April 5, 1932. W. D. GRANT 1,852,408

SUBAQUATIC ROCK DRILLING DEVICE

Filed Nov 26, 1929 3 Sheets-Sheet 1

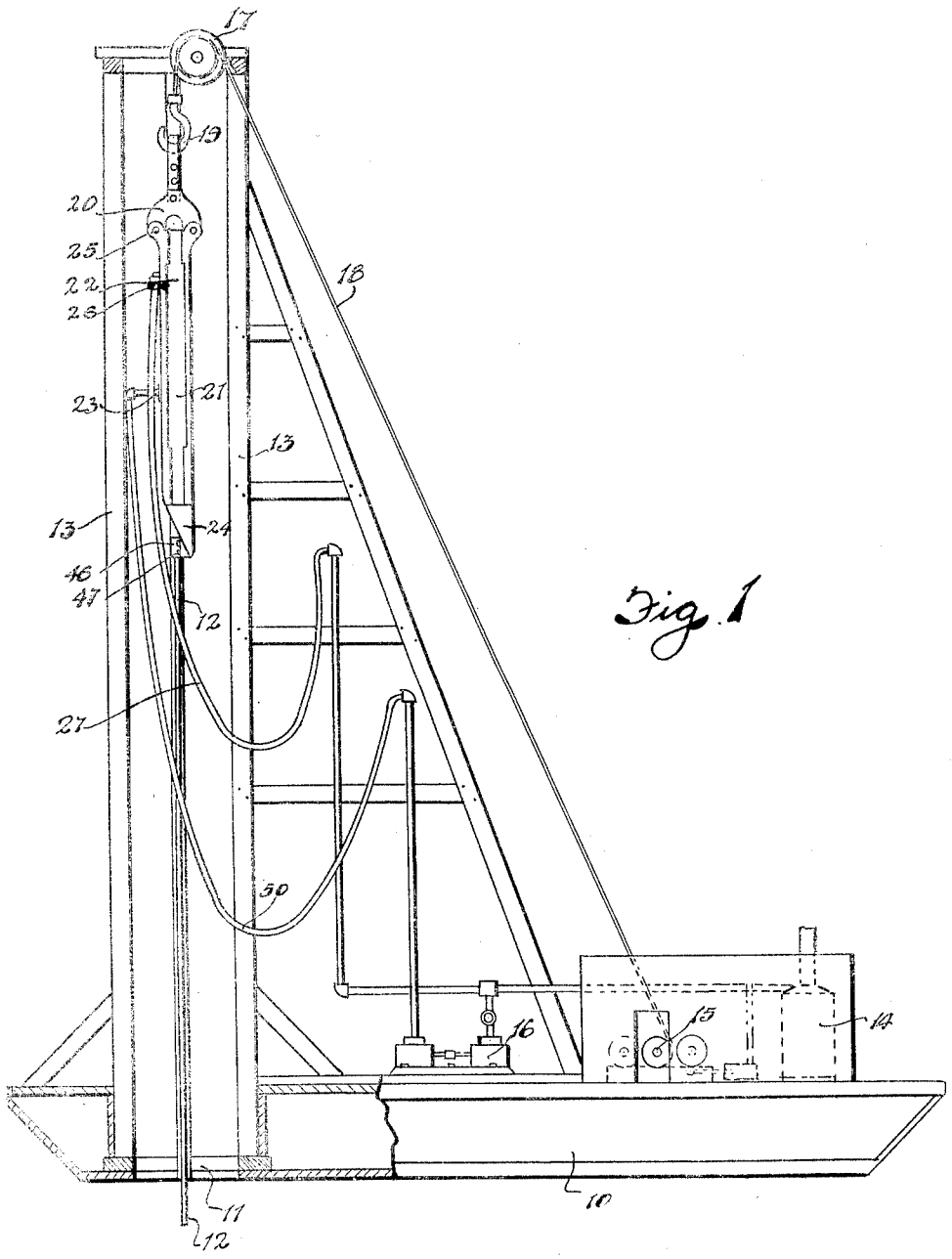

Fig. 1

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SUBAQUATIC ROCK DRILLING DEVICE

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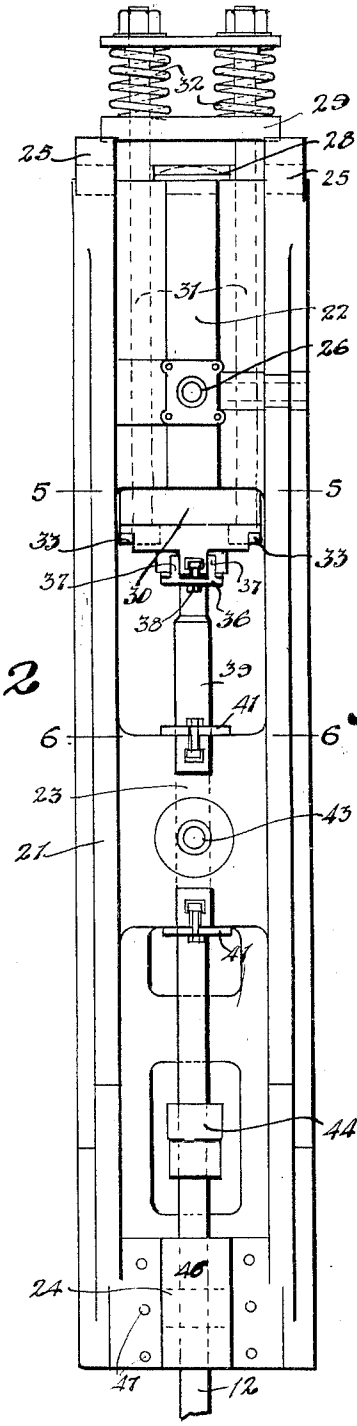

Fig 2

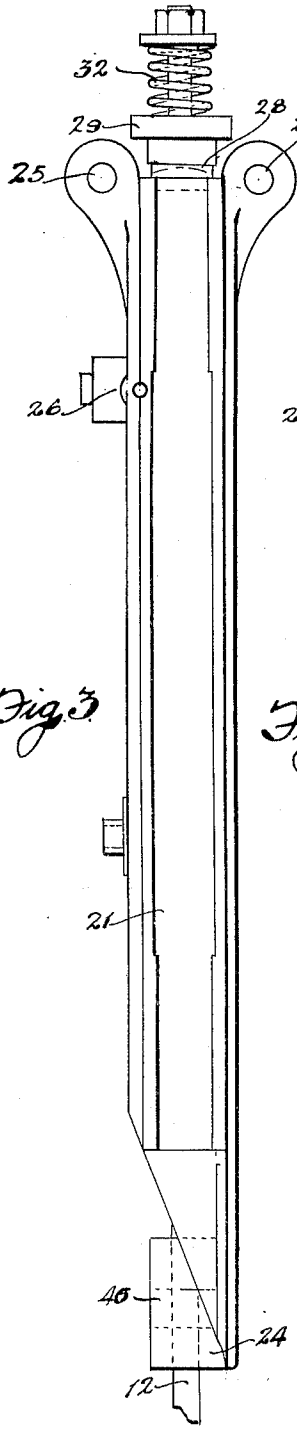

Fig 3

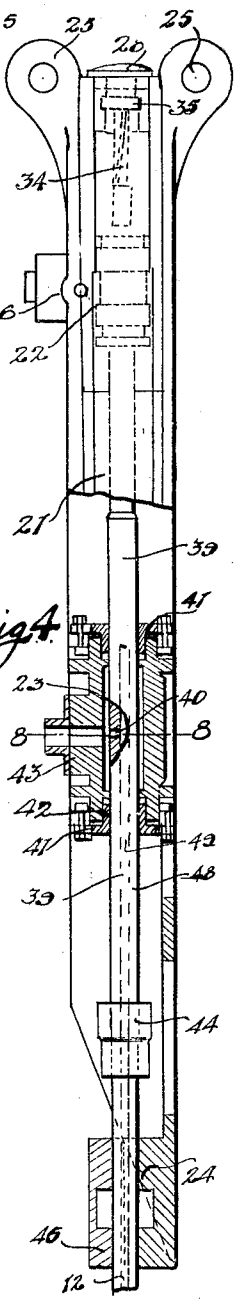

Fig 4

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SUBAQUATIC ROCK DRILLING DEVICE

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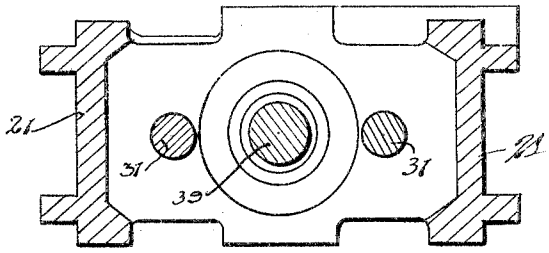

Fig. 5

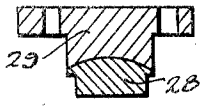

Fig. 10

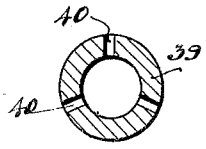

Fig. 8

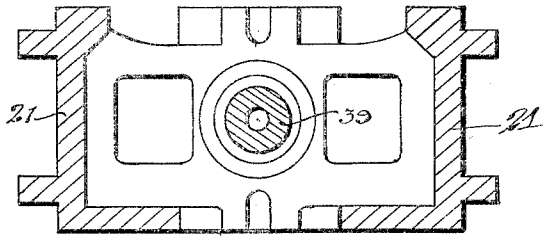

Fig. 6

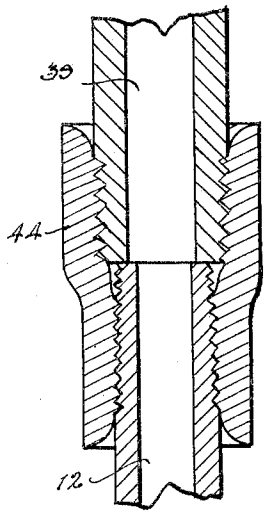

Fig. 9

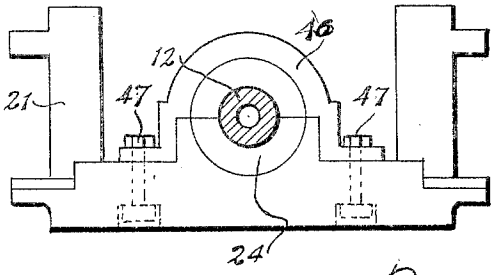

Fig. 7

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Patented Apr. 5, 1932 1,852,408

UNITED STATES PATENT OFFICE

WILLIAM D. GRANT, OF VANCOUVER, BRITISH COLUMBIA, CANADA

SUBAQUATIC ROCK DRILLING DEVICE

Application filed November 26, 1929. Serial No. 409,958.

This invention relates to improvements in subaquatic rock drilling devices. One of its main objects is to effect a comprehensive co-ordination of the apparatus involved whereby a more direct application of the tools is secured, resulting in considerable added efficiency over rock drilling operations as usually conducted.

In this connection it is to be noted that this plant is principally used on floating equipment such as scows and other like vessels, and often in tidal waters subjected to constant change of surface level as well as to sudden surface disturbance caused by passing vessels, both of which effects create difficulty in the handling and manœuvring of the plant by creating alterations to the relative position of the drill head in respect to the working face of the rock under operation.

To illustrate this point the operator may be drilling during a rising tide and this would necessitate the gradual paying out of cable in order to keep the drill effectively engaged otherwise the drill would be raised and its operation cease.

Conversely, should the drill be operated during a falling tide the supporting cable must be hauled in to compensate for the changing water level; in other words unless the operation is adroitly handled with great care and good judgment so that the blow from the drill may be most effective and also that the proper end clearance of the piston within the steam cylinder may be maintained, there is grave danger of the piston being driven violently into the cylinder and smashing out the cylinder head.

In order to overcome these difficulties I have invented special means whereby the dangers recited are largely or entirely overcome.

The reasons for the attainment of these and other objects of the invention are better seen and more clearly described by the aid of the drawings accompanying and forming a part of this application, and in which:

Figure 1 is a general view in side elevation of the equipment as used by me for subaquatic rock drilling work.

Figure 2 shows to an enlarged scale the body member of the device into which are incorporated the principal components of the plant under operation.

Figure 3 is a side view of Figure 2.

Figure 4 is a semi-sectional view of Figure 3 with the cylinder head, bolts and springs removed.

Figure 5 is a cross section on line 5—5 of Figure 2.

Figure 6 is a cross section on line 6—6 of Figure 2.

Figure 7 is an end view of Figure 2 from the front.

Figure 8 is a cross section of the piston-rod on line 8—8 in Figure 4 to an enlarged scale,

Figure 9 is a vertical section of the piston and drill rod coupling.

Figure 10 is a cross section of the convex cylinder plug and bridge member.

In these drawings the numeral 10 indicates a scow adapted to support the drilling equipment and provided with an aperture 11 in its bottom through which the drill rod 12 passes. A vertical framework 13 suitably braced is supported from the bottom of the scow and provided with a peripheral water-tight casing below the deck of same to maintain the buoyancy of the scow.

A steam boiler 14 provides energy for operating winding drums 15 and pump 16. A suitable sheave 17 is mounted on the head of the framework and supports the cable 18 terminating in the hook 19. A suitable shackle member 20 unites the hook 19 with the body-member 21 which incorporates the more salient features of the invention.

The latter member comprises the steam cylinder 22, the water-box 23, the lower guide 24, and the suspension lugs 25 by which the whole of the drill rod equipment is supported.

The steam cylinder 22 is provided with an ordinary D valve at 26 and is supplied with steam through the flexible pipe 27. A prominent feature of the device relates to means for absorbing the shock of the piston and parts moving therewith at the extremity of the return stroke.

The piston and piston rod are integral and

the piston, after passing through the lower gland 36 of the cylinder 22, is continued through the water-box 23, its diameter being enlarged at 39 to permit of its being bored longitudinally as shown at 48, the bore 49 being continued from the coupling end of the piston rod to a point beyond the longitudinal centre line of the water-box 23. At an intermediate point within the water-box 23 the piston rod 39 is pierced transversely by the apertures 40 (Fig. 8).

That portion of the piston rod 39 adjacent the apertures 40 is encircled by the water-box 23 so that water under pressure may be forced into the water-box and through the apertures 40 into the bore 49 of the piston rod 39 and thence into the hollow drill rod 12 to be delivered to the drill bit to free the cutting faces thereat of detritus regarding which it may be noted that in rapid high power drilling operations the effective removal of the detritus from the vicinity of the cutting head is a prominent determining factor in the efficient operation of the plant.

It is to be further noted that with this plant a high steam pressure is preferably employed on account of the great weight of the parts involved and the necessity for a maximum of compactness. Owing to the necessity for maintaining rapid and effective work, drills of comparatively large size are used involving corresponding increase in the strength and weight of all the parts involved.

With these objects in view the top end of the steam cylinder is provided with a convex plug 28 having a substantial steam-tight metal to metal joint with the cylinder. This plug 28 is held in position by the bridge member 29 which is secured to the cylinder cover 30 at the opposite end of the cylinder by the longitudinal bolts 31 against the pressure of the helical compression springs 32, the heads 33 of the bolts 31 engaging rectangular recesses as shown whereby the cylinder head plug 28 may be relieved from receiving the full impact of the piston in the event of this latter being subjected to an undue strain, thus absorbing and cushioning the impact by the action of the springs 32 should the piston be inadvertently driven beyond its intended stroke.

The usual means for rotating the drill and piston rods is indicated by the helically grooved rod 34 which engages a correspondingly grooved nut secured to and positioned within an axial recess in the end of the piston, the top end of the rod 34 being secured to a ratchet wheel 35 in connection with a pawl whereby the wheel 35 and the rod 34 are held non-rotatable in one direction thereby rotating the piston and rods secured thereto according to the pitch of the said helical grooves as the rod 34 slides vertically through the grooved nut in the end of the piston.

In order to withstand the effect of the severe vibrational and concussive strains the gland 36 which is provided with a bushing divided diametrically for erection purposes is fitted with yoke extensions 37 which engage corresponding members on the cover 30 and serve to effectively reinforce the gland bolts 38.

The water-box 23 is provided at each end with a tubular gland 41 and corresponding stuffing box 42, and has a suitable water pipe connection at 43. The drill rod 12 used with this equipment may be of unusually greater length, provision being made in the framework to accommodate this, whereby deeper drilling may be accomplished without the delays consequent upon frequent shifts and replacements of tackle. The various sections of the drill rod are united by sleeve couplings of the usual type. The water-box 23 is connected to the pump 16 by the flexible connection 50.

The coupling which unites the piston rod and the drill rod proper is developed as shown in detail in Figure 9 to meet the particular conditions of the case exemplified. The piston rod 39 is provided with a screw-thread differing in pitch from that employed on the drill rod 12, and the direction of the pitch of both threads is in opposition to that of the helical grooves in the rod 34, thereby tightening the screw hold of the coupling 44 which is further secured against concussional displacement by the differential effect between the two separate threads which sets up a self-locking function.

A feature of the coupling 44 relates to its complete enclosure of the screw threads on the rods. Each end of the coupling is bell-mouthed to a point which is beyond the screw thread on the rod, thus providing an annular receptacle for grease. By this device all possibility of damage to the non-engaged portion of the screw thread on the rods is eliminated and the engagement is retained in a condition which facilitates dismantling.

The lower extremity of the body member 21 carries the guide and bearing 24, the outer portion of which or cap 46 is secured to the body by the bolts 47.

From the above it will be seen that in consequence of incorporating the usually separated members 22, 23, 24 as an integral part of the massive casting forming the body member 21 much stability is added to the drilling operation so that the increased driving power and weight of the drill is not productive of undue vibration, but in consequence of the elongated guides is made available to increase its drilling capacity.

Having now particularly described my invention, I hereby declare that what I claim and desire to be protected in by Letters Patent, is:

1. In subaquatic rock drilling apparatus,

an elongated open rectangular casting having outer longitudinal slideways in its sides, a steam cylinder formed integrally with said casting and located between the sides thereof and adjacent one end, a drill-rod guide formed integrally with said casting adjacent its other end and located between the sides of said casting, and a water-box also formed integrally with said casting and lying intermediate the ends and between the sides thereof.

2. In subaquatic rock drilling apparatus, an elongated open rectangular casting having outer longitudinal slideways in its sides, a steam cylinder formed integrally with said casting and located between the sides thereof and adjacent one end, a drill-rod guide formed integrally with said casting adjacent its other end and located between the sides of said casting, and a water-box also formed integrally with said casting and lying intermediate the ends and between the sides thereof, a piston in said cylinder, a piston rod passing through said water-box and connected to said piston, and a drill rod passing through said drill-rod guide and connected to said piston rod.

In testimony whereof I affix my signature.

WILLIAM D. GRANT.