No. 816,642. PATENTED APR. 3, 1906.

S. W. CHILES.

AIR LOCK.

APPLICATION FILED JUNE 15, 1905.

3 SHEETS—SHEET 1.

Fig. 1.

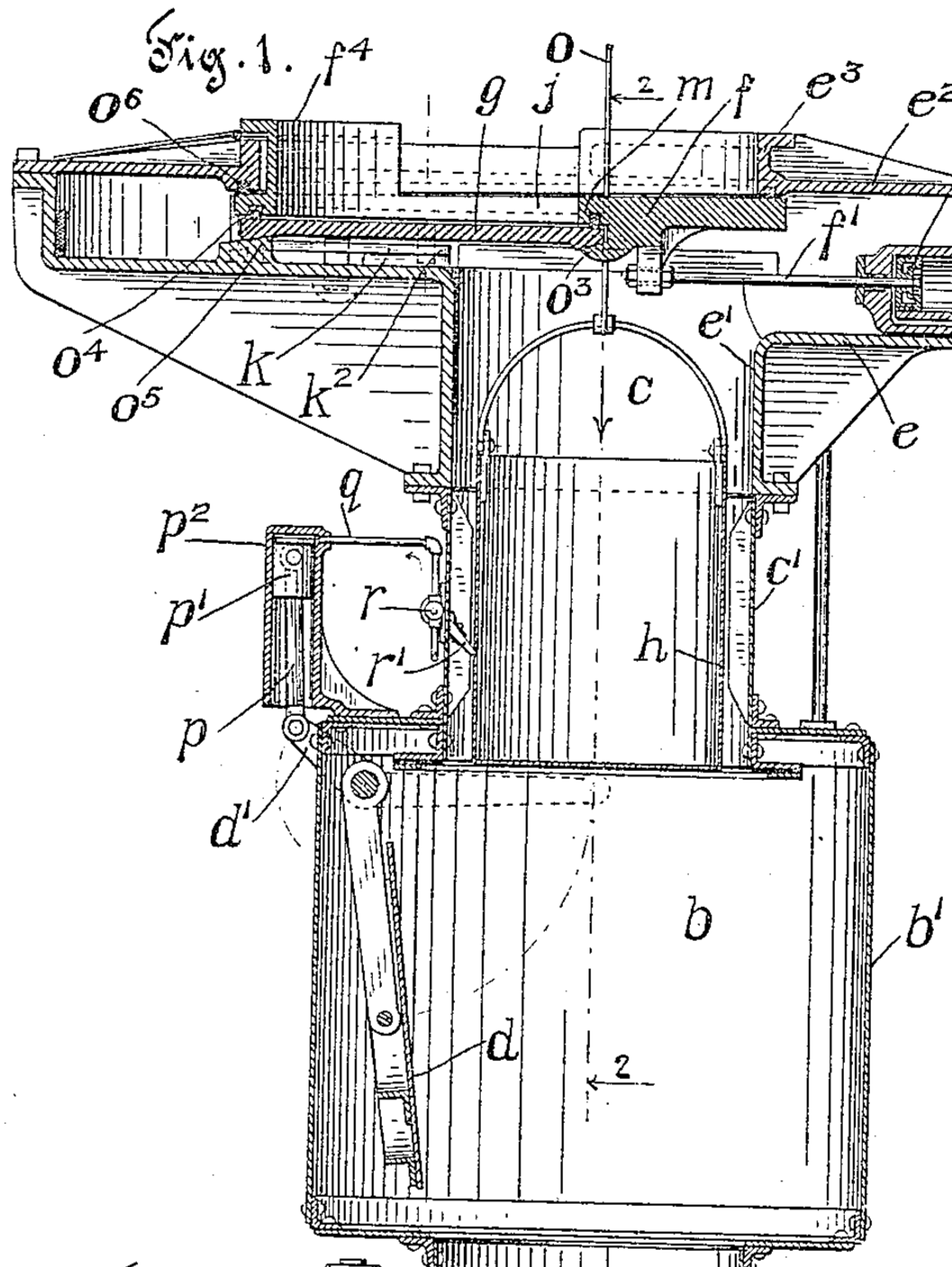


Fig. 2.

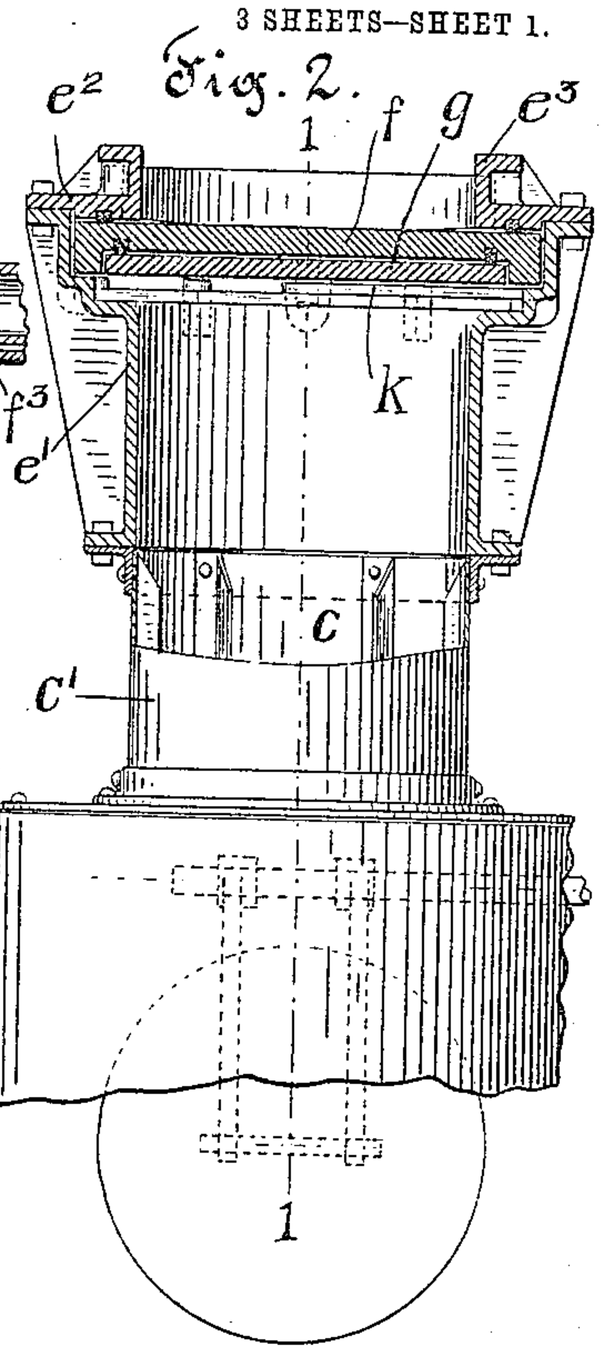


Fig. 1a.

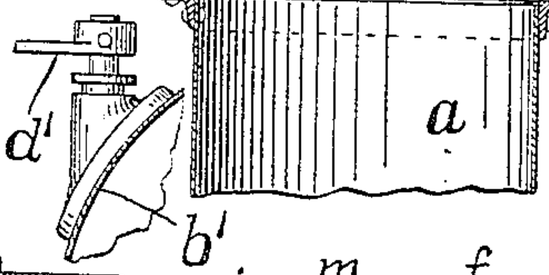


Fig. 6

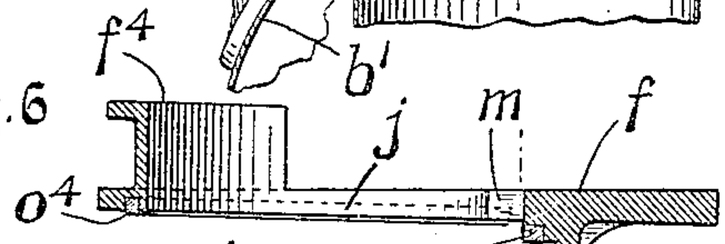


Fig. 15.

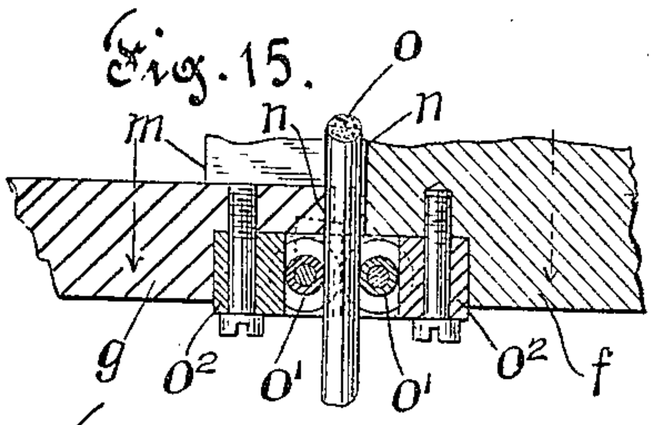


Fig. 10

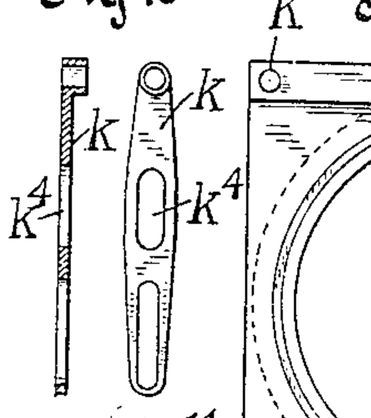


Fig. 11

Fig. 7.

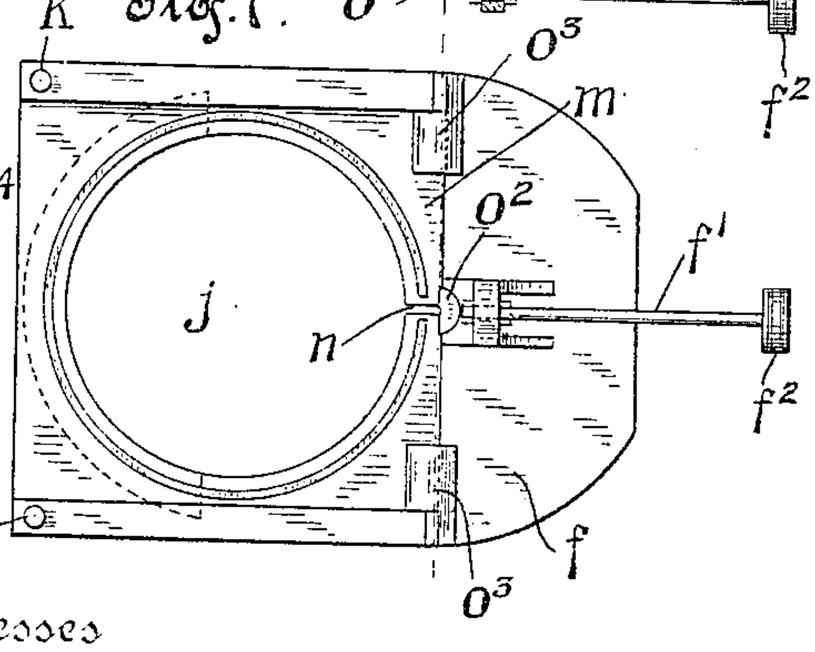
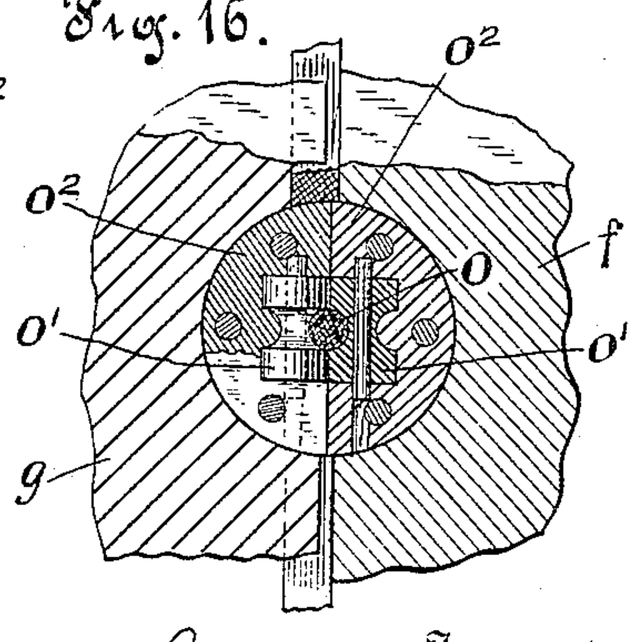


Fig. 16.



Witnesses
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3 SHEETS—SHEET 2.

Fig. 3

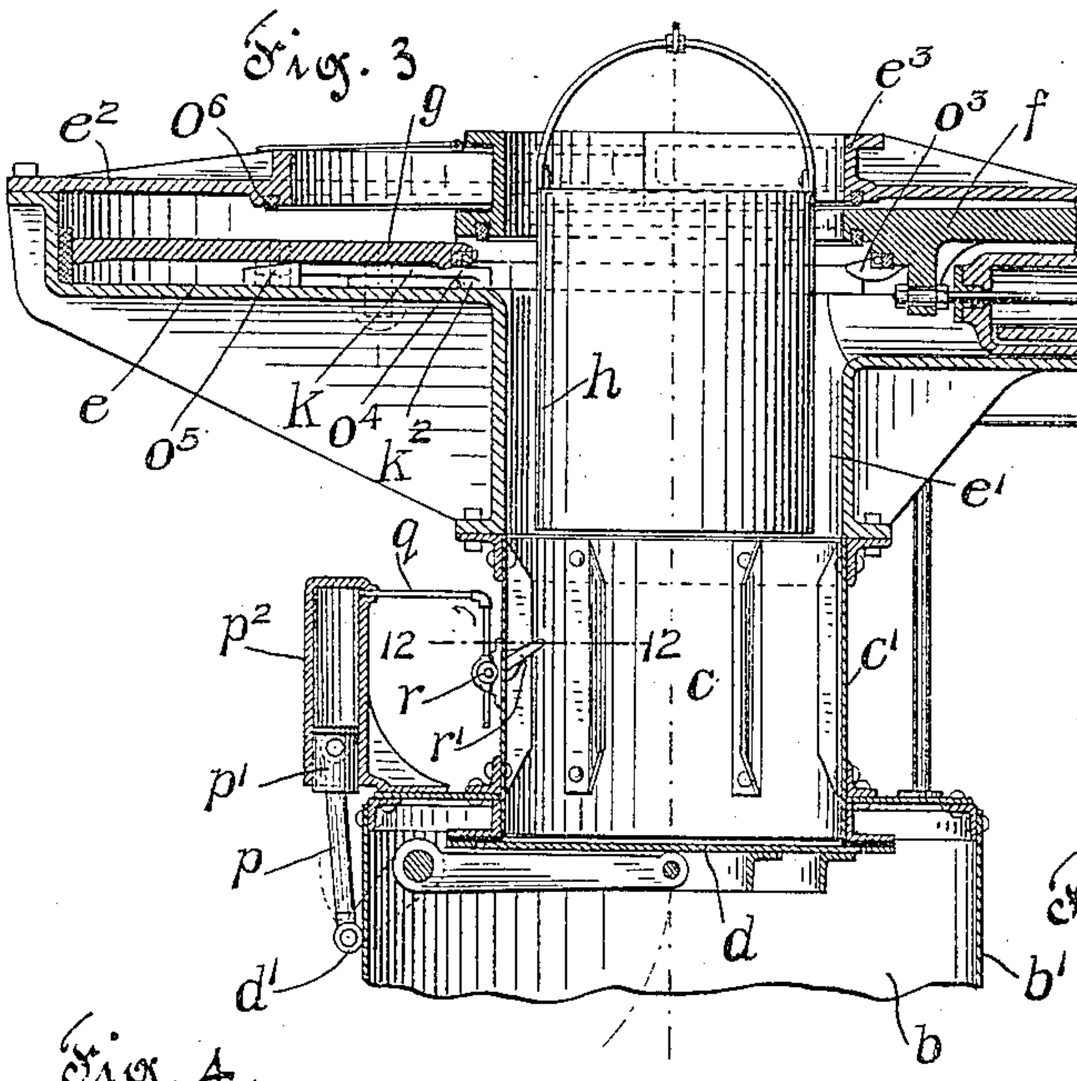


Fig. 12.

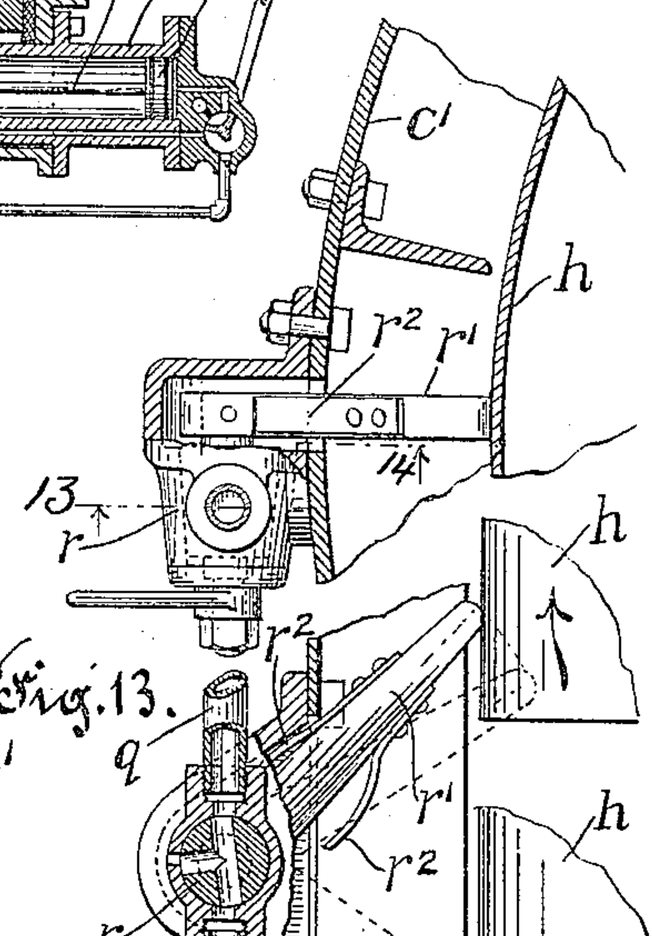


Fig. 4.

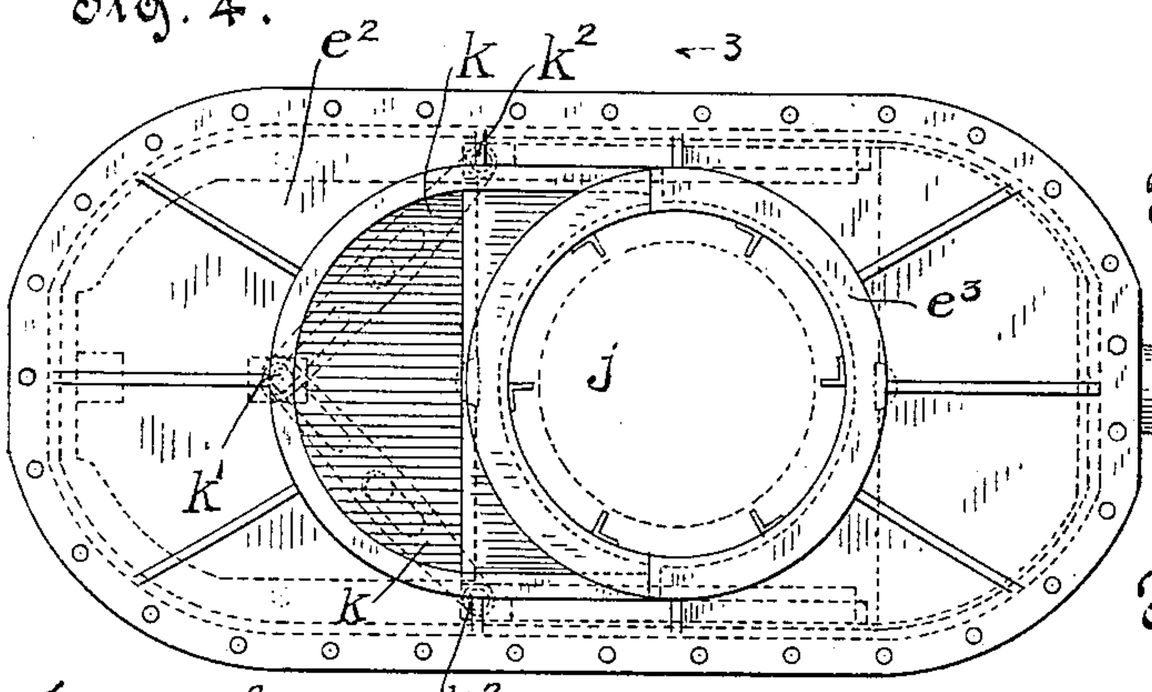


Fig. 13.

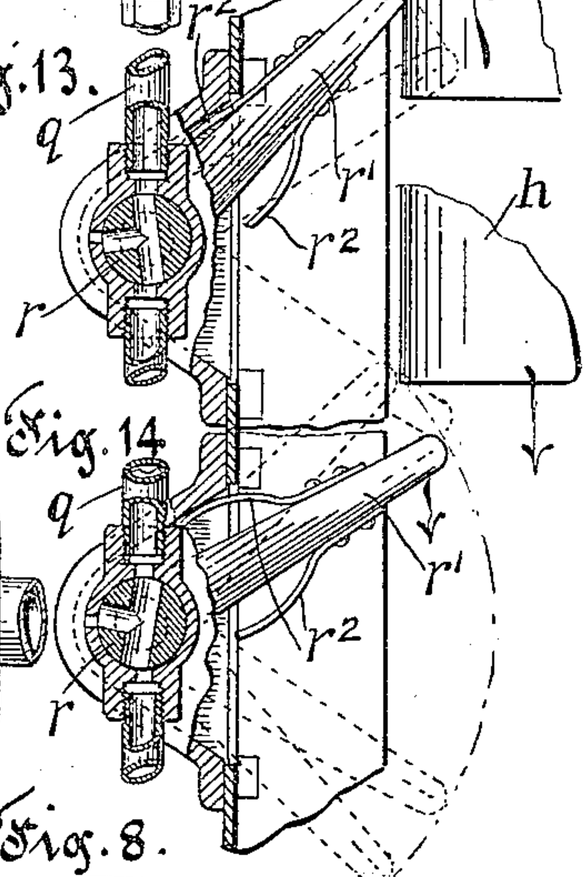


Fig. 14

Fig. 8.

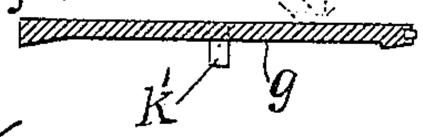


Fig. 5

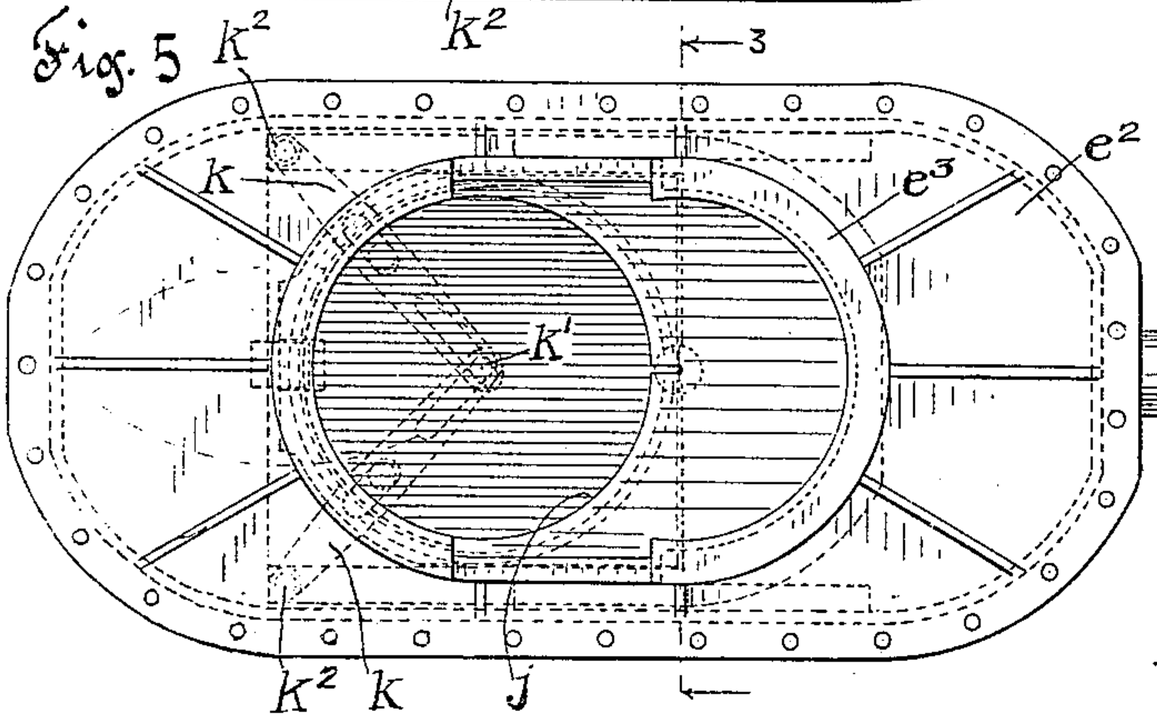
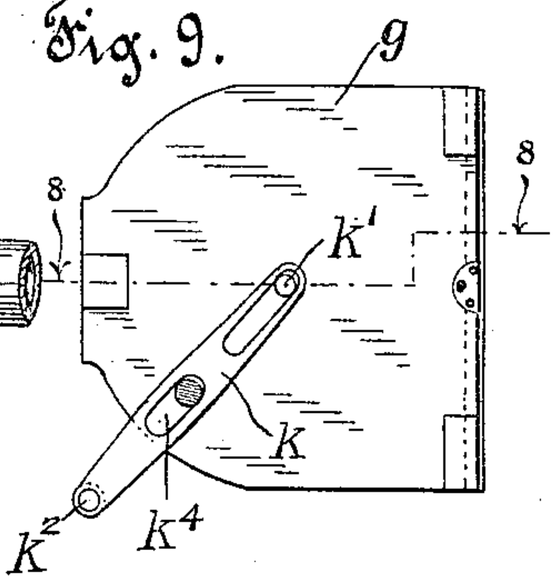


Fig. 9.



Witnesses
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No. 816,642. PATENTED APR. 3, 1906.

S. W. CHILES.

AIR LOCK.

APPLICATION FILED JUNE 15, 1905.

3 SHEETS—SHEET 3.

Fig. 17.

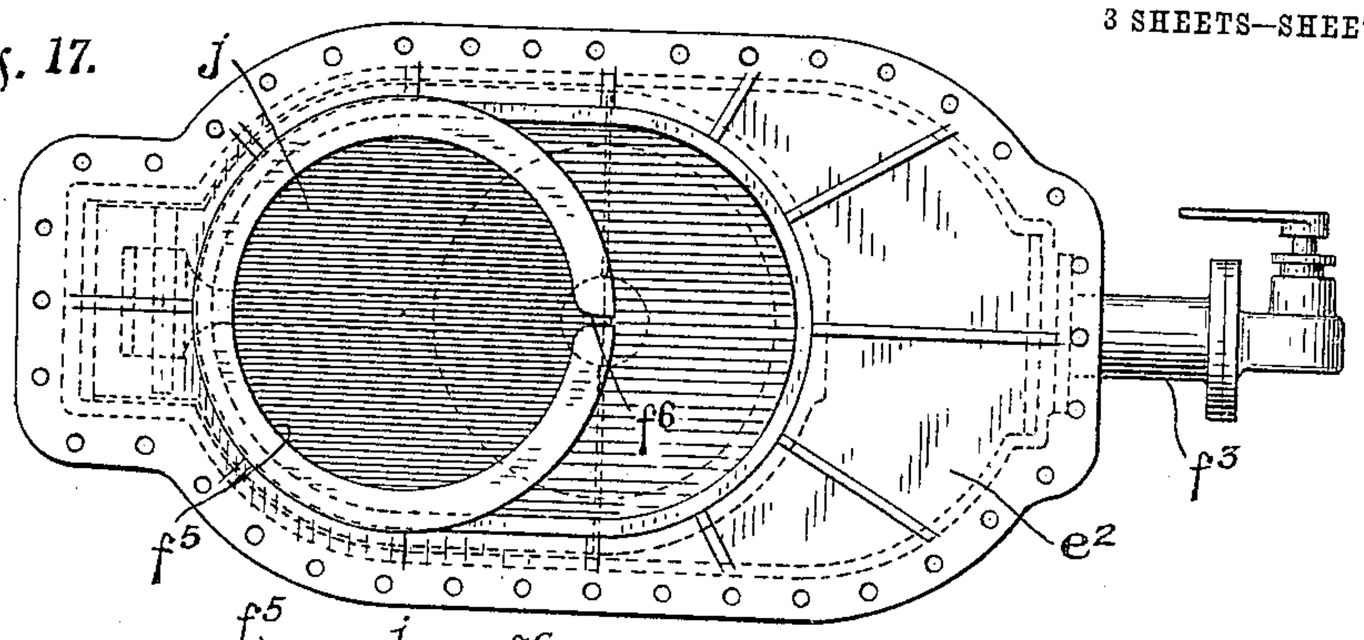


Fig. 18.

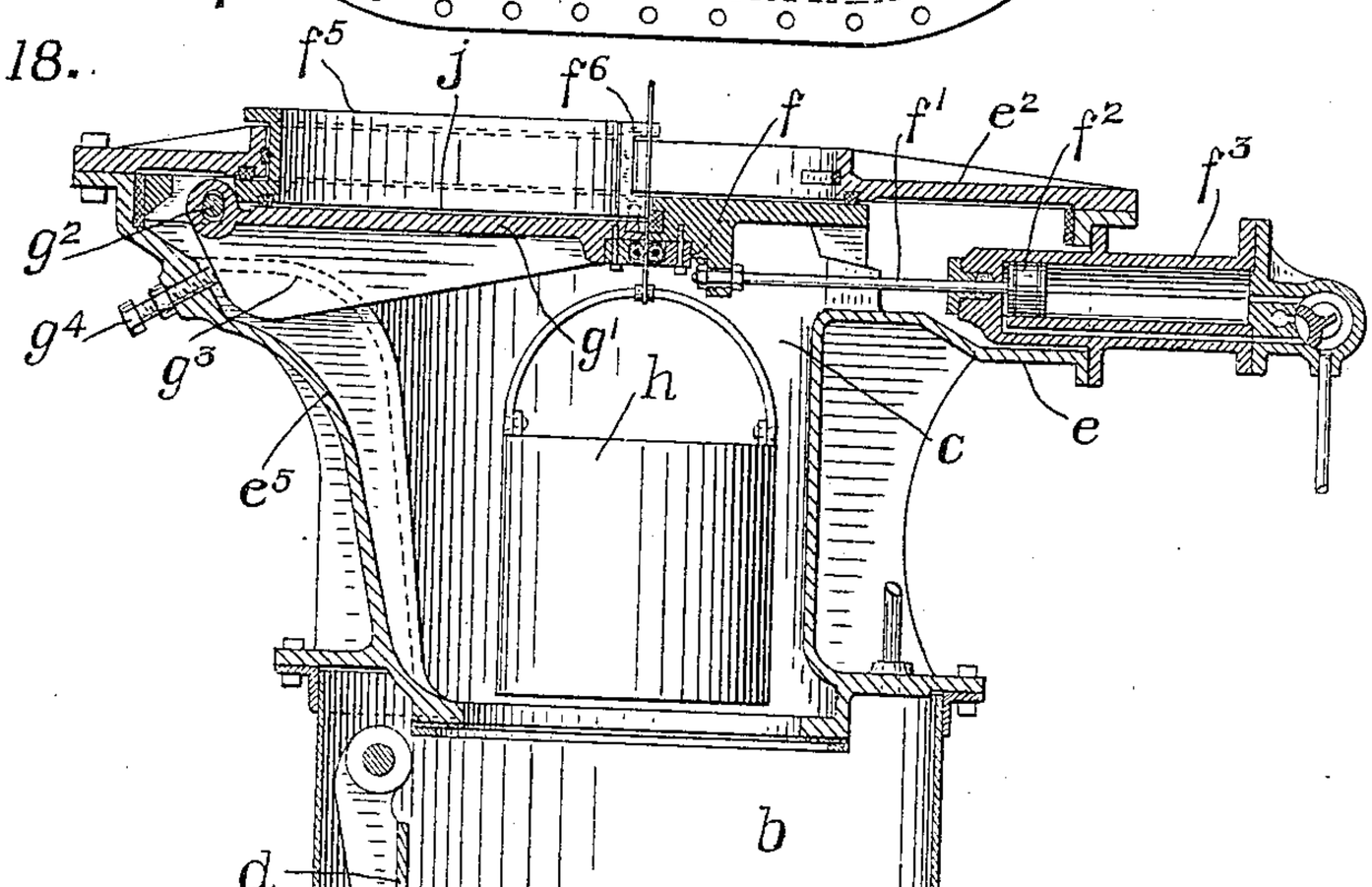
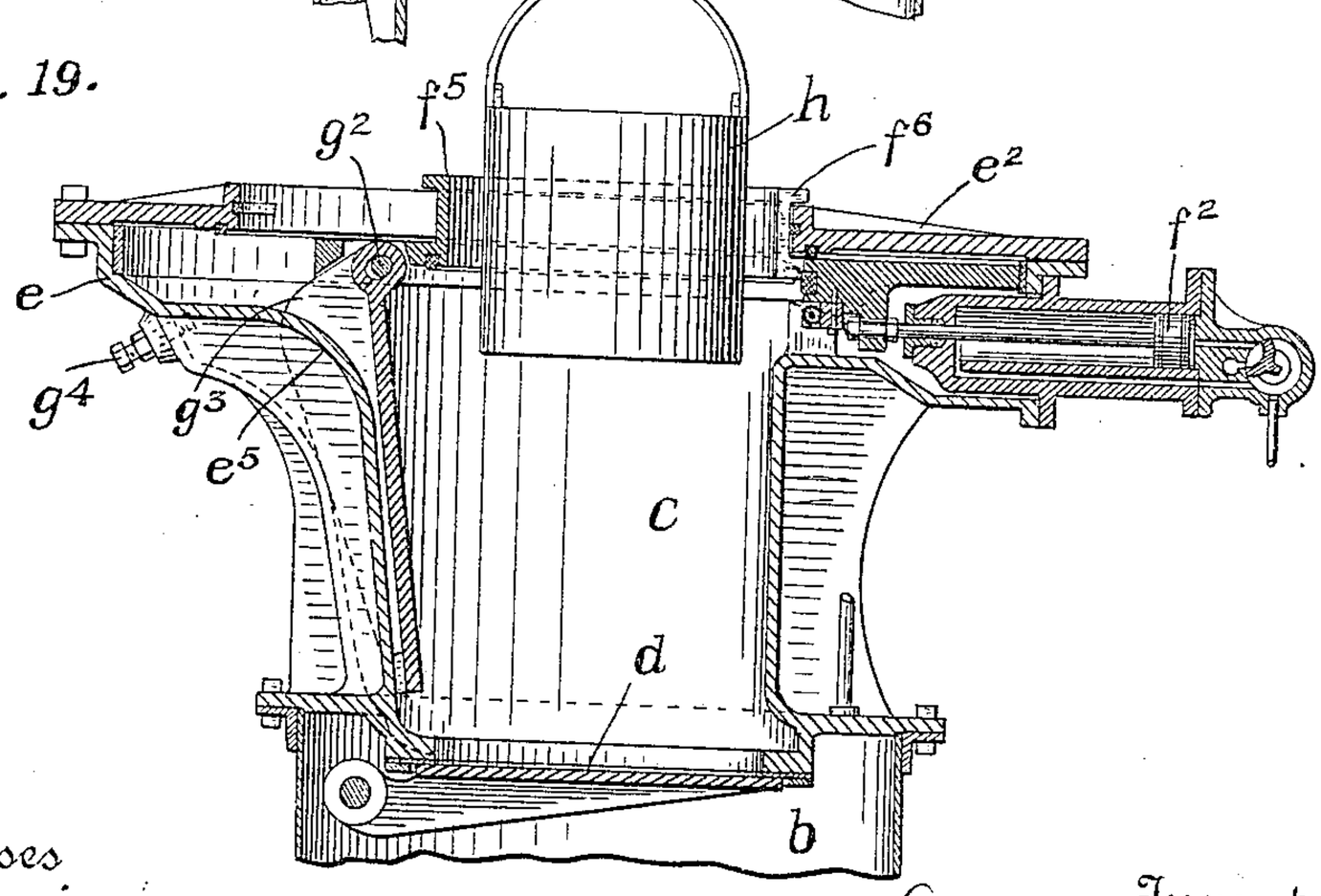


Fig. 19.



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UNITED STATES PATENT OFFICE.

SINCLAIR W. CHILES, OF SOUTH BETHLEHEM, PENNSYLVANIA.

AIR-LOCK.

No. 816,642. Specification of Letters Patent. Patented April 3, 1906.

Application filed June 15, 1905. Serial No. 265,416.

To all whom it may concern:

Be it known that I, SINCLAIR W. CHILES, of South Bethlehem, county of Northampton, State of Pennsylvania, have invented an Improvement in Air-Locks, of which the following is a specification.

More particularly, my invention relates to air-locks for caissons and the like in which an air-pressure substantially above atmosphere is maintained. In such locks as they are usually constructed there are two valves forming between them an air-lock chamber through which the bucket passes in its ascent and descent, and this chamber is in communication with the caisson-shaft or the atmosphere, according to which valve is open. When the bucket is ascending, the lower valve is open and the upper valve is closed. After the bucket has passed into the air-lock chamber the lower valve is closed, the pressure in the air-lock chamber is relieved, and the upper valve is opened. The bucket may then pass out. On the descent of the bucket these operations are reversed. The upper valve is open, and after the bucket has passed into the air-lock chamber that valve is closed and the lower valve is opened, permitting the bucket to pass into the caisson-shaft. The opening and closing of the lower valve may be controlled automatically by the bucket in its ascent and descent.

My improvements relate particularly to the upper valve, and are designed to facilitate the operations and to enable the bucket to be raised and lowered without loss of air-pressure in the caisson and its shaft and without disconnecting the bucket from its hoisting rope or cable, and also to means for automatically operating the lower valve.

In the drawings, Figure 1 is a longitudinal vertical section of the air-lock on the line 1 1 of Fig. 2, showing the upper valve closed and the lower valve open. Fig. 1^a is a detail view of part of the connections of the lower valve. Fig. 2 is a transverse vertical section on the line 2 2 of Fig. 1. Fig. 3 is a view similar to Fig. 1, showing the upper valve open and the lower valve closed. Fig. 4 is a plan view with the upper valve open, as shown in Fig. 3. Fig. 5 is a similar view with the upper valve closed, as in Fig. 1. Fig. 6 is a sectional view of the movable head forming part of the upper valve. Fig. 7 is an inverted plan view of the same. Fig. 8 is a longitudinal section of one form of the valve for closing the aperture in the movable head, taken on the line 8 8 of Fig. 9. Fig. 9 is an inverted plan of the same with one of its operating-levers. Figs. 10 and 11 are respectively a longitudinal section and plan view of one of the operating-levers of the aperture-closing valve. Fig. 12 is a horizontal section, enlarged, on the line 12 12 of Fig. 3. Figs. 13 and 14 are vertical sections on the line 13 14 of Fig. 12, showing the operation of the bucket-actuated valve and lever. Fig. 15 is a vertical sectional view, enlarged, of a portion of the closed upper valve, showing the cable-guideway therein. Fig. 16 is a horizontal section of the same. Fig. 17 is a plan view of the air-lock embodying a modification. Fig. 18 is a longitudinal vertical section of the same with the upper valve closed and the lower valve open; and Fig. 19 is a similar view with the positions of the valves reversed.

The air-lock is arranged at the top of the shaft a, leading from the tunnel or working chamber.

b is the lower chamber of the air-lock, which merely constitutes the chamber for the lower valve d and may be considered as a continuation of the shaft. Above this chamber b is a chamber or shaft extension the bottom of which communicates with the chamber b and is controlled by the lower valve d and the top of which opens to the air through a suitable head-casting e and is controlled by the upper valve f g. This chamber constitutes the air-lock, controlled by the valves d and f g, through which the bucket h passes when it is hoisted out of the shaft. In the construction shown in Sheets 1 and 2 this air-lock chamber c is formed of a shell c', bolted to the top of the shell b' of chamber b, and a tubular extension e' of the head-casting e, which is bolted to the shell c'. The top of the head-casting e is covered by a plate e^2, having an oblate or elongated aperture which is in line with the shaft and air-lock chamber, but is extended beyond it at one end. Arranged horizontally below the plate e^2 is a movable head f, which, as shown, is connected by a rod f' with a motor, by means of which the head may be reciprocated. The motor shown is a piston f^2 in a cylinder f^3 in the head-casting. The head f when projected, as shown in Figs. 1 and 5, extends under the elongated aperture in the head-casting, and is provided with an aperture j at its outer end which corresponds in shape and size with the passage-way through the air-lock chamber c and which registers therewith when the

head is retracted, as shown in Figs. 3 and 4. As shown, the top plate e^2 is provided on one side of the aperture with a collar e^3, and the head f with a complementary collar f^4 at the outer side of the aperture j, which when the head f is retracted forms, with the collar e^3, an aperture registering with the passage-way through the air-lock. The movable collar f^4, with the fixed collar e^3, thus forms an expansible and contractible aperture in the plate e^2.

The valve g is arranged horizontally under the top plate e^2 on the side opposite the head f and is operatively connected therewith, so as to move forward when the head f is projected and to move back when said member is retracted. In the construction shown this operative connection consists of levers k k, having their inner ends slotted and pivoted together at the center line of the valve g, as shown at k', their outer ends pivoted, as at k^2, to the sides of the head f, and their intermediate portions pivoted in slots k^4 to the valve g. When the head f is moved, these links will impart movement in the opposite direction to the valve g, moving it toward the head f when that part is projected and away from it when retracted. Any other suitable power-transmitting means may be employed for thus moving the part g. When the head f is retracted, as in Figs. 3 and 4, the valve g is also retracted, and the collar f^4, with the collar e^3, forms an aperture in the top plate e^2 through which the bucket h may pass. When, however, the head f is projected, it passes under and closes part of the aperture in the plate e^2 and the valve g also moves forward and closes the other part of the aperture. The chamber c is then air-locked. It is necessary that the parts f and g should close tightly together, and for this purpose the part f is formed on its lower face with a transverse ledge m, tangential to the aperture j, against which the edge of the part g fits. These abutting edges may be suitably faced to produce a practically air-tight joint.

o^4 is a packing-ring forming a seat on the lower face of the head f about the aperture j, and when the valve g is closed it is pressed upward against this packing-ring by wedge-shaped guides o^3 o^3 at the edge m of the part f and a wedge-shaped guide o^5 on the head-casting e.

o^6 is a packing-ring on the under side of the plate e^2 about the aperture therein, which forms an air-tight contact with the head f when the latter is projected.

To enable the hoisting-rope o to pass through the valve formed by the members f g when they are closed, a small notch n is formed in their abutting faces, and this notch in the part f extends through the portion of the edge which projects over the edge of the part g, as shown in Figs. 5, 7, and 15. I prefer to arrange small grooved rollers o' o' in the parts f g at the notch between which the rope passes, as shown in Figs. 15 and 16. These rollers thus form by their grooves the lower part of the notch through which the rope passes and not only reduce friction, but prevent escape of air. The rollers are shown journaled in plates o^2, secured to the lower faces of the parts f and g.

As shown, the lower valve d is opened and closed automatically by the bucket as it ascends and desends. To this end the shaft which carries the valve projects through the shell b' and is provided with a crank-arm d', connected with the rod p of a piston p' of a fluid-pressure motor p^2. The admission and discharge of the actuating fluid to the motor through the pipe q is controlled by a valve r, the spindle of which carries an arm r', projecting into the path of the bucket in the air-lock chamber c. The valve d is open when the bucket is below it, and the valve f g is closed. When the bucket rises in the chamber c, it strikes the lever r' and throws it up, as shown in Fig. 3. This actuates the valve r to admit pressure to the motor p^2, and the valve d is closed, as shown in Fig. 3. When the bucket descends, it strikes the lever r' and rocks it back into the former position. This actuates the valve r to relieve the pressure in the motor and permits the valve d to open. The bucket-actuated lever r' must have a range of movement sufficient to permit the bucket to pass it in either direction and yet must project in the path of the bucket after the bucket has passed it. For this reason the lever is provided with springs r^2 r^2 on each side, which will cause the lever after the bucket has passed to spring back sufficiently to project into position to be actuated on the return of the bucket. When the loaded bucket passes into the air-lock chamber c and closes the valve d behind it, the motor f^2 is operated to close the valve f g in the manner described. As the chamber c, however, is at this time filled with air under pressure, it is necessary to relieve that pressure before the valve f g is opened. This may be accomplished in any convenient manner, as by a suitable relief-pipe from the chamber c. When the pressure in c is relieved, the valve f g is opened and the bucket is hoisted out. On lowering the bucket the operations are reversed, the valve f g being closed after the bucket has passed it and the valve d being then automatically opened. The rope-guide n in the parts f g permits the bucket to be hoisted and lowered without disconnection and without appreciable loss of pressure when the valve f g is closed. The curvature of the aperture j and the elongation of the notch n in edge m insures the engagement of the rope with the guide formed by the notches.

In the construction shown in Figs. 17 to 19 the construction is substantially the same

as has been described, except that in this case the head f is formed with an annular collar f^5 about the aperture j, provided with a slot f^6 on one side to enable it to pass the rope, and instead of a sliding valve g a rocking valve g' is employed. The valve g' is hinged, as at g^2, to an extension f' of the head f and is provided on the back with a cam-fin g^3, which rides on a cam-guide e^5 in the interior of the head-casting e when the member f is reciprocated and rocks the member g' on its hinge. When the valve f g' is closed, this member g' is raised under the aperture j and seals it. When the head f is retracted, the member g' opens and the aperture j is brought in register with the shaft and air-lock chamber c. The slot f^6 in the collar f^5 permits the rope to pass through when the valve is opened. g^4 is an adjustable bearing for the cam-fin g^3 at the end of its closing movement. It may be adjusted to insure a perfect closure between the faces of the parts g' and f.

The various details of construction which have been shown may be varied without departing from my invention, which consists, broadly, in the combination, in an air-lock for the purposes described, of a movable head having an aperture adapted when the head is moved in any manner or by any mechanism to be brought into register with the air-lock chamber and a valve member or piece which is moved to close said aperture, and thus close the upper valve.

What I claim as new, and desire to secure by Letters Patent, is as follows:

1. In an air-lock, the combination of a movable head having an aperture for the passage of the bucket and adapted, when moved in one direction to partially close the air-lock chamber, a valve member operatively connected with the head to close the aperture therein when said head is moved to partially close the air-lock chamber.

2. In an air-lock, the combination with the air-lock chamber, of a movable head having an aperture for the passage of the bucket and movable across the opening of the air-lock chamber, a movable valve member, adapted to close the aperture in the head, and power-transmitting connections between said valve member and head.

3. In an air-lock, the combination with the air-lock chamber, of a movable head having an aperture for the passage of the bucket and movable across the opening of the air-lock chamber, a movable valve member, adapted to close the aperture in the head, said head and valve member having between their adjacent edges when closed together an opening for the passage of the hoisting-rope, and power-transmitting connections between said head and valve member.

4. In an air-lock, the combination with the air-lock chamber, of a movable head having an aperture for the passage of the bucket and movable across the opening of the air-lock chamber, and means controlled by the movements of the said head to close the aperture therein when said head is moved to bring the aperture out of register with the passage through the air-lock chamber and to open it when said aperture is brought in register with said passage.

5. In an air-lock, the combination of a movable head, having an aperture for the passage of the bucket, and adapted when moved in one direction to partially close the air-lock chamber, and a valve member operatively connected with the head to close the aperture therein when the head is moved to partially close the aperture, said head and valve member meeting at the point of travel of the hoisting-rope and having an opening between them for the passage of said rope at said point of meeting.

6. In an air-lock, the combination of a movable head, having an aperture for the passage of the bucket, and adapted when moved in one direction to partially close the air-lock chamber, and a valve member operatively connected with the head to close the aperture therein when the head is moved to partially close the aperture, said head and valve member meeting at the point of travel of the hoisting-rope and having an opening between them for the passage of said rope at said point of meeting, and grooved rollers at said point of meeting carried by said parts, between which the hoisting-rope passes when said parts are closed.

7. In an air-lock, the combination with the air-lock chamber of a sliding head having an aperture for the passage of the bucket and movable transversely across the opening of the air-lock chamber, and a sliding valve member operatively connected with the head to close the aperture therein when the head is projected.

8. In an air-lock, the combination with the air-lock chamber of a sliding head having an aperture for the passage of the bucket and movable transversely across the opening of the air-lock chamber, a sliding valve member, and links between said head and valve member to move the valve member in the opposite direction to the head when the head is moved.

9. An air-lock consisting of a valve member and a movable head oppositely moving and meeting when closed at the point of travel of the hoisting-rope, and having an opening between them for the passage of the hoisting-rope at said point of meeting.

10. In an air-lock, the combination with the air-lock chamber, of a movable head having an aperture adapted to be brought in register with the air-lock chamber, and having a seat about said aperture on its lower face, and a valve member operatively connected with

said head to close upon said seat and close the aperture when said head is moved to bring its aperture in register with the air-lock chamber.

11. In an air-lock, the combination with the air-lock chamber, of a movable head having an aperture adapted to be brought in register with the air-lock chamber, and having a seat about said aperture on its lower face, and a valve member operatively connected with said head to close upon said seat and close the aperture when said head is moved to bring its aperture in register with the air-lock chamber, said head and valve member meeting at the point of travel of the hoisting-rope and having an aperture for the rope at said point of meeting.

12. In an air-lock, the combination with the air-lock chamber, of the sliding head *f* having the aperture *j* and the ledge *m* substantially tangential to said aperture, and the sliding valve member *g* operatively connected with the head *f* and moving in the opposite direction thereto and adapted when moved forward to seat against said ledge *m* and close the aperture *j*, said head and valve member *g* having between them when closed together an aperture for the hoisting-rope.

13. In an air-lock, the combination of the air-lock chamber, the upper and lower valves for opening and closing said chamber, and means to operate the lower valve, automatically controlled by the passage of the bucket through said air-lock chamber.

14. In an air-lock, the combination of the air-lock chamber, the upper and lower valves for opening and closing said chamber, means to operate the lower valve, and controlling devices for controlling said means to operate the lower valve, adapted to be automatically actuated by the bucket in its passage through the air-lock chamber.

15. In an air-lock, the combination of the air-lock chamber, the upper and lower valves for opening and closing said chamber, means to operate the lower valve, and controlling devices for controlling said means to operate the lower valve having an operating part extending in the path of the bucket in the air-lock chamber and adapted to be automatically actuated by the bucket in its passage through the air-lock chamber.

16. In an air-lock, the combination of the air-lock chamber, the upper and lower valves for opening and closing said chamber, means to operate the lower valve, and controlling devices for controlling said means to operate the lower valve, embracing a lever projecting in the air-lock chamber in the path of the bucket and adapted to be actuated thereby.

17. In an air-lock, the combination of the air-lock chamber, the upper and lower valves for opening and closing said chamber, means to operate the lower valve, and controlling devices for controlling said means to operate the lower valve, embracing a lever projecting in the air-lock chamber in the path of the bucket and adapted to be actuated thereby, and provided with means to restore said lever to position to be again actuated by the bucket after it has been moved thereby.

18. In an air-lock, the combination of the air-lock chamber, the upper and lower valves for opening and closing said chamber, a fluid-pressure motor for operating said lower valve, a controlling-valve in the motor-fluid pipe to said pressure-motor, and a lever for said valve projecting in the air-lock chamber in the path of the bucket and adapted to be actuated thereby.

19. In an air-lock, the combination of a movable head having an aperture for the passage of the bucket and adapted when moved in one direction to partially close the air-lock chamber, and a movable valve member adapted to close the aperture in said head when it is moved to partially close the air-lock chamber.

20. In an air-lock, the combination with the air-lock chamber, of a head movable transversely across the air-lock chamber and having an aperture for the passage of the bucket adapted to be brought in register with the passage-way through said air-lock chamber when the head is shifted into one position, and a movable valve adapted to close the aperture in said head.

In testimony of which invention I hereunto set my hand.

SINCLAIR W. CHILES.

Witnesses:
GEO. W. BUSS,
AARON SEIGFRIED.