

Aug. 25, 1936.

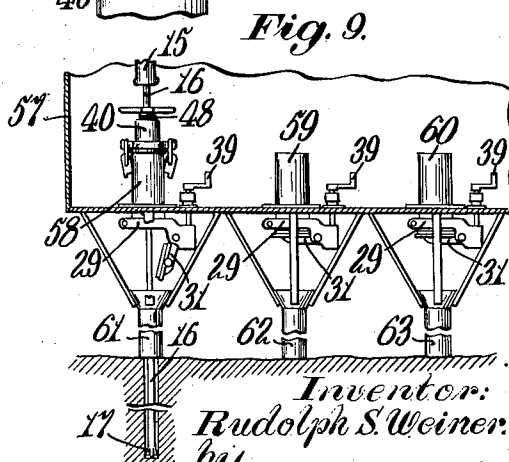
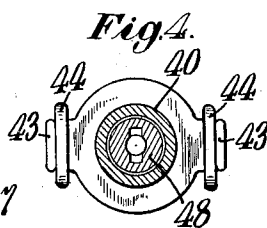
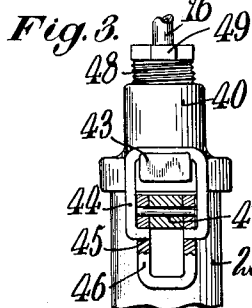
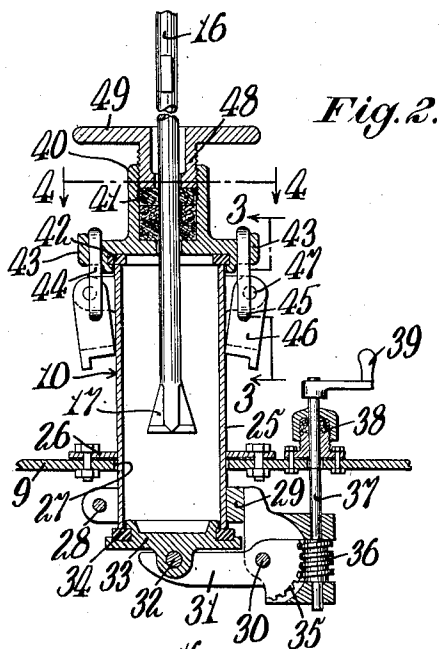
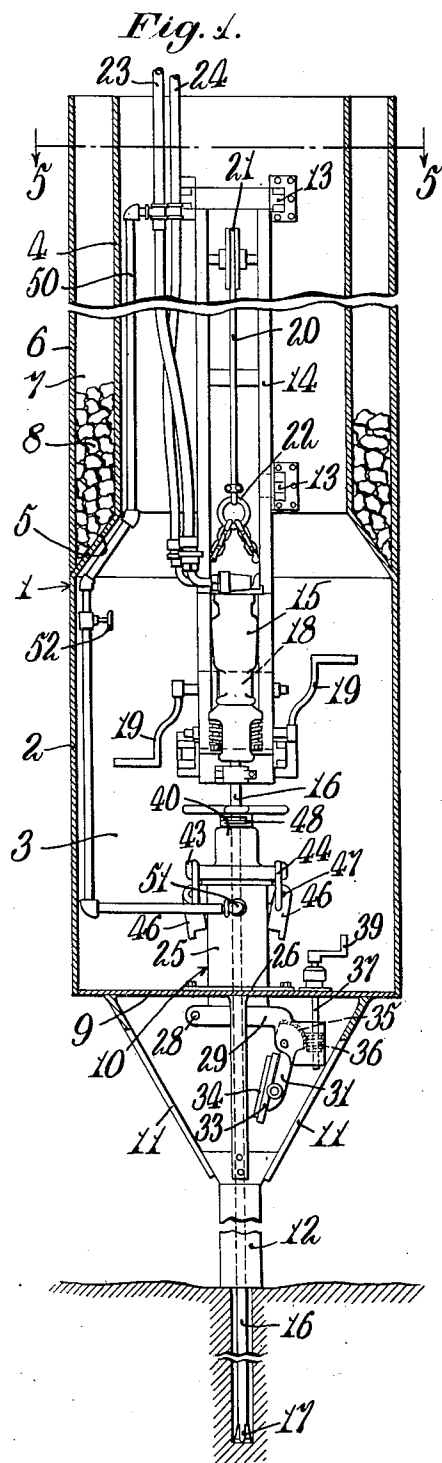
R. S. WEINER

2,051,926

CAISSON

Filed July 1, 1933

3 Sheets-Sheet 1



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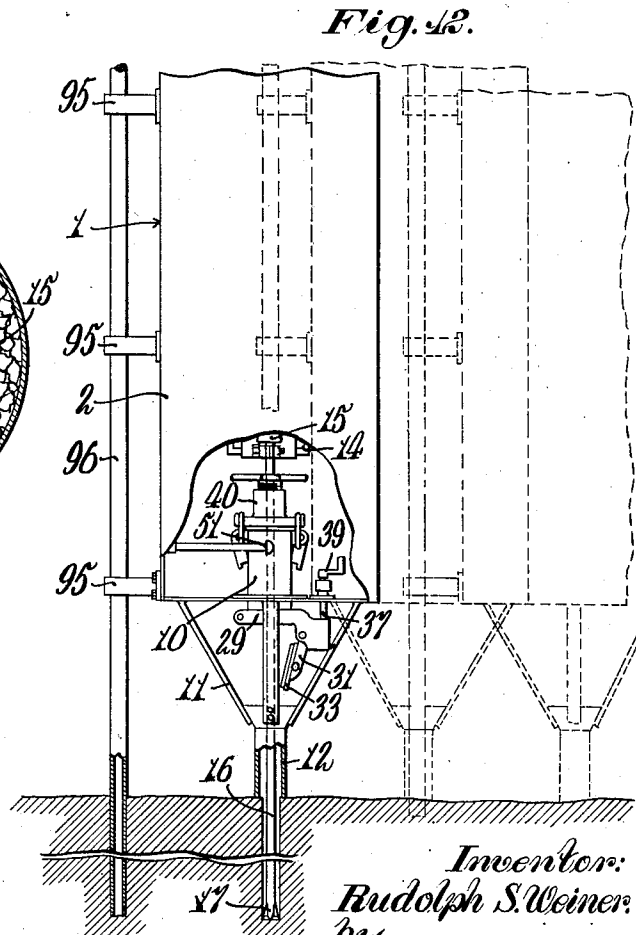
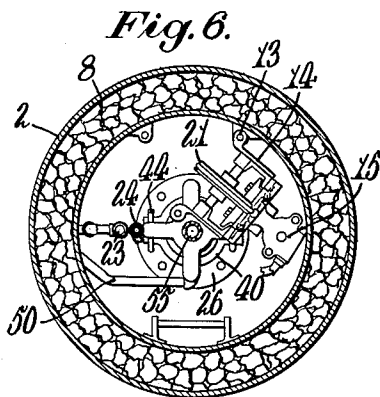
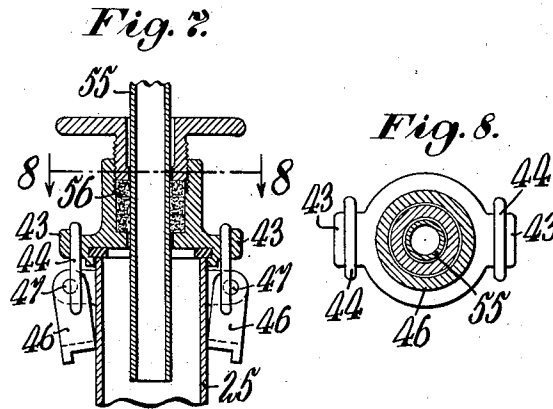
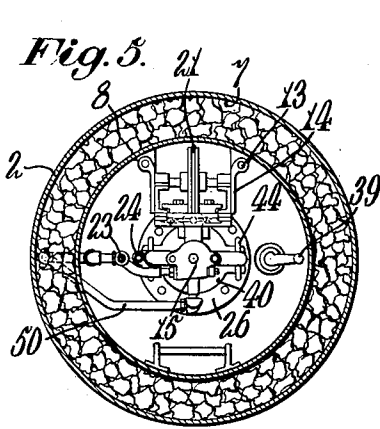
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

Fig. 10.

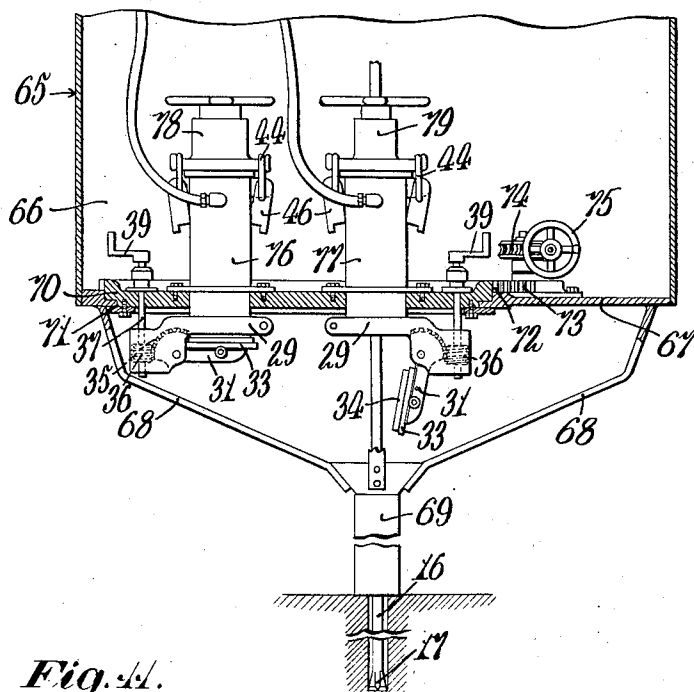
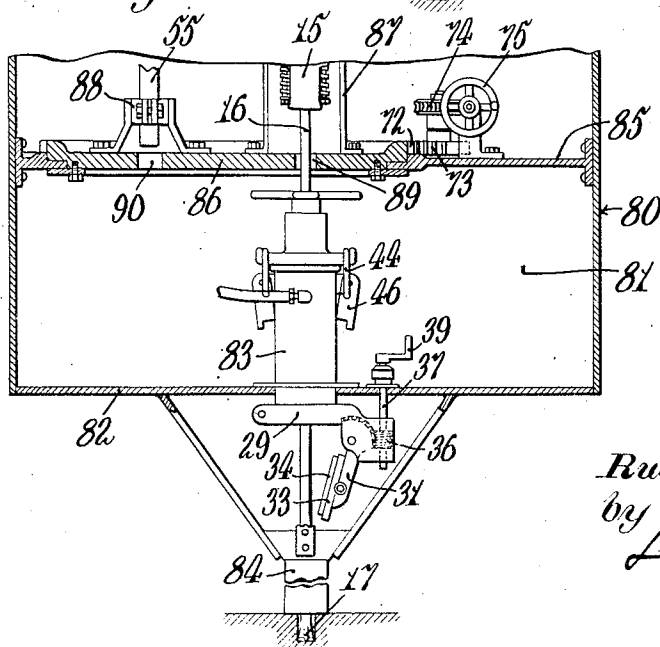


Fig. 11.



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UNITED STATES PATENT OFFICE

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CAISSON

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Application July 1, 1933, Serial No. 678,621

2 Claims. (Cl. 61—82)

This invention relates to caissons, and more particularly to improvements in caissons especially designed for use in submarine drilling operations and to improvements in submarine drilling methods.

An object of the present invention is to provide an improved caisson especially designed for use in submarine drilling, wherein the hole is drilled and the hole loaded with a blasting charge, while the caisson assumes but one position, the loading operation occurring after completion of the drill hole and before the caisson is moved to another drilling position. Another object is to provide an improved caisson particularly designed for use in submarine drilling work. A further object is to provide means in submarine drilling methods wherein a caisson is employed to facilitate drilling and loading of the blast holes. Yet another object is to provide an improved caisson particularly designed for use in submarine drilling, having an improved lock at the bottom thereof whereby drilling and loading of the blast hole may be accomplished through the same lock and through the same opening at the bottom of the caisson. A still further object of the invention is to provide an improved submarine drilling apparatus whereby the drilling can be more simply, precisely and rapidly performed, and with the use of smaller, lighter drills relatively close to the work and using smaller drill steel. 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, several forms which the invention may assume in practice.

In these drawings,—

Fig. 1 is a longitudinal section through one illustrative form of the improved caisson, showing the drilling unit in position therein.

Fig. 2 is a longitudinal section through the improved drill and loading tube lock, showing a drill steel in position therein.

Fig. 3 is a detail section taken on line 3—3 of Fig. 2.

Fig. 4 is a cross section taken on line 4—4 of Fig. 2.

Fig. 5 is a cross sectional view taken on line 5—5 of Fig. 1, showing the drill in drilling position.

Fig. 6 is a view similar to Fig. 5, showing the drill in its inoperative position and with the loading tube in its operative loading position.

Fig. 7 is a detail sectional view showing the caisson lock with a different form of stuffing box for use with the loading tube.

Fig. 8 is a cross section taken on line 8—8 of Fig. 7.

Fig. 9 is a detail sectional view showing a modified form of caisson wherein a plurality of caisson locks are employed.

Fig. 10 shows a further modified form of caisson construction.

Fig. 11 is a view similar to Fig. 10 and showing a still further modified form of caisson construction.

Fig. 12 shows the improved caisson shown in Fig. 1, with a modified form of loading tube arrangement.

In the illustrative embodiment of the invention shown in Figs. 1 to 8, inclusive, there is shown a caisson, generally designated 1, a series of which are mounted at each side of the drill boat or other suitable support, and these caissons are sunk into the water to the desired depth, with the upper end of the caisson projecting above the water surface open so that the pressure within the caisson is at all times atmospheric. In this instance, the caisson is comprised of a tubular casing 2 having formed therein a working chamber 3. The upper end 4 of the caisson is also preferably tubular in form and of reduced cross section, the lower end of the tubular portion 4 being united to the bottom casing 2 by an inclined partition 5. Encircling the tubular portion 4 of the caisson is an outer cylindrical casing 6 secured to the bottom casing and preferably of the same diameter as the bottom casing. The wall portions 4 and 6 form an annular chamber 7 for receiving ballast 8 of some sort for increasing the weight of the caisson, thereby facilitating lowering of the caisson into the water. Obviously, the amount of ballast may be varied in accordance with the variation in the depth of the water. The chamber casing 2 has an end wall or bottom 9 carrying centrally within the caisson chamber a drill and loading tube lock, generally designated 10. Attached by struts 11 or otherwise, to the lower end wall 9 of the caisson and arranged beneath the latter, is a mud pipe, or so-called mud pot 12, herein preferably arranged in coaxial alignment with the drill and loading tube lock 10 centrally along the axis of the caisson. If desired, the mud pot may be formed as an integral part of the caisson casing. Mounted at 13, 13 within the reduced tubular portion 4 of the caisson is a drill guide frame 14 having longitudinal guideways for receiving a rock drill 15 of a standard design. The mounting is herein shown as hinged, but obviously any other form of mounting permitting either the drill or the guide frame

to be moved out of the way during loading is within the scope of my invention. The rock drill may be any suitable type of motor for actuating the drill steel, and for illustration I have shown an impact motor for actuating a drill steel 16 having a usual drill bit 17. In the illustrative embodiment I have shown, mounted at the lower end of the drill guide frame, a suitable windlass 18 operated by hand cranks 19, and this windlass has wound thereon a hoisting cable 20 passing around a pulley 21 at the top of the drill guide and extending downwardly for connection at 22 to the rear end of the rock drill 15. Of course any other suitable hand-actuated or power-actuated mechanism can be used instead of this mechanism illustrated. Motive fluid and cleansing fluid, herein preferably air under pressure, are supplied to the rock drill through usual supply lines 23 and 24 extending downwardly through the caisson and connected at their upper ends to suitable sources of fluid supply, for instance, a compressor plant, carried on the drill boat.

The improved drill and loading tube lock 10 comprises a cylindrical casing 25 having an integral supporting flange 26 bolted to the end wall or bottom 9 of the caisson in such manner as to form a seal between the caisson wall and the lock casing. The lower end of the lock casing extends downwardly through the end wall 9 of the caisson through an opening 27 in the manner shown in Fig. 2. Attached by a clamp 28 to the lock casing beneath the caisson bottom, is a bracket 29 having pivotally mounted thereon at 30 an arm 31. Pivotally mounted at 32 on the pivoted arm 31 is a closure member or lock gate 33 carrying a soft rubber ring 34 or other sealing device for engagement with the lower edge of the lock casing. For swinging the arm from within the caisson chamber to move the closure member or gate 33 into and out of its sealing position, there is provided a worm rack 35 formed on the lever arm 31 and meshing with a worm 36 fixed to a vertical operating rod 37 suitably journaled within the bracket 29. This operating rod extends upwardly through a stuffing box 38 attached to the end wall 9 of the caisson, and carried at the upper end of the rod 37 within the caisson chamber is an operating handle 39. It will be understood, of course, that the bottom closure for the lock may assume various forms, another very practical one of which might consist of a gate valve arranged so that the valve element would move transversely of the lower end of the lock, and be actuated either by means wholly inside the caisson, or part inside and part outside, depending upon whether the valve were just above the bottom or floor of the caisson, or below the latter in the plane of the bottom of the casing 25 as the latter is shown in Fig. 2.

Carried at the top of the lock casing 25 is a detachable top head 40 carrying a stuffing box 41 for engaging the drill steel 16 to form a seal, thereby to prevent leakage of water into the caisson. This upper top head carries a soft rubber ring 42, or other sealing device, for engagement with the upper edge of the lock casing to form a seal. Formed on the upper head 40 are lateral lugs 43, 43 carrying link or eye members 44, and pivotally connected at 45 to toggle levers 46. The levers 46 are pivotally mounted at 47 on lateral ears integral with the lock casing. Threadedly connected with the upper end of the stuffing box and engageable with the packing 41 for adjusting the latter, is a plug 48 having an operating handle 49. When it is desired to insert the drill bit

17 within the lock casing, the upper head 40 is removed by releasing the toggle levers 46 and swinging the links or eyes 44 out of engagement with the lugs 43. The top head may then be lifted from the top of the lock casing and the shank of the drill steel inserted upwardly through the stuffing box into the position shown in Fig. 2. The handle 49 of the plug may be turned to tighten the packing 41 about the body of the drill steel. Obviously, if desired, the hole through the bottom of the stuffing box may be made large enough to permit the bit end of the drill to be passed through it, and semi-circular packing elements, arranged with staggered joints, put in the box closely to surround the drill shank. The upper head is then again placed on top of the lock casing and the parts adjusted in the position shown in Fig. 2 to rigidly hold the upper head in position on the lock casing.

When the drill bit 17 is in the position shown in Fig. 2 and it is desired to lower the drill bit down through the lock at the bottom of the caisson, the operator turns the lever 39, thereby swinging the closure member 33 downwardly from the bottom of the lock casing. As the closure 25 member 33 is released, the lock casing partially fills with water, but leakage of water from the casing into the caisson chamber is prevented by the stuffing box 41. A pipe 50 connected to the motive fluid supply line 23 for the rock drill is connected at 51 to the upper end of the lock casing, and this pipe is provided with a control valve 52. When it is desired to withdraw the drill bit from the lock, the drill bit is moved upwardly within the lock casing to the position shown in Fig. 2, and the closure member 33 moved to the position shown, in sealing engagement with the bottom of the lock casing. If desired, fluid under pressure may be conducted to the lock casing through the pipe 50 to blow out the water from the casing prior to the closure of the lower end of the casing. Instead of blowing out the casing through the pipe 50 with air supplied from the motive fluid supply line 23, the lock casing may be blown out by air under pressure supplied to the lock casing down through the rock drill steel, which is in most instances made hollow.

When it is desired to drill a hole in the rock at the river or lake bottom, the caisson is lowered from the drill boat into the position shown in Fig. 1, with the mud pipe or so-called mud pot 12 engaging the bottom surface. The drill steel which has been inserted within the air or water lock 10 is then lowered through the bottom of the lock casing, the closure member 33 being released as shown, and the drill bit 17 fed downwardly within the mud pipe 12. Air under pressure is then conducted down through the drill steel 16 to blow out the mud or other substances from the mud pipe. This result may also be effected by a water pipe (not shown) on the mud pot. When the drill bit 17 of the drill steel is in drilling position at the bottom, motive fluid is admitted through the supply line 23 to the rock drill 15, and as the drill of the illustrative embodiment is percussively actuated it is fed downwardly by the windlass and cable, along the drill guide frame 14, in a well known manner. During the drilling operation, the cuttings and mud are blown out of the drill hole by pressure fluid supplied to the bottom of the hole through the hollow drill steel. Steel changes may be made in an obvious manner. Upon completion of the drill hole, the rock drill is raised upwardly along its guide frame and the drill bit 17 moved within

the lock to the position shown in Fig. 2. The lock casing may then be blown out by fluid pressure and the lower end thereof sealed by the closure member 33. Obviously it is unnecessary to blow out the lock, however, as the closure member seals the bottom thereof and no more water can enter; and such water as may stand in the lock above the closure member will ordinarily be unobjectionable. The top head and stuffing box 40, 41 are then removed and the drill steel removed from the upper end of the lock casing. The drill guide frame 14 is then swung about its hinges 13, 13 from the drilling position shown in Fig. 5 laterally to its inoperative position shown in Fig. 6. The loading tube 55 is then placed in position, and the special loading tube stuffing box 56 (similar to the stuffing box 40, 41 for the drill steel) is placed in sealing engagement with the upper end of the lock casing 25, as shown in Fig. 7. The bottom closure member or gate 3 is then swung downwardly into its released position and the loading tube lowered by means of suitable apparatus carried within the caisson or by the drill boat, downwardly through the lock and mud pipe into the drill hole; and the loading charge is thereafter inserted within the loading tube and forced downwardly therethrough to the bottom of the drill hole in the usual manner. The loading tube is then removed from the drill hole upwardly into a position wherein the lower end thereof is within the lock casing, as shown in Fig. 7; and thereafter the lower end of the air lock is sealed by the closure member 33 and the loading tube withdrawn from the lock. The caisson is then raised upwardly and moved laterally along the drill boat to another drilling and loading position. It will thus be seen that both drilling and loading take place through a common opening at the bottom of the caisson and through a common caisson lock.

In the modified form of construction shown in Fig. 9, the caisson 57 extends along the side of the drill boat and is of a narrow elongated shape so that the drill and loading tube may be moved lengthwise of the caisson into different drilling and loading positions without necessitating movement of the caisson into different positions relative to the drill boat after each drilling and loading operation. Carried at the bottom of this elongated caisson is a series of drill and loading tube locks 58, 59 and 60 and a series of mud pipes 61, 62 and 63. After drilling and loading has taken place through the lock 58, the drill is moved successively in positions above the locks 59 and 60. Also, if desired, while the drill is operating through one lock, loading may be taking place in another lock. Although but three drill and loading tube locks are shown herein, it is desirable to use a larger number, and it is evident that any number desired may be employed.

In the modified form of caisson construction shown in Fig. 10, the caisson is generally designated 65, the working chamber 66, and the bottom end wall 67. Secured by braces 68, or otherwise, to the bottom of the caisson, is the mud pipe or so-called mud pot 69. Rotatably mounted on the end wall 67 of the caisson bottom is a horizontal turntable 70 having a fluid-tight swivel mounting 71. For rotating the turntable there are formed gear teeth 72 on the outer periphery of the turntable, and meshing with these teeth is a spur gear 73 operated through worm gearing 74 and a hand wheel 75. The turntable is mounted for rotation about a vertical axis par-

allel with and offset from the longitudinal center of the caisson; and mounted on this turntable structure is a pair of locks 76 and 77 of a design similar to the lock 10, the lock 76 constituting a loading tube lock, while the lock 77 constitutes a drill lock. When the parts are in the position shown, the drill lock 77 is arranged directly over the drill hole at the longitudinal center of the caisson, and drilling takes place through this lock in the manner described above in the preferred form of the invention. When the drill hole has been completed and the drill steel has been withdrawn from the drill lock, the turntable is rotated to move the drill lock out of the center of the caisson and to move the loading lock 76 into a position at the center of the caisson. The loading tube 55 is then lowered through the lock 76 into the drill hole to permit insertion of the blasting charge within the drill hole, and is withdrawn from the hole through the lock 76 in the manner clearly described above. The stuffing box and top head 78 for the loading lock 76 are identical to those disclosed in Figs. 7 and 8 of the preferred form of the invention, while the stuffing box and top head 79 of the drill lock are identical to those disclosed in Fig. 2, and each of the locks is provided with a releasable bottom closure member or gate, similar to the closure member 33 shown in Fig. 2. It will thus be seen that drilling and loading take place down through the center of the caisson, through separate loading and drill locks instead of through but a single lock, as disclosed above in the preferred form of the invention.

In the modified form of caisson construction shown in Fig. 11, the caisson is generally designated 80, the working chamber 81, and the lower end wall or bottom 82. In this form of the invention the lock 83 and mud pipe or so-called mud pot 84 are identical to and mounted in the same manner on the caisson bottom, as in the preferred form of the invention shown in Fig. 1. In this modified form of construction, there is arranged above the end wall 82 of the caisson a transverse support 85 on which a turntable structure 86 is rotatably mounted. This turntable structure may be identical to that described above in regard to the caisson construction disclosed in Fig. 10, and therefore a repetition of the description thereof is considered unnecessary. In this form of the invention, the turntable structure has mounted thereon a guide frame 87 for the rock drill and a guide bracket and clamp 88 for the loading tube 55, and the turntable is perforated by openings 89 and 90 through which the drill steel and loading tube are adapted to move downwardly through the turntable structure. When the parts are in the position shown, the drill steel opening 89 is in axial alignment with the caisson lock and mud pipe, and the drill steel is operated through the air lock and mud pipe to effect drilling of the drill hole. After the drill hole has been completed, the drill steel is withdrawn from the caisson lock upwardly through its opening in the turntable structure, the top head and stuffing box structure 40, 41 shown in Fig. 2 being released to permit withdrawal of the drill steel from the lock casing. The turntable 86 is then rotated to bring the loading tube opening 90 into axial alignment with the air lock, and the loading tube is lowered through the stuffing box 56 shown in Fig. 7, which is then attached to the upper end of the lock casing, and downwardly through the lock and mud pipe into the drill hole. After the blasting charge has been lowered through the loading tube to the

bottom of the drill hole, the loading tube is raised upwardly through the air lock and the caisson is thereafter raised upwardly and moved into another drilling and loading position, as in the preferred form of the invention described above.

In the modified form of construction shown in Fig. 12, the caisson 1 and drill lock 10 are identical to those described in the preferred form of the invention shown in Fig. 1. In this form of the invention there are secured to the side of the casing a plurality of lateral supports or brackets 95 for guiding a loading tube 96, the loading tube being arranged with its axis parallel with the longitudinal axis of the caisson and having its axis spaced from the center of the caisson a distance equal to the distance the drill holes are spaced apart. By thus arranging the loading tube, it is possible to effect loading of the completed drill hole while the drill is operating to drill the next succeeding hole. When this drilling and loading operation is completed, the drill steel and loading tube are raised upwardly and the caisson moved to the next drilling position, and thereafter the loading tube is lowered into the last completed hole while the drilling of the next succeeding hole is taking place, this operation being repeated until a series of holes is drilled and loaded. It will thus be seen that by arranging the loading tube in guides on the exterior of the caisson casing it is possible to effect loading of the blast hole without the necessity of a loading tube lock. It is preferable, however, under most conditions, to drill and load through a common opening or caisson lock at the bottom of the caisson, as in the other forms of the invention above described.

As a result of this invention, it will be noted

that an improved method and apparatus for blasting in the submarine drilling operations are provided, wherein a caisson is employed through which the drilling and loading operations take place. It will further be noted that an improved caisson is provided, especially designed for submarine drilling work, wherein a common opening or lock is provided at the bottom of the caisson, through which the drilling and loading operations take place. These and other uses and advantages of the invention will be clearly apparent to those skilled in the art.

While I have in this application specifically described several embodiments which my invention may assume in practice, it will be understood that these forms are shown for illustrative purposes only, and that 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 submarine drilling apparatus, a caisson having in the bottom thereof a lock providing for drilling and loading selectively therethrough, and means within said caisson for supporting drilling and loading implements, movable to superimpose either selectively over said lock.

2. In a submarine drilling apparatus, a caisson having in the bottom thereof a lock providing for drilling and loading selectively therethrough, and a turntable rotatable about an axis offset laterally from the axis of said lock for supporting drilling and loading implements and rotatable to superimpose either selectively over said lock.

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