMMER-DRILL UNIT.

Application filed August 24, 1925. Serial No. 52,136.

This invention relates to submarine drills, but more particularly to a submarine hammer drill unit, in which a fluid actuated rock drill of the hammer type is lowered into the water and effects the drilling operations while submerged. The rock drill may be raised for changing steels as the depth of the drilled hole increases, and the entire operation of submarine drilling is carried out by substantially the same mode of operation which obtains on land with drills of the hammer type.

The objects of the invention are to obviate the great length of steel required with ordinary submarine drills of the percussive or reciprocating piston type, commonly known as piston drills in which the drill steel is connected to the piston, as distinguished from hammer drills in which the hammer piston strikes the drill steel, avoid the necessity of high towers on the drill barge, reduce the weight of the drilling units, lighten the labor of the drill operators and simplify and cheapen the cost of the entire operation of submarine drilling.

To all these ends the invention is shown in one of its preferred forms in the accompanying drawings, in which—

Figure 1 is a side elevation partly broken away and partly in section showing a portion of a barge having submarine hammer drills mounted thereon. Three positions of the drill steel are shown;

Figure 2 is an end elevation of the barge and machines shown in Figure 1;

Figure 3 is an enlarged detail sectional elevation partly broken away showing the submarine hammer drill cylinder and including the rotation mechanism for the drill steel and the submarine front head bell. In this view the drill steel is in the act of being lowered into the mud guard or protective shield which is projected through the loose material and broken rock down to the submerged rock or hard material layer to be drilled;

Figure 4 is an enlarged detail transverse sectional view partly broken away taken on line 4—4 of Figure 1;

Figure 5 is an enlarged detail side elevation of the vertically slidable drilling element or frame carrying the hammer drill and rotation mechanism;

Figure 6 is an end view of the drilling element shown in Figure 5; and

Figure 7 is an enlarged detail sectional elevation partly broken away of a modification showing the hammer cylinder provided with a lug chuck to take lugged steel.

Referring to the drawings, the barge A, only a portion of which is shown, may be of any suitable or usual construction for submarine drilling and is adapted to have mounted thereon one or more submarine drilling units B as shown in Figure 1, in this instance three being shown, and each unit being provided with the submarine rock drill C of the hammer type adapted to be submerged in the water D during the operation of drilling. The loose material and broken rock usually lined in the bed of a river or on the bed of any body of water is represented at E and the rock or hard material to be drilled is represented at F.

The barge A may be provided with the usual shed or housing or several sheds or housings G for sheltering the usual compressors, engines, pumps, implements and tools required for submarine drilling, although, for purposes of simplicity, these particular engines and machines are not shown, it being understood that the rock drills C forming a part of this invention are preferably adapted to be operated by motive fluid, as for instance compressed air, in which case a compressor or compressors would be required.

Each submarine drilling unit of the hammer type, as shown, is provided with a main frame H of any suitable construction preferably in the form of a tower of moderate height and having guides J which may be in the form of plates extending downwardly a sufficient distance, as for instance to the points *a*, to form guides for the drilling element or frame K shown separately in Figures 5 and 6, which element or drilling frame is slidable vertically on the guides J, but is preferably of sufficient length so that the upper end of the drilling frame remains out of water and is never submerged during the operation of drilling.

The guides J are conveniently secured to the channels L forming a part of the main frame H and the drilling frame is formed with the side plates O and cross braces P to which angle irons Q are secured, thus forming guide channels into which the guide plates J extend so that the drilling frame may be guided on the guides.

A fluid actuated rock drill of the hammer type is suitably secured to the lower end of the drilling frame or element K and preferably comprises the cylinder R containing the reciprocating hammer piston S, the separable front head T containing the chuck parts of rotation mechanism for the drill steel U which is preferably a hollow steel so that cleansing fluid may be supplied through the steel, and a bell V into which the exhaust of the rock drill passes through the exhaust passage W in any suitable manner so that water is prevented from entering the rock drill parts. The hammer piston S may be operated automatically in any suitable manner, as is customary with hammer drills, in this instance live pressure fluid being supplied to the rearward end of the cylinder R through the port 10 leading from the valve chamber 12 for driving the piston forwardly, and is supplied to the forward end of the cylinder through the passage 13 for driving the piston rearwardly, while the exhaust passes forwardly through the exhaust passage W. Any suitable valve (not shown) may be provided in the valve chamber 12, since these elements form no part of the present invention. The pressure fluid supply pipe Y is understood to be controlled by any suitable form of main valve, to turn on and off the air from the main line, and the rock drill itself would be provided with the usual throttle (not shown) for controlling the starting and stopping of the operation of the hammer piston. The efficiency of the submarine hammer piston is maintained by operating at higher air pressure from the supply than on land, due to the back pressure. It will also be observed that the chuck cavity into which the shank of the drill steel extends is subject to exhaust pressure because of the loose fit of the drill steel shank in the chuck and because of access through other front head parts which further aids in keeping water out of the rock drill. A small bleeder port X is also preferably formed in the cylinder R leading from the pressure supply pipe Y and valve chamber 12 to the exhaust passage W so that live pressure fluid is constantly supplied to the bell which aids in keeping the water out of the rock drill parts as the machine is being lowered beneath the water and before the drill starts in operation and during submergence and operation. The air through the small bleeder port X is not sufficient to start the drill alone. Cleansing water is supplied to the rock drill in the usual manner through the water supply pipe Z and water tube *b* which pipes are adapted to be carried in any suitable manner to the drill barge A as for instance, through hose pipes and there supplied with air and water respectively under pressure. The drilling frame K is adapted to be raised and lowered by means of the rope or cable *c* passing upwardly over the sheave *d* at the top of the main frame H and connected to be operated by any suitable winding engine *e* having the frame *f*. This lifting and lowering cable *c* may be connected to one of the plates P of the drilling frame at the point *g*.

A supplemental frame formed by the rods *h* and the foot piece *j* to which the rods are suitably connected is vertically slidable in the brackets *k* carried by the main frame H and conveniently secured to the guide plates P as by means of the bolts *o* shown particularly in Figure 4. A rope or cable *p* connected to the foot piece *j* of the supplemental frame at the point *q* passes upwardly over a small winding engine *r* of any suitable type supported from the main frame H as shown in Figure 2, so that the drilling frame or element K and the supplemental frame formed by the members *h* and *j* are independently vertically movable and adjustable. The supplemental frame carries a tubular mud guard or protective shield *s* which is adapted to be forced through the loose or broken material E on top of the rock F for the purpose of protecting the drill steel and the hole to be drilled. By reason of the construction described, a convenient method of forcing or driving the mud guard *s* down into the rock is that indicated in Figure 1 in which the supplemental frame is first lowered until the mud guard is within the material E and then the drilling frame K is lowered until the weight of the frame and the parts carried thereby rests upon the foot piece *j*. A short length of drill steel U preferably projects through the mud guard *s* as shown in the drill unit at the left hand side of Figure 1. The operation of the hammer drill is then started and cleansing water is at the same time forced down through the drill steel through the pipe Z. The weight of the drilling frame and its parts together with the vibration caused by the operation of the hammer together with the cleansing effect of the water forced down through the drill steel will quickly drive or thrust the mud guard through the loose or broken material E until the mud guard rests upon hard surface or rock F to be drilled. The drilling frame is then raised and a longer drill steel inserted and again lowered for the operation of drilling the hole as indicated in the central drilling unit in Figure 1. The drilling unit at the right hand side of Figure 1 indicates the drilled hole as about completed, it being assumed that the longest length of drill steel U necessary for this purpose has been used.

In order that the rotation of the drill steel may be at all times observed from a point above the surface of the water on the barge A, independent rotation is applied to the drill steel operated by a suitable motor *t* carried on the bracket P′ at the upper end

of the drilling frame K. This motor may be a pressure fluid motor or an electric motor or one of any other suitable type and is moved up and down together with the drilling frame. Suitable operative connections are provided between the rotation motor *t* and the rotation mechanism located in the front head of the rock drill and for this purpose a rod or shaft *u* may be conveniently provided operated by the motor gears *v* at the upper end and provided with a pinion *w* at the lower end meshing with the rotation gear *x* on the chuck *y* into which the shank of the drill steel U extends. By this means the rotating shaft or rod *u* and the motor are always visible from the barge A and if the drill steel sticks the operator is aware of the fact and can cease drilling until the drill steel is released. Furthermore, the operator always knows whether or not drilling is being effected.

In Figure 3 a collared drill steel is shown having the collar *z* and means are provided in the form of rocking clamps 3 for clamping the drill steel. These clamps are secured to the pivots 4 on the bell V and are provided with levers 5 outside the bell connected by the rope 6 which leads to a suitable point on the barge A so that the drill steel clamp may be set or released as desired by hand.

In the modification shown in Figure 7, a Leyner chuck of the rock drill is shown adapted to receive a lug steel having the lugs 7 so that the drill steel clamp is unnecessary and the drill steel is released by slightly turning the rock drill which may be effected in any suitable manner as by twisting the rotating shaft or reversing the motor *t*.

I claim:

1. In a submarine hammer drill unit, the combination of a main frame having guides, a vertically movable drilling element on said guides comprising a drilling frame, a hammer drill cylinder secured to the lower end of said movable drilling frame and adapted to be submerged for drilling purposes, a fluid actuated hammer piston reciprocating in said cylinder adapted to impart blows of impact to a drill steel, and means for utilizing the exhaust from the hammer drill for preventing water from entering the cylinder and front head parts while submerged.

2. In a submarine hammer drill unit, the combination of a main frame having guides, a vertically movable drilling element on said guides comprising a drilling frame, a fluid actuated rock drill of the hammer type secured to the lower end of said drilling frame, and a bell at the front end of said rock drill into which the rock drill exhausts to prevent water from entering the rock drill while submerged.

3. In a submarine hammer drill unit, the combination of a main frame having guides, a vertically movable drilling element on said guides comprising a drilling frame, a hammer drill cylinder secured to the lower end of said movable drilling frame and adapted to be submerged for drilling purposes, a fluid actuated hammer piston reciprocating in said cylinder adapted to impart blows of impact to a drill steel, and a bell at the front end of said drill cylinder into which the cylinder exhausts to prevent water from entering the cylinder and front head parts while submerged.

4. In a submarine hammer drill unit, the combination of a main frame having guides, a vertically movable drilling element on said guides comprising a drilling frame, a fluid actuated rock drill of the hammer type secured to the lower end of said drilling frame, a bell at the front end of said rock drill into which the rock drill exhausts to prevent water from entering the rock drill while submerged and additional means for continuously permitting live pressure fluid to flow into said bell.

5. In a submarine hammer drill unit, the combination of a main frame having guides, a vertically movable drilling element on said guides comprising a drilling frame, a hammer drill cylinder secured to the lower end of said movable drilling frame and adapted to be submerged for drilling purposes, a fluid actuated hammer piston reciprocating in said cylinder adapted to impart blows of impact to a drill steel, a bell at the front end of said drill cylinder into which the cylinder exhausts to prevent water from entering the cylinder and front head parts while submerged, and additional means for continuously permitting live pressure fluid to flow into said bell.

6. In a submarine hammer drill unit, the combination of a main frame having guides, a vertically movable drilling element on said guides comprising a drilling frame, a fluid actuated rock drill of the hammer type secured to the lower end of said drilling frame, a vertically movable supplemental frame carried by said main frame, a tubular mud guard or protective shield secured to said supplemental frame and located below the drilling frame, said mudguard being adapted to rest directly upon and be supported by the rock or material to be drilled, and a drill steel adapted to project through said mud guard and removable rearwardly through the mud guard, whereby the mud guard may be forced through the loose bottom material down upon the solid rock to be drilled by permitting the weight of the drilling frame to initially rest upon the supplemental frame while the rock drill is submerged.

7. In a submarine hammer drill unit, the combination of a main frame having guides,

a vertically movable drilling element on said guides comprising a drilling frame, a fluid actuated rock drill of the hammer type secured to the lower end of said drilling frame and adapted to be bodily submerged for drilling purposes, a vertically movable supplemental frame carried by said main frame, a tubular mud guard or protective shield secured to said supplemental frame and located below the drilling frame, said mud guard being adapted to rest directly upon and be supported by the rock or material to be drilled, a drill steel adapted to project through said mud guard and removable rearwardly through the mud guard, whereby the mud guard may be forced through the loose bottom material down upon the solid rock to be drilled by permitting the weight of the drilling frame to initially rest upon the supplemental frame while the rock drill is submerged, said drill steel being hollow, and means for supplying cleansing water under pressure to said drill steel for clearing mud and dirt out of the mud guard while said guard is being forced down to the rock bottom to be drilled and during drilling operation.

8. In a submarine hammer drill unit, the combination of a main frame having guides, a vertically movable drilling element on said guides comprising a drilling frame, a hammer drill cylinder secured to the lower end of said movable drilling frame and adapted to be submerged for drilling purposes, a fluid actuated hammer piston reciprocating in said cylinder, a vertically movable supplemental frame carried by said main frame, a tubular mud guard or protective shield secured to said supplemental frame and located below the drilling frame, said mud guard being adapted to rest directly upon and be supported by the rock or material to be drilled, and a drill steel adapted to project through said mud guard and removable rearwardly through the mud guard, whereby the mud guard may be forced through the loose bottom material down upon the solid rock to be drilled by permitting the weight of the drilling frame to initially rest upon the supplemental frame while the rock drill is submerged.

9. In a submarine hammer drill unit, the combination of a main frame having guides, a vertically movable drilling element on said guides comprising a drilling frame, a hammer drill cylinder secured to the lower end of said movable drilling frame and adapted to be submerged for drilling purposes, a fluid actuated hammer piston reciprocating in said cylinder, a vertically movable supplemental frame carried by said main frame, a tubular mud guard or protective shield secured to said supplemental frame and located below the drilling frame, said mud guard being adapted to rest directly upon and be supported by the rock or material to be drilled, a drill steel adapted to project through said mud guard and removable rearwardly through the mud guard, whereby the mud guard may be forced through the loose bottom material down upon the solid rock to be drilled by permitting the weight of the drilling frame to initially rest upon the supplemental frame while the rock drill is submerged, said drill steel being hollow, and means for supplying cleansing water under pressure to said drill steel for clearing mud and dirt out of the mud guard while said guard is being forced down to the rock bottom to be drilled and during drilling operation.

10. In a submarine hammer drill unit, the combination of a main frame having guides, a vertically movable drilling element on said guides comprising a drilling frame, a hammer drill cylinder secured to the lower end of said movable drilling frame and adapted to be bodily submerged for drilling purposes, a fluid actuated hammer piston reciprocating in said cylinder adapted to impart blows of impact to a drill steel, and means for utilizing the exhaust from the hammer drill for preventing water from entering the cylinder and front head parts while submerged, and independent means for rotating the drill steel having portions constantly visible from above the surface of the water in which the rock drill is submerged, whereby the operator may constantly observe from the surface the operation of drilling under water.

11. In a submarine hammer drill unit, the combination of a main frame having guides, a vertically movable drilling element on said guides comprising a drilling frame, a fluid actuated rock drill of the hammer type secured to the lower end of said drilling frame, said rock drill including a hammer cylinder and reciprocating fluid actuated piston, a separable front head containing rotation mechanism, and a separable bell forwardly of the front head into which the rock drill exhausts to prevent water from entering the rock drill while submerged.

In testimony whereof I have signed this specification.

CHARLES C. HANSEN.