C. WILLIAMSON.

SUBMARINE OPERATING APPARATUS.

APPLICATION FILED MAR. 14, 1910. RENEWED SEPT. 6, 1911.

1,023,541. **Patented Apr. 16, 1912.**

2 SHEETS—SHEET 1.

Fig. 1.

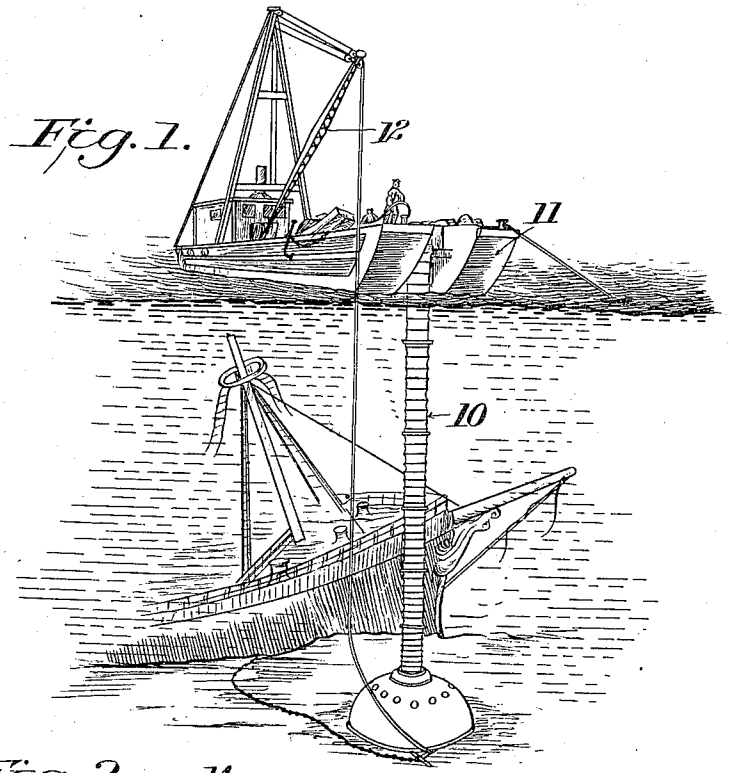
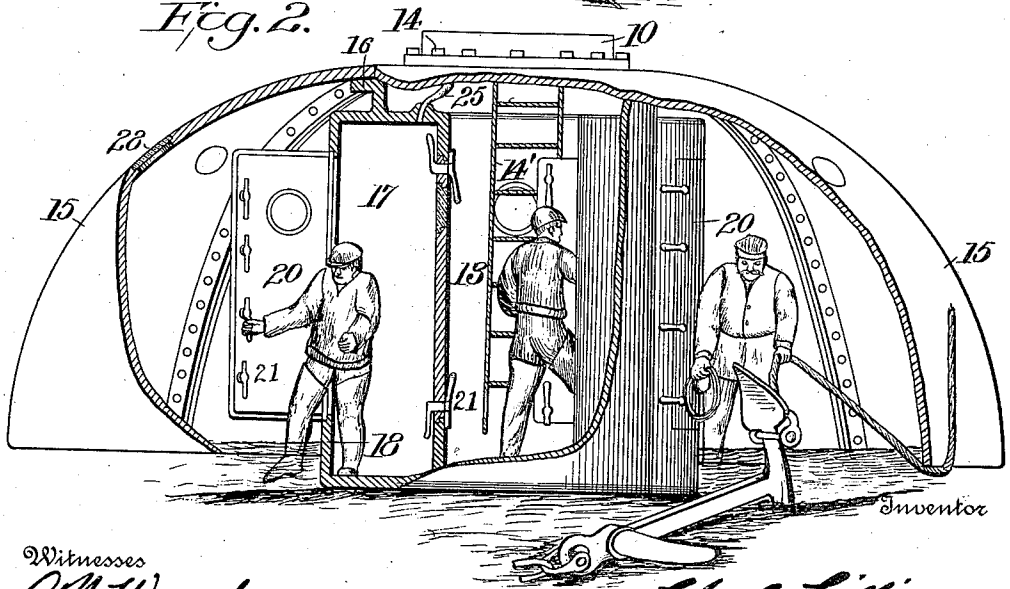


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

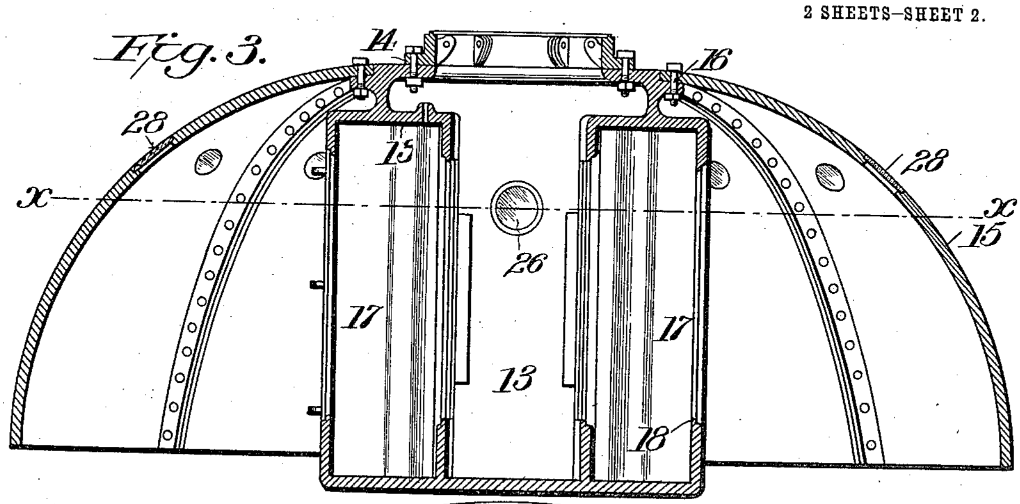
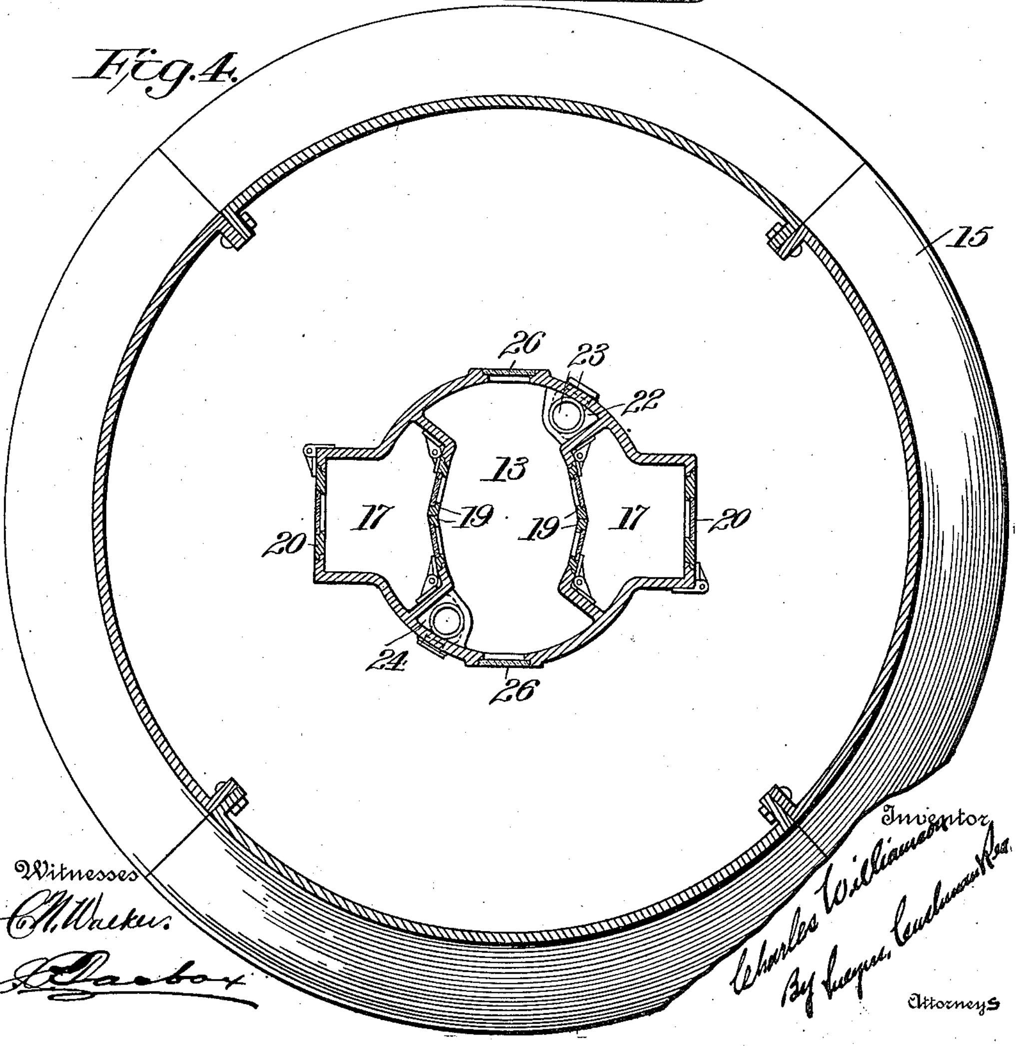


Fig. 4.



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UNITED STATES PATENT OFFICE.

CHARLES WILLIAMSON, OF NORFOLK, VIRGINIA.

SUBMARINE OPERATING APPARATUS.

1,023,541. Specification of Letters Patent. Patented Apr. 16, 1912.

Application filed March 14, 1910, Serial No. 549,112. Renewed September 6, 1911. Serial No. 648,128.

To all whom it may concern:

Be it known that I, CHARLES WILLIAMSON, a citizen of the United States, residing at Norfolk, in the county of Norfolk and State of Virginia, have invented new and useful Improvements in Submarine Operating Apparatus, of which the following is a specification.

My invention is an improved submarine operating apparatus of the open air caisson type, with which is coupled a work chamber of the compressed air type. Such an apparatus usually consists of a caisson closed at its bottom and open at its top, and long enough to extend from the surface of the water to a point near the bottom or upon the bottom, and a relatively high pressure work chamber of the compressed air type associated with the bottom of the caisson, this chamber being opened at the bottom and closed at the top so that the compressed air forced into it is retained, and forms the atmosphere in which the workmen operate. The advantages of such an apparatus as compared with the compressed air caisson or diving bell used alone are several, among which are the following. In the first place the base of operation is transferred from the surface of the water to the river bottom. Engineers or foremen can go down to the bottom of the open air caisson where there is an operating chamber, and direct at short range the work of men in the work chamber. Although totally unaccustomed to the air in the work chamber, and perhaps unable to stand it for a short time, the most delicate man can station himself at the bottom of the open air caisson and direct the operations of others with ease. In the second place comparatively little time is lost in relieving men from the work chamber.

In apparatus of the compressed air type as usually constructed, the work chamber or diving bell has to be moved to the surface of the water before the operator can be relieved. If the compressed air work chamber extends from surface to bottom, the operator has to ascend within the chamber to the top before he can be relieved. In apparatus of the type of this invention, this difficulty is entirely obviated, and the workmen in the work chamber are at all times in close communication with the open air caisson, it being but a step through suitable locks from one to the other.

My invention resides chiefly in the provision of certain novel features which increase the efficiency of the apparatus, and in the advantageous combinations of main elements and in details of those elements with an addition to furthering the efficiency of the apparatus, make it cheaper to construct and most durable and reliable.

The aim of my invention is to produce an apparatus by which submarine operations may be carried on on a larger scale, and with greater freedom and range, and with a higher degree of safety than has hertofore been possible.

I delineate a specific embodiment of my invention in the accompanying drawing.

Figure 1 is a sectional perspective view of the apparatus in use; Fig. 2 is an enlarged view of the chambers at the bottom of the apparatus with certain parts broken away and in section to show the relation of the chambers to each other; Fig. 3 is a central vertical section of the chambers of Fig. 2, and Fig. 4 is a lateral section on line X—X of Fig. 3.

10 is an open air caisson of the flexible collapsible type described in my Patent No. 745,469, issued December 1, 1903. This caisson is supported at its upper end by a scow 11 on which is mounted a suitable hoisting apparatus 12 which may be used for raising and lowering the caisson. This scow also may carry compressed air pumps for supplying compressed air to the work chamber of the apparatus. Any known type of float may be used in lieu of the scow shown, but I prefer to use a boat of the scow type carrying a complete power plant.

At the bottom end of the caisson 10, and in direct continuation of said caisson, I provide an operating chamber 13. Although this operating chamber may have its side walls and its bottom formed of the same material as is the caisson 10, I prefer to form it a single casting of metal as shown and attach it by a flanged connection 14 to the bottom of the caisson 10. In effect it is a part of the caisson 10, and constitutes its bottom. I also prefer to enlarge the operating chamber 13, in order to have it of such dimensions as it will comfortably accommodate

several men. As thus made up the caisson 10 and the operating chamber 13, together constitute a caisson of the open air type. Suitable means of entrance to and exit from the operating chamber 13 at the bottom are provided, such for instance as the ladder 14', and men may pass up and down the caisson to and from the operating chamber at will and without the manipulation of any gate or air lock. Atmospheric air is present throughout the caisson, and men in the operating chamber can work and breathe with the freedom with which they do in the outer air. Surrounding this operating chamber 13, which I have shown cylindrical in form, is a work chamber 15. Instead of having a closed bottom and an open top as has the open air caisson, this work chamber has an open bottom and a closed top. It is formed as a bell flaring outwardly from the outer part of the operating chamber 13 and then downwardly, the diameter of the bell being such that a work chamber of large dimensions relatively is formed concentric with and completely surrounding the operating chamber 13.

As clearly shown in Figs. 2 and 4, the work chamber bell is formed in sections, and is attached to the operating chamber by means of a flanged connection 16. At diametrically opposite points in the walls of the operating chamber 13 are formed locks 17. In this embodiment these locks 17 are identically alike. They are cast in the walls of the operating chamber and extend vertically, about half of the body of each lock being within the operating chamber, and the other half being in the work chamber. This divides the body of the lock between the work chamber and the operating chamber and thus avoids taking too much space for the lock in either chamber. It will be observed that the entire structural arrangement is symmetrical, and that such arrangement gives to the apparatus a symmetrically distributed buoyancy. The bottoms of the locks are substantially at the bottom of the caisson operating chamber and of the work chamber, but their side walls extend upwardly unbroken to a point as 18 which point is above the normal water level in the work chamber. There is thus no danger that water will enter the lock or enter the operating chamber from the lock when transfers are being made through it. Each lock is provided with outer doors 19 and inner doors 20, both of which doors open inwardly of the work chamber, so that pressure in the work chamber always tends to close them. The doors are hinged on one side, and are provided with suitable closing clamps 21. The outer doors 20 are double doors, being made double for the purpose of securing a more easy handling of the doors, economy of the relatively limited space with the lock and convenience of operation. The faces of the doors are of course either accurately fitted to their seats on the lock or else provided with suitable packings. These main locks just described, are intended for workmen. In order to economize in the use of compressed air, a smaller lock 22 is provided in the jamb between the walls of one of the main locks 17 and the walls of the operating chamber for the purpose of passing tools, etc., to and from the work chamber. This is angular in shape as clearly shown in Fig. 4, and is provided with gates 23, one in the operating chamber, and the other in the work chamber. Another of these auxiliary locks may be provided at an opposite point as at 24, and as many as desired may be used.

As thus organized, my invention combines a very extended field of use in submarine operation. The caisson may be lowered until the work chamber and the bottom of the operating chamber rest upon the bottom of the body of water in which operations are to be carried on. Workmen may then enter the work chamber, in which air is, of course, confined under high pressure, and work in a few inches, or work in a few feet of water over quite an extended area. In case the caisson does not happen to be positioned in exactly the right spot, a workman can by walking along the bottom and pushing against the wall of the work chamber, easily move the apparatus from one point to another. Foremen or engineers may descend to the bottom of the open air caisson, and from the operating chamber direct the operations of the workmen in the work chamber. In the operating chamber the men directing the work, have at all times a plentiful supply of air at atmospheric pressure, while fresh air is supplied to the compressed air chamber through a hose 25 which is shown as entering the top of one of the locks 17, though of course it may enter the work chamber at any suitable point. By having the air hose discharge into the lock instead of directly into the work chamber, additional security is had against leakage, as the inner door of the lock can be readily closed in case the air hose should spring a leak, or in case valves connected with it should get out of order, and the supply of compressed air be maintained in the work chamber undiminished.

In order to facilitate the directing of the work from within the operating chamber, lights 26 are provided in the walls of the operating chamber, in the space between the locks. These lights open on the work chamber, and through them men in the operating chamber can readily follow what is going on in the work chamber and direct it with great exactness. Lights are also provided in the inner and outer doors of the locks, and through them signals as to the oper-

ation of the lock to suit the movements of the workmen, can be carried on with great facility. Likewise the workmen find these lights of convenience in governing their own movements, to and from the operating chamber. These lights also serve as means for admitting light to the work chamber, and in order to still further light this chamber, lights 28 are provided in the outer walls of the work chamber. Through these lights 28, workmen can see for some feet in the vicinity of the apparatus, and can thereby govern their movements of the apparatus.

What I claim is:

1. In a submarine operating apparatus, a relatively low pressure operating chamber, and a relatively high pressure work chamber completely surrounding said operating chamber.

2. In a submarine operating apparatus, a substantially cylindrical operating chamber, and a circular work chamber completely surrounding said operating chamber.

3. In a submarine operating apparatus, a substantially cylindrical operating chamber, and a circular work chamber, said work chamber surrounding completely said operating chamber and being concentric therewith.

4. In a submarine operating apparatus, an operating chamber open at the top and closed at the bottom, and a work chamber which completely surrounds said operating chamber at the bottom, said work chamber being closed at the top and open at the bottom.

5. In a submarine operating apparatus, an operating chamber, and a bell-shaped work chamber surrounding said operating chamber.

6. In a submarine operating apparatus, an open air caisson, an operating chamber at the bottom thereof, and a bell flaring outwardly and downwardly from a point adjacent the juncture of said operating chamber and said caisson.

7. In a submarine operating apparatus, an open air caisson, an operating chamber at the bottom thereof, a circumferential flange adjacent the juncture of said operating chamber and said caisson, and a bell bolted thereto and projecting downwardly to form a work chamber.

8. In a submarine operating apparatus, an operating chamber, a work chamber surrounding said operating chamber, and locks in the walls of said operating chamber at opposite points.

9. In a submarine operating apparatus, a circular operating chamber, a work chamber surrounding said operating chamber, and locks in the walls of said operating chamber at diametrically opposite points.

10. In a submarine operating apparatus, an operating chamber, a work chamber surrounding said operating chamber, and a lock in a side wall of said operating chamber, the body of which lock is half within and half without said operating chamber.

11. In a submarine operating apparatus, a work chamber adapted to contain air at high pressure, a lock communicating with said work chamber, and inner and outer doors for said lock, both of which doors open inwardly.

12. In a submarine operating apparatus, a work chamber, a lock associated therewith, inner and outer doors to said lock, and a light in the inner door of said lock.

13. In a submarine operating apparatus, a work chamber, a lock communicating therewith, inner and outer doors for said lock, and a light in the outer door of said lock.

14. In a submarine operating apparatus, a work chamber, a lock communicating therewith, inner and outer doors for said lock, and a light in each door.

15. In a submarine operating apparatus, a work chamber, a lock communicating therewith and located in a wall of the work chamber, the bottom of said lock being substantially at the bottom of said work chamber, and the bottom walls of said lock extending upwardly a height greater than the normal water level in said work chamber.

16. In a submarine operating apparatus, an open air operating caisson, a compressed air work chamber adjacent thereto, a lock communicating with the work chamber from the operating caisson, and an air conduit which supplies air to the work chamber which leads through the open air caisson to said chamber.

17. In a submarine operating apparatus, a work chamber, a lock communicating therewith, and double outer doors for said lock which open inwardly of the same.

18. In a submarine operating apparatus, an operating chamber, a work chamber surrounding said operating chamber, vertically extending locks in the side walls of said operating chamber which communicate with said work chamber, said locks being spaced laterally apart, and lights in the walls of said operating chamber between said locks, said lights opening on said work chamber.

19. In a submarine operating apparatus, a work chamber, a main air lock of relatively large size for workmen, and an auxiliary air lock of relatively small size for tools.

20. In a submarine operating apparatus, a work chamber, a lock communicating therewith and located part within and part without said chamber, and an auxiliary lock in the jamb between the main lock and the wall of said work chamber.

21. In a submarine operating apparatus, a work chamber, a lock communicating therewith and located in a wall of said work chamber, said lock being angular, one branch

being perpendicular and the other parallel to said wall.

22. In a submarine operating apparatus, an operating caisson of relatively low pressure, and symmetrically distributed inclosed working spaces of relatively high pressure on opposite sides of said operating caisson.

23. In a submarine operating apparatus, an operating chamber, a work chamber surrounding said operating chamber, and a lock in a side wall of said operating chamber, the body of which lock is part within and part without said operating chamber.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

CHARLES WILLIAMSON.

Witnesses:
J. S. OAKES,
J. F. DRUMMOND.