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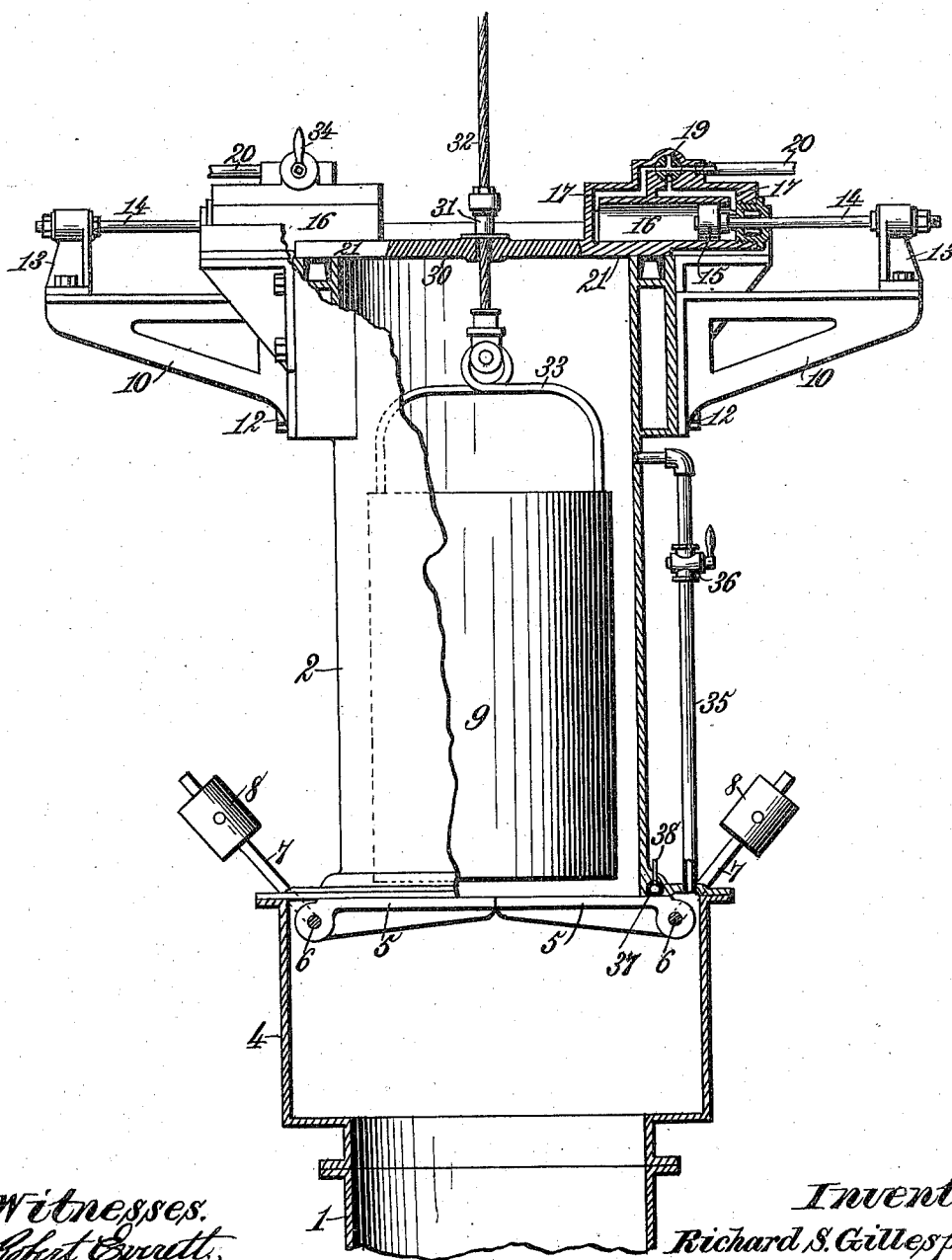
2 Sheets—Sheet 1.

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AIR LOCK FOR CAISSONS, &c.

No. 576,445.

Patented Feb. 2, 1897.

Fig. 1.



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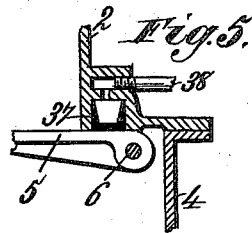
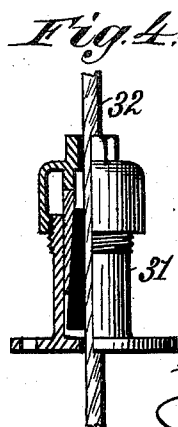
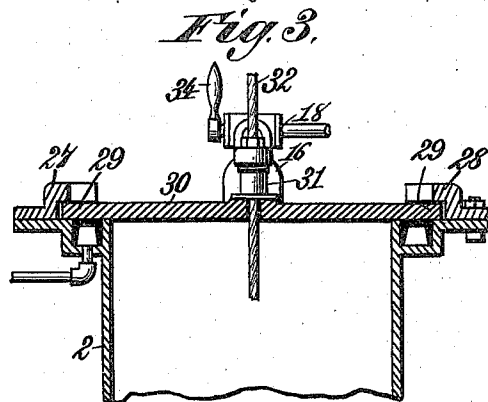
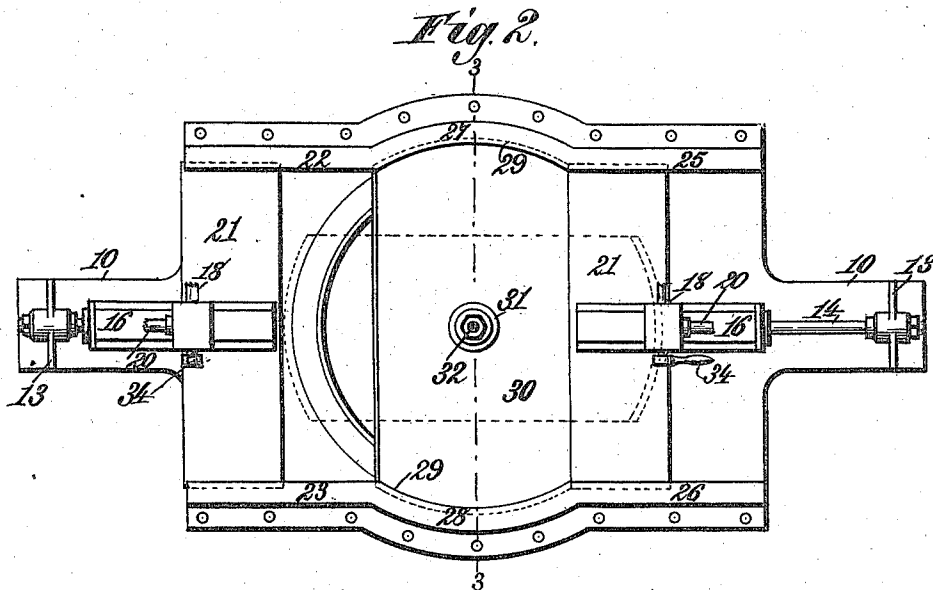
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2 Sheets—Sheet 2.

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UNITED STATES PATENT OFFICE.

RICHARD S. GILLESPIE, OF NEW YORK, N. Y.

AIR-LOCK FOR CAISSONS, &c.

SPECIFICATION forming part of Letters Patent No. 576,445, dated February 2, 1897.

Application filed July 20, 1896. Serial No. 599,933. (No model.)

To all whom it may concern:

Be it known that I, RICHARD S. GILLESPIE, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented new and useful Improvements in Air-Locks for Caissons, &c., of which the following is a specification.

This invention relates to air-locks arranged on the upper ends of caissons for constructing subaqueous and other foundations and the like or in operative connection with apparatus designed for tunneling purposes. In this class of apparatus upper and lower sets of doors or valves are employed in such manner that buckets can be raised into the air-locks while the upper valves are closed to prevent the escape of compressed air and the lower doors or valves then be closed to prevent escape of compressed air from the caissons, when the upper doors or valves are opened for unloading the buckets of material which has been raised from the caissons or for loading the buckets with material to be carried down into the caissons.

It has heretofore been proposed to employ cylinders and pistons for opening and closing the doors of an air-lock by reciprocating the pistons, but the prior construction and arrangement are objectionable in that portions of the cylinders, the stuffing-boxes, and portions of the piston-rods are located within the air-lock itself, and when the doors are closed the cylinders, stuffing-boxes, and piston-rods are under air-pressure and are not readily accessible nor visible to the eye of the attendant or operator.

The chief object of my invention is to provide piston and cylinder mechanism so constructed and applied that the cylinders, with their stuffing-boxes, piston-rods, and pipe connections for supplying the working fluid, are located wholly outside of the air-lock, where they are under the eye of the attendant and are conveniently accessible whenever necessary.

The invention also consists in certain other features of construction and combination or arrangement of parts hereinafter described and claimed, reference being made to the accompanying drawings, in which—

Figure 1 is a sectional side elevation of an air-lock applied to the upper end of a caisson or similar structure and constructed in ac-

cordance with my invention. Fig. 2 is a top plan view of the same. Fig. 3 is a sectional view taken on the line 3 3, Fig. 2. Fig. 4 is a detail vertical sectional view of the stuffing-box carried by the cross bar or plate which coöperates with the upper sliding doors or valves to close the top of the air-lock, and Fig. 5 is a detail sectional view of a modified form of packing for the lower doors or valves.

In order to enable those skilled in the art to make and use my invention, I will now describe the same in detail, referring to the drawings, wherein—

The numeral 1 indicates a cylinder or structure which may be a caisson for constructing subaqueous or other foundations and the like or may be part of an apparatus designed for tunneling purposes, wherein work is effected in the presence of compressed air, as is well known. The upper end of the cylinder or structure 1 is surmounted by an air-lock casing 2, having a somewhat enlarged or expanded lower section or chamber 4, which is secured to the upper end of the cylinder or structure 1 in any suitable manner.

The section or casing 4 may or may not be of the same diameter as the main casing 2 of the air-lock, but, preferably, it is enlarged or expanded to more readily accommodate the opening and closing of the lower doors or valves 5 of the air-lock.

The casing 2 is preferably in the form of a cylinder, but it may be of any form or shape in cross-section suitable for the purpose in hand.

The lower doors or valves 5 are mounted on rock-shafts 6, to one end of which are secured arms or levers 7, provided with counterweights 8, in such manner that when the arms or levers and counterweights are at one side of the axes of the rock-shafts 6 the doors or valves 5 will be held horizontally in their closed position, as in Fig. 1, and when the arms or levers and counterweights are shifted to the opposite side of the axes of the rock-shafts the doors or valves 5 will be swung to and held in their open position for the passage of the ordinary or usual bucket 9, which is employed either to raise material from the caisson or to lower material thereinto for executing the work in hand, whatever it may be, such, for example, as constructing subaqueous foundations or tunneling purposes. The

upper end of the air-lock casing is provided at opposite sides with exterior rigidly-attached horizontally-projecting brackets or supports 10, which may be secured in place by bolts, as at 12, or by any other suitable means. The outer ends of the brackets or supports 10 are provided with standards or vertical arms 13, to which are rigidly secured the outer ends of horizontally-arranged piston-rods 14, having pistons, as at 15, secured to their inner ends. The pistons may be of any suitable construction and are located within horizontally-slidable cylinders 16, each having inlet-ports 17, exhaust-port 18, valve 19, and a supply-pipe 20, whereby it is possible to introduce a working fluid, such as air, steam, water, or gas, into the cylinders at either side of the fixed piston, thereby causing the cylinders to move horizontally, in either direction, according to the side of the fixed piston at which the working fluid is introduced under pressure.

The cylinders 16 are each mounted upon and rigidly fixed to the exterior of a horizontally-sliding door or valve 21, the construction being such that the cylinders form actual parts of the doors or valves.

In practice the outer ends of the cylinders are provided with stuffing-boxes, through which the piston-rods work. The cylinders, as shown, are mounted at the centers of the doors or valves, and the latter have their ends arranged to slide under the overhanging guide-flanges 22, 23, 25, and 26. The overhanging guide-flanges 22 and 23 are parallel, and the same remark applies to the overhanging guide-flanges 25 and 26.

The guide-flanges 22 and 23, as shown, are connected with the guide-flanges 25 and 26 through the medium of opposite segmental-shaped overhanging guide-flanges 27 and 28, adapted to receive under them the curved or arc-shaped ends 29 of a cross bar or plate 30, having at its center a stuffing-box 31, through which the bucket-hoisting cable 32 extends and is adapted to slide. The tubular bore of the stuffing-box is coincident with a hole in the cross bar or plate 30, and the lower end of the cable is secured to the bail 33 of the bucket 9. The cross bar or plate 30 is susceptible of revolving in a horizontal plane on the cable 32 as an axis, so that when the upper sliding doors or valves 21 are opened the cross bar or plate 30 may be turned in a horizontal plane to disengage its curved or arc-shaped ends 29 from beneath the overhanging segmental guide-flanges 27 28. When this is accomplished, the bucket may be raised out of the air-lock and will carry with it the cross bar or plate 30, as will be obvious without further explanation.

The valves 19 are shown as rotary valves to be operated by suitable handles 34, but I wish to be clearly understood as not limiting myself to any particular construction of valves, nor do I limit myself to any particular arrangement of ports for introducing the

working fluid into the horizontally-slidable cylinders which constitute parts of the upper sliding doors or valves of the air-lock.

The cable 32 is ordinarily a wire rope, as is well known, and although I have shown it attached to the bail 33 of the bucket 9, as is usual, I do not limit myself to the use of the bail.

The air-lock casing at a point above the lower doors or valves 5 is connected with the base portion of the casing through the medium of an ordinary pressure-equalizing pipe 35, having a suitable valve 36.

The opposite edges of the cross bar or plate 30 are beveled, as best seen in Fig. 1, to seat against the beveled inner edges of the sliding doors 21, and since the parts are preferably of metal the edges referred to may be ground and thus caused to fit fluid-tight against one another to effectually prevent escape of compressed air when the upper doors or valves are closed and the workmen occupy the caisson in the execution of the work in hand.

The lower end of the air-lock casing 2 is provided with an annular groove, in which is arranged a tubular expansible packing-ring 37, having a nipple 38, one or more, communicating with its interior, so that a fluid can be introduced into the tubular packing-ring to expand the same and cause it to make a perfectly air-tight connection with the lower doors or valves 5. The fluid for expanding the tubular packing-ring 37 may be introduced in any suitable manner; that is to say, a separate apparatus may be employed for expanding the packing-ring, or the latter may be made to communicate with the interior of the air-lock, so that the compressed air therein contained at certain times will flow into the ring and expand the same to make an air-tight connection with the lower doors or valves when closed or brought to their horizontal position, as shown in Fig. 1.

Instead of making the expansible packing-ring in the form of a tube, as shown in Fig. 1, it may be made in the form of a trough or U-shaped, as shown in Fig. 5, so that a fluid introduced therein will expand the trough or U-shaped packing-ring and cause it to press closely against the lower doors or valves when they are closed, and thus effect a perfect air-tight joint between the parts.

In the practical operation of the air-lock, assuming that the bucket is to be introduced from the exterior, the lower doors or valves are closed and the upper ones are opened, the bucket is introduced, the cross bar or plate 30 is turned on the cable until its curved or arc-shaped ends 29 engage under the segmental overhanging guide-flanges 27 28, as in Fig. 2, and the working fluid is introduced into the cylinder 16 at the inner sides of the fixed pistons, whereby the fluid-pressure will slide the cylinders longitudinally in the direction required to close the doors or valves 21 and seat them tightly against the beveled or other suitably-shaped edges of the cross

bar or plate 30. The lower doors 5 are then opened and the bucket is lowered into the caisson. If the bucket is to be raised from the caisson into the air-lock, this is accomplished during the time the upper doors are closed, so that the compressed air contained in the caisson will not escape during the time the lower doors or valves 5 are open. After the bucket is raised into the air-lock the lower doors or valves 5 are closed, and the upper doors or valves are opened by introducing the working fluid into the cylinder 16 at the outer sides of the fixed pistons, as will be obvious without further explanation. The cross bar or plate 30 is then turned on the cable to disengage its curved or arc-shaped ends from the segmental overhanging guide-flanges, and then the bucket can be raised out of the air-lock and will carry with it the cross bar or plate.

When the upper doors or valves are slid to their closed position and the air-pressure exists in the air-lock, the tendency of the pressure is to raise or press upward the doors 21 and the cross bar or plate 30, but this is impossible by reason of the fact that the ends of the doors and cross-bar are firmly held down in operative position by the overhanging guide-flanges 22, 23, 25, and 26.

It will be obvious that in my invention the cylinders, with their stuffing-boxes, the piston-rods, and the pipe connections for the fluid which works the cylinders back and forth, are wholly outside the air-lock, where they are under the eye of the attendant and are conveniently accessible whenever necessary, which is advantageous and cannot be practicably effected in such prior construction where the cylinders are stationary and are located beneath the doors of the air-lock.

The base section or chamber 4 of the air-lock casing 2 is enlarged or expanded to accommodate the working of the lower doors or valves 5 and to enable the main body 2 of the casing to be diminished in diameter, so that the bucket will approximately fill it, and thus reduce the amount of space from which the compressed air escapes when the upper doors or valves are opened to remove or discharge the bucket.

Having thus described my invention, what I claim is—

1. The combination with an air-lock casing having guides at its top portion, and doors slidable in engagement with said guides, of cylinders mounted upon the exterior of the doors outside the air-lock, stationary piston-rods held rigid outside the air-lock and having pistons arranged in said cylinders, and pipe connections for supplying a working fluid to the cylinders at either side of the fixed pistons to slide the cylinders longitudinally and thereby open or close the doors, substantially as described.

2. The combination with an air-lock casing, having guides at its top portion, of slidable

doors or valves having cylinders mounted on and secured to their upper sides and sliding back and forth therewith, stationary pistons arranged in the cylinders, and a cross-bar adapted to lie between and against which the doors or valves close, substantially as described.

3. The combination with an air-lock casing, having guides at its top portion, of doors or valves slidable in engagement with said guides, and having cylinders mounted thereupon, fixed thereto, and sliding therewith, a cross bar or plate adapted to lie between and against which the doors close, and a stuffing-box mounted on the cross bar or plate and through which the bucket-hoisting cable extends, substantially as described.

4. The combination with an air-lock casing, having guides at its top portion, of doors or valves slidable in engagement with said guides and having cylinders mounted thereupon, fixed thereto, and sliding therewith, stationary pistons arranged in the cylinders, means for supplying a working fluid to either side of the fixed pistons to slide the cylinders and thereby open or close the doors, a bucket-hoisting cable, and a cross bar or plate swiveled on the cable and against opposite sides of which the doors or valves close when the cylinders are slid toward each other, substantially as described.

5. The combination with an air-lock casing, having upper and lower opening and closing doors, of an annular expansible packing-ring inserted into the lower portion of the air-lock casing to form an air-tight joint with the lower doors or valves when they are closed, and means for introducing a fluid into said ring to expand the same, substantially as described.

6. The combination with an air-lock casing, having parallel guides 22, 23, 25 and 26, and segmental guides 27 and 28, at its top portion, of doors or valves slidable in engagement with said parallel guides, and having cylinders mounted thereupon, fixed thereto, and sliding therewith, a cross bar or plate for engaging the segmental guides, brackets or supports extending from and rigidly connected to the upper portion of the casing, stationary piston-rods connected with and supported by said brackets or supports, pistons fixed to the inner ends of the piston-rods and arranged in the cylinders, and means for supplying a working fluid to the cylinders at either side of the fixed pistons to slide the cylinders longitudinally and thereby open or close the doors or valves, substantially as described.

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

RICHARD S. GILLESPIE.

Witnesses:

ALBERT H. NORRIS,
THOS. A. GREEN.