No. 859,931. PATENTED JULY 16, 1907.

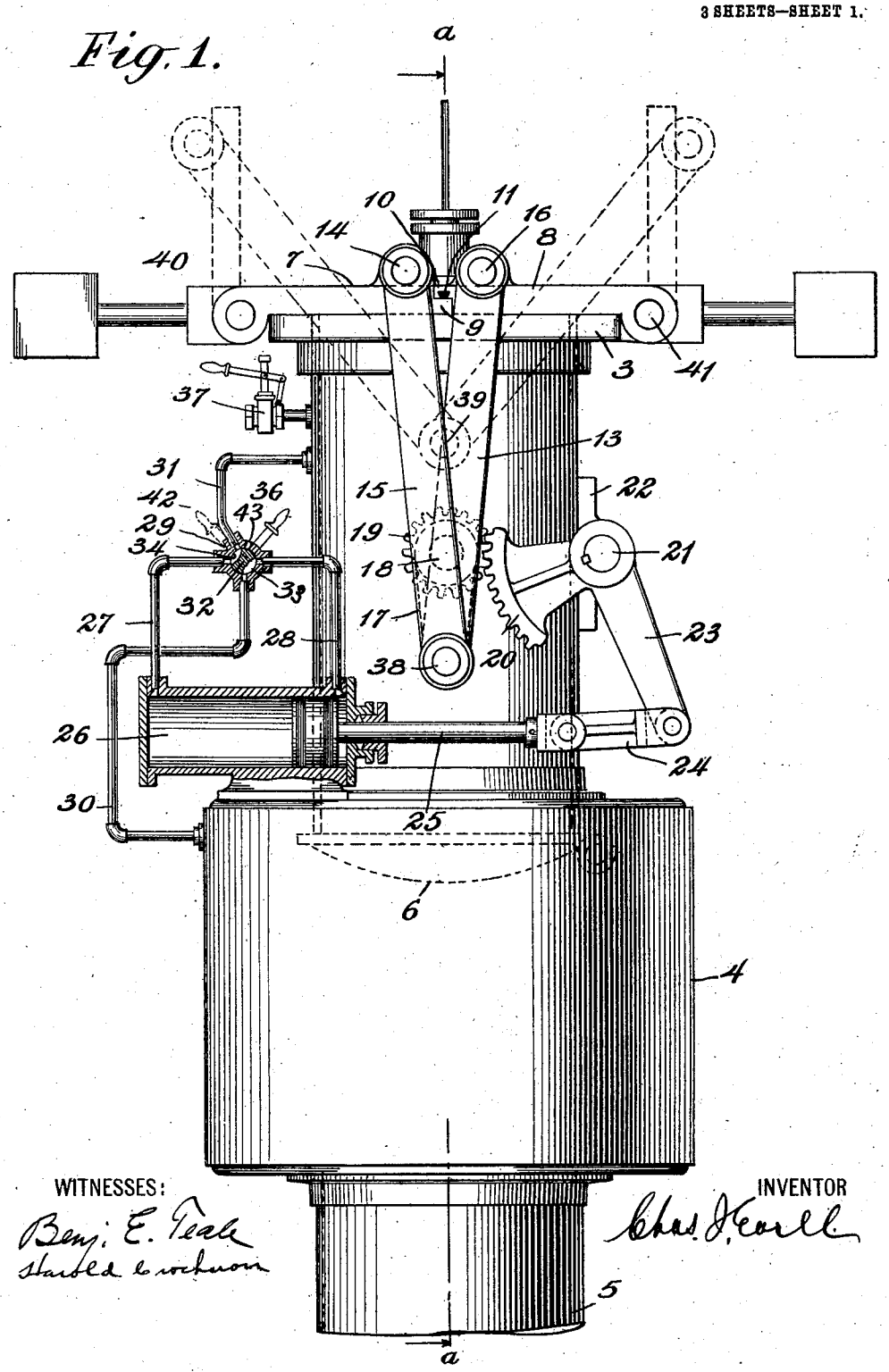
C. I. EARLL.

AIR LOCK FOR CAISSONS.

APPLICATION FILED MAR. 6, 1905.

3 SHEETS—SHEET 1.

Fig. 1.



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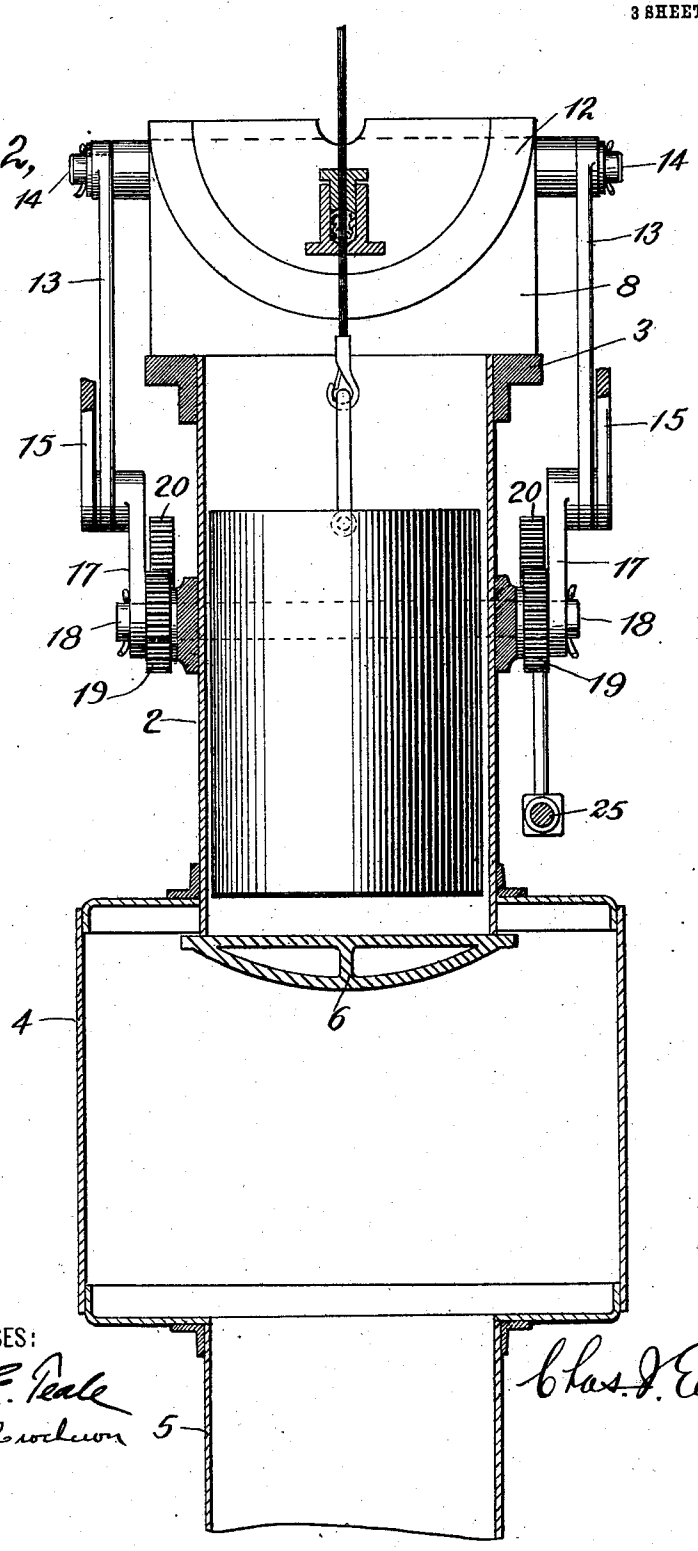
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3 SHEETS—SHEET 2.

Fig. 2.



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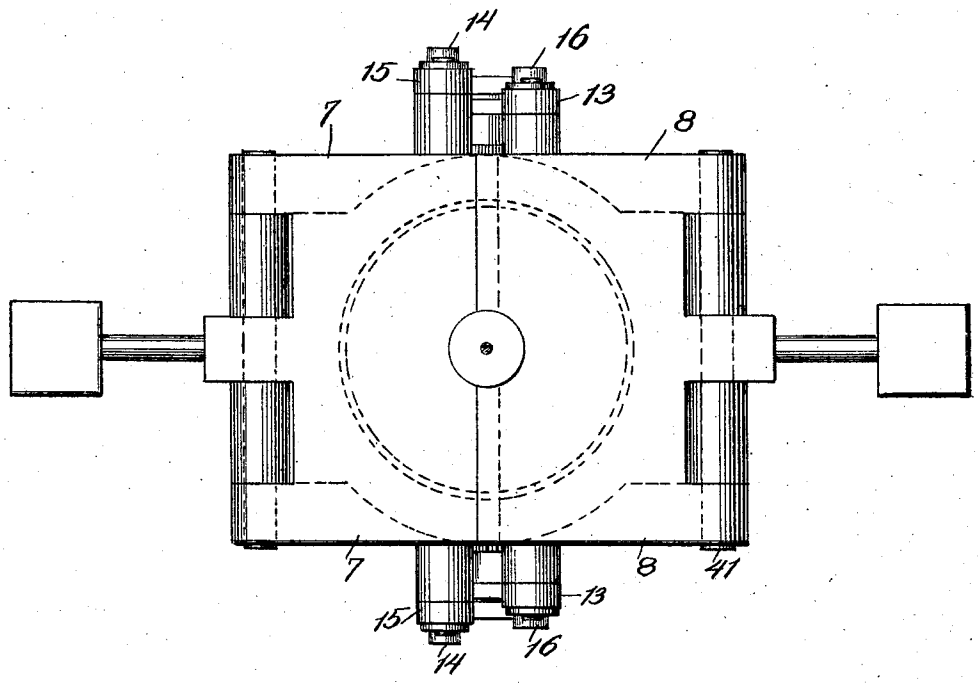
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3 SHEETS—SHEET 3.

Fig. 3.



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UNITED STATES PATENT OFFICE.

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AIR-LOCK FOR CAISSONS.

No. 859,931. Specification of Letters Patent. Patented July 16, 1907.

Application filed March 6, 1905. Serial No. 248,537.

To all whom it may concern:

Be it known that I, CHARLES I. EARLL, a citizen of the United States of America, and a resident of the city, county, and State of New York, have invented certain new and useful Improvements in Air-Locks for Caissons, of which the following is a specification.

My invention relates to air locks for caissons, the object being to provide an air lock which shall be simple and effective in its construction and operation, one in which the principal parts of the working mechanism are located outside of the air lock proper where they are at all times conveniently accessible for inspection and care, the organization of the parts being such as to facilitate the rapid and safe manipulation of the lock and to prevent the accidental opening of the outer valve through carelessness or ignorance at any time except when the inner valve is closed, as such opening would result in lowering the air pressure in the entire caisson with dangerous or disastrous consequences as is well known.

My invention relates more particularly to the outer closure and the mechanism for operating the same in an air lock where material is passed into and out of the caisson through the air lock by means of a bucket or other receptacle attached to a cable operated from a position outside of the air lock. But it is not limited to this particular use.

My invention consists in a general way in providing an air lock chamber of any convenient shape and size having a closure for its inner end of any suitable construction, a seat on its outer end and a plurality of outwardly movable doors, gates or closures, preferably two in number, adapted to open and close the outer end, having an opening in their center for the passage of a cable, mechanism adapted to open and close the doors, gates or valves, a pneumatic cylinder and piston therein for operating the opening and closing mechanism and means for preventing the opening of the doors when there is pressure in the lock.

In the drawings accompanying and forming part of this specification, Figure 1 is a side view of an air lock embodying my invention and Fig. 2 is a section on line *a*—*a* of Fig. 1. Fig. 3 is a plan view.

The reference characters are used in the same sense in the drawings and specification.

Numeral 1 represents the air lock chamber. It is composed of a shell 2 having a flat valve seat 3 rigidly secured to its upper end. The lower end of the air lock chamber is rigidly secured to the upper end 4 of the air shaft 5, the upper end 4 being enlarged so as to receive and permit the operation of the inner or lower gate or valve 6 which controls communication between the air lock chamber 1 and the interior of the caisson.

Communication between the air lock chamber and the outside atmosphere is controlled by the valves or doors 7 and 8 which are hinged or pivotally connected to the valve seat 3, or to any other stationary part of the structure. The valve or door 7 is provided with a lip or projection 9 which fits a corresponding projection 10 on the valve 8, the projection 10 being provided with a packing strip 11 of rubber or other suitable material. Each valve is also provided with a semi-circular packing strip 12 attached in any suitable manner and adapted to come between the valves and the valve seat 3. Links 15 are pivoted on their upper ends to the valve 7 on the pins 14 on each side of said valve, and links 13 are pivoted at their upper ends to the valves 8 on the pins 16. The lower ends of the links 13 and 15 are pivoted to the ends of the links or levers 17 which are mounted on the studs 18, which latter are rigidly secured to the shell 2 of the caisson chamber.

Rigidly secured to the levers or links 17 are the gears 19. These gears engage toothed segments 20 which are secured to the rock shaft 21 mounted in bearings 22, which bearings are rigidly secured to the shell of the air lock. One of the segments 20 has formed upon it an arm 23 which has its end pivoted to the link 24, the other end of the link being connected to the piston rod 25, which operates in the cylinder 26.

The pipes 27 and 28 connect respectively the two ends of the cylinder 26 with the controlling valve 29. The pipe 30 connects the controlling valve with the upper end of the air shaft, it may in fact, lead from any portion of the cassion below the lower gate 6. The pipe 31 connects the controlling valve with the air lock chamber 1. The controlling valve stem 32 has recesses 33 and 34 on opposite sides and are adapted to open and close communication between the pipes leading to the valve. A handle 36 is secured to the valve stem 32 by means of which the valve is operated. A vent or relief valve 37 is secured to the chamber 1 for the purpose of allowing the air to escape from the chamber to reduce the pressure.

The operation of my invention is as follows: When the links 17 are turned to the left as seen in Fig. 1 through 180 degrees the pin 38 of the links 17 will occupy the position 39 and in turning will cause the valves 7 and 8 to swing about the hinges 40 and 41 to the position shown in dotted lines. Owing to the difference in the inclination of the links 13 and 15 the valve 8 will rise somewhat in advance of the valve 7. When the links 17 are turned in the opposite direction and brought back to the position indicated in Fig. 1. the valves will close, the valves 7 closing slightly in advance of the valve 8. It will be seen that the links 13 and 15 in connection with the links 17 form a toggle joint capable of bringing the valves down upon their seats with great pressure and capable of resisting great

pressure to open the same. It will be obvious that means may be employed to operate the opening and closing mechanism manually. I prefer however, to operate them by means of the rock shaft and geared connection above described.

As will be seen from Fig. 1 when the piston rod 25 is moved to the left as seen in that figure the valves will be opened and when moved to the right, closed. When the controller valve handle 36 stands in the position shown communication is established between the air space under the lower valve 6 and the pipe 28. This space is always under pressure being in direct communication with the interior of the caisson. It will also be seen that in this position of the controller handle the pipe 27 is in communication with the interior of the air lock chamber from which it results that if the pressure has been allowed to fall in the air lock chamber the pressure upon the piston through the pipe 28 will force the piston to the left and open the upper valves. If however, the lower gate 6 has not been closed the pressure in the air lock chamber will be the same as the pressure below the lower gate 6 and the pressure upon the opposite or closing side of the piston will be equal to or greater than on the side which operates to open the valves. If therefore, the operator, through carelessness or ignorance should move the controller handle 36 to the position indicated in Fig. 1 before having closed the lower valve 6 and exhausted the air from the air lock chamber, no movement of the upper valves will take place. It would of course, under ordinary circumstances produce great danger and probably loss of life to the operators within the caisson if the upper valves were open at a time when the lower valve was also open. This would immediately lower the pressure within the caisson. to atmospheric pressure. When the valves are opened and it is desired to close them the controller handle is moved to the position 42, in which position communication is established between the pipe 27 and the pipe 30, thus admitting pressure to the end of the cylinder which closes the upper valves and at the same time opens communication between the other end of the cylinder and the air vent 43, thus permitting the air to exhaust from this end thereby causing the piston to move to the right as seen in Fig. 1 and close the upper valves.

Having thus described my invention what I claim is:

1. In an air lock for caissons the combination with the air lock chamber of a seat upon the outer end of said chamber, a plurality of outwardly swinging valves pivoted to said chamber and means for locking said valves in a closed position when there is air under pressure in said airlock chamber and for unlocking and opening said valves when said pressure is reduced.

2. In an air lock for caissons the combination with the air lock chamber of a plurality of outwardly swinging valves pivoted to the outer end of said chamber and links arranged in the form of a toggle joint in pivotal connection with said valves and said chamber adapted to open and close said valves and hold them in a locked position.

3. In an air lock for caissons the combination with the caisson chamber of outwardly swinging valves pivoted to the outer end of said chamber having a central opening when closed for the passage of a cable, of links pivoted to said valves and means for operating said links in one direction to open said valves and in the other direction to close and securely lock the same against internal pressure.

4. In an air lock for caissons the combination with an air lock chamber of a seat on the outer end of said chamber, an outwardly swinging valve pivotally mounted on the outside of said chamber, a link having one end in pivotal connection with said valve and its other end in pivotal connection with a second link whose other end is in pivotal connection with the caisson chamber.

5. In an air lock for caissons the combination with an air lock chamber of a seat on the outer end of said chamber, an outwardly swinging valve pivotally mounted on the outside of said chamber, a link having one end in pivotal connection with said valve and its other end in pivotal connection with a second link or lever which is pivoted on a stud fixed to the airlock chamber, an air cylinder and piston therein and connections between said piston and said last named link or lever.

6. In an air lock for caissons the combination with an air lock chamber, of outwardly swinging valves pivoted to the outer end of said chamber, links oppositely disposed in pivotal connection with each of said valves, a second pair of links pivoted to said caisson chamber on opposite sides thereof and having one of their ends in pivotal connection with said first named links, a gear secured to said last named pair of links engaging gears fixed to a rock shaft which is mounted in bearings secured to the air lock chamber, an air cylinder and piston, and connections between said piston and said rock shaft whereby the movement of said piston controls the opening and closing of said valves.

7. In an air lock for caissons the combination with an air lock chamber and a valve for the inner end thereof, of a valve for the outer end, a pneumatic cylinder having a piston therein, connections between said piston and said outer valve whereby the movement of said piston opens and closes said outer valve, a controller valve and connections between the air lock chamber, the caisson shaft below the inner valve and ports in said pneumatic cylinder whereby when communication is established between the space below the lower valve and said pneumatic cylinder to open the upper valve communication is simultaneously established between the opposite end of said cylinder and the air lock chamber.

8. In an air lock for caissons the combination with the air lock chamber, of an inner valve, an outer valve, means for operating said outer valve and means for preventing the opening of said outer valve when said inner valve is open.

9. In an air lock for caissons the combination with the air lock chamber of an inner valve and an outer valve, means for opening and closing said outer valve and means for preventing the opening of said outer valve until pressure in said chamber has been relieved.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES I. EARLL.

Witnesses:
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ELSIE C. NEUKRANTZ.