(No Model.) 3 Sheets—Sheet 1.

C. T. DÖRR & M. STÜHLER.

MEANS FOR AUTOMATICALLY OPERATING BULKHEAD DOORS.

No. 588,793. Patented Aug. 24, 1897.

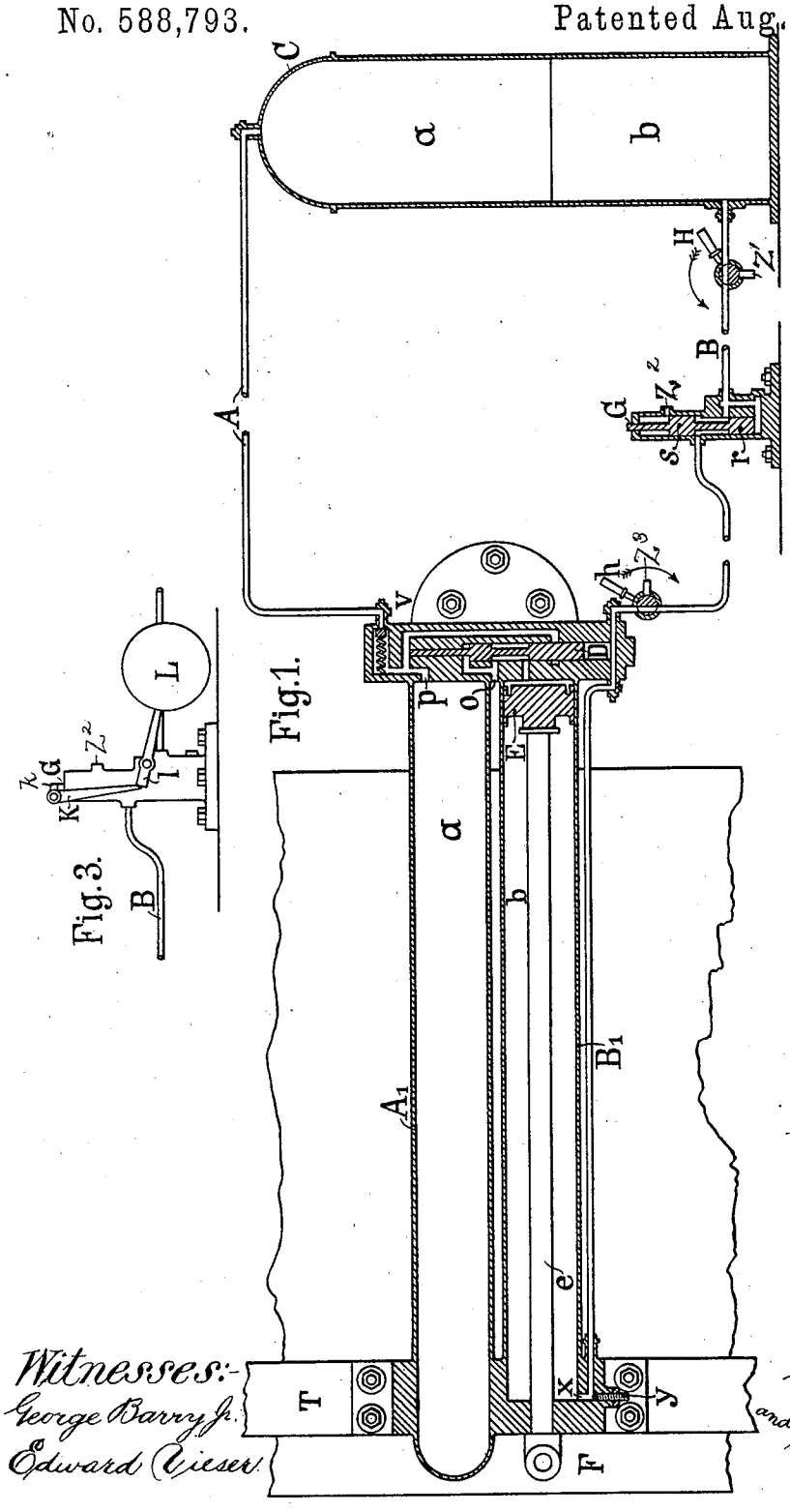


Fig.1.

Fig.3.

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C. T. DÖRR & M. STÜHLER.

MEANS FOR AUTOMATICALLY OPERATING BULKHEAD DOORS.

No. 588,793. Patented Aug. 24, 1897.

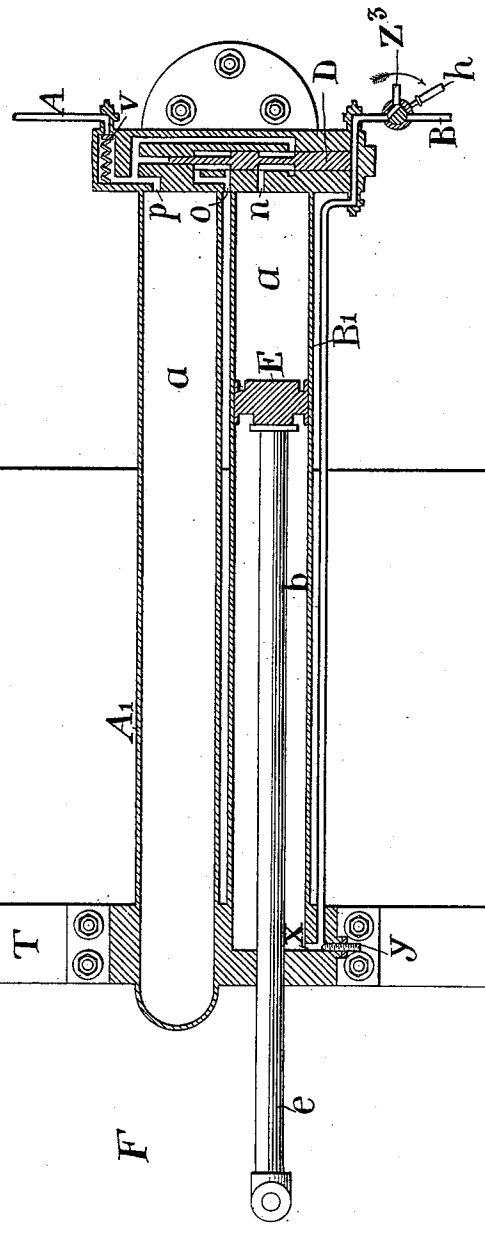


Fig. 2.

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C. T. DÖRR & M. STÜHLER.

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Fig.7.

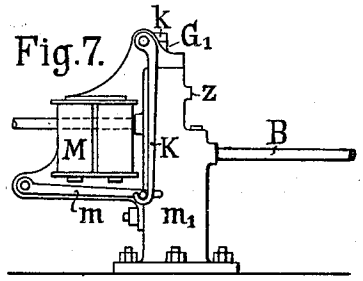


Fig.5.

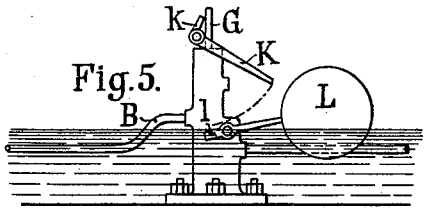


Fig.11.

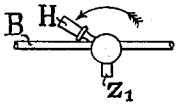


Fig.6.

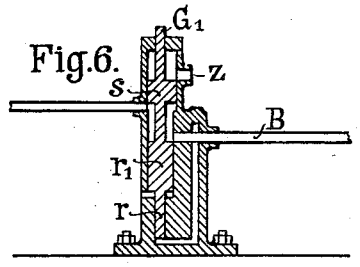


Fig.4.

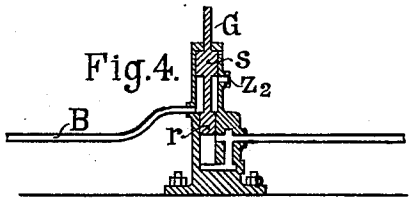


Fig.10.

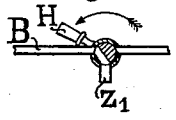


Fig.9.

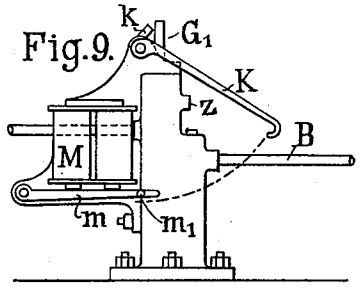
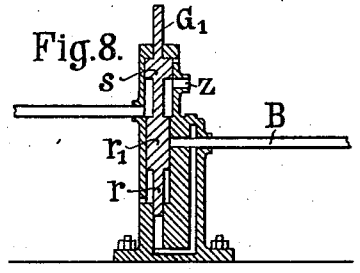


Fig.8.



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UNITED STATES PATENT OFFICE.

CARL THEODOR DÖRR AND MARTIN STÜHLER, OF COLOGNE, GERMANY, ASSIGNORS TO SAID DÖRR.

MEANS FOR AUTOMATICALLY OPERATING BULKHEAD-DOORS.

SPECIFICATION forming part of Letters Patent No. 588,793, dated August 24, 1897.

Application filed November 19, 1896. Serial No. 612,682. (No model.)

To all whom it may concern:

Be it known that we, CARL THEODOR DÖRR and MARTIN STÜHLER, subjects of the King of Prussia, German Emperor, and residents of Cologne, Germany, have invented certain new and useful Improvements in Means for Automatically Operating Bulkhead-Doors, of which the following is a specification.

In this apparatus a compressor or a receiver filled with air or partly filled with a liquid and partly filled with air under pressure is combined by pipes and valves with means capable of receiving motion through the difference in pressure in said receiver or compressor and pipes and on said valves and of thereby actuating the doors with which said means are connected.

The invention will be readily understood by the following description with reference to the annexed drawings.

Figure 1 comprises a vertical sectional view of an apparatus embodying our invention and a face view of one of the doors to which it is applied. Fig. 2 comprises similar views of a portion of said apparatus and of the door, showing the parts in a different position. Figs. 3 and 5 represent elevations, and Fig. 4 a vertical section, of certain details, and Figs. 7 and 9 represent elevations, and Figs. 6 and 8 vertical sections, of modifications of said certain details of the apparatus, which will be hereinafter described. Figs. 10 and 11 are details of certain conduits, cocks, and outlets hereinafter referred to.

At a proper place in the ship, preferably in the engine-compartment thereof, a main receiver C is mounted, the lower half of which contains a liquid *b* and the upper half contains air *a* under pressure.

From the liquid-containing half, as well as from the compressed-air-containing half, of the receiver a system of pipes branches off through the ship.

The branches of the air-pressure conduit A terminate in separate receivers A′, which may be termed "secondary" receivers, while the branches of the liquid-pressure conduit B terminate in separate cylinders B′, the pistons E of which by means of the piston-rods *e* are connected either directly or by means of intermediate mechanical means indirectly with the separate bulkhead-doors F.

If the communicating conduits are put under pressure by pumping, according to requirement, either air or liquid into the main receiver C, the liquid *b* will act upon the pistons E in such direction as to open the doors, while the compressed air *a* is driven into the separate receivers and is retained therein by the valves *v*. It is a matter of course that the pressure exerted by the pressure-medium conduits must exceed the counter-pressure created, for example, by trap-doors. Now as the non-elastic column *b* of the water under pressure is subject to the continuous action of the elastic column *a* of the air under pressure and as the water penetrating through the joint between the piston and the bore of the cylinder may easily escape into the open air any want of tightness or leakage in the pistons, piston-rods, valves, &c., does not matter. Therefore in the state of rest a gradual lowering down of the trap-doors, as well as the running down of a sliding door, if the ship is heavily rolling, is almost entirely prevented.

If the whole or any desired branch of the system of the liquid-pressure conduit is discharged by the action of outlet-valves G G′ H *h*, presently to be described, all the differential piston-valves D within the reach of such discharge will automatically change position or be reversed, and the compressed air will act from the opposite side upon the pistons E, so that the doors will close by the simultaneous outflow of the liquid *b*, which now acts as a brake. If the original pressure is restored by again changing the position of or reversing the heretofore-acting outlet-valves G G′ H *h*, the differential piston-valves D will reassume their original position, and the doors will open again.

Fig. 1 shows a diagrammatical illustration of the main receiver C, the conduits A and B for the pressure medium, as well as the cylinders A′ and B′ by which the sliding door F is worked. The compressed air *a* passes through the conduit A into the receiver A′, which is automatically closed by the valve *v* after each compensation of pressure. The liquid *b*

passes through the conduit B, which is provided with the outlet-valves H G *h*. The liquid acts against the larger area of the bottom of the differential piston-valve D and maintains the same as well as the main piston E in its most outward position. The main piston E is connected by the piston-rod *e* with the door F. The waste water escaping through the piston-joint at E takes its way through *n o* into the open air or into a waste-pipe. In the liquid-conduit B a suitable number of outlet-valves G G′ H *h* are arranged, which, if they are worked, will discharge the branched-off part, while at the same time they close the main conduit. H and *h*, Figs. 1, 2, 10, and 11, are simple three-way cocks. It will be suitable to arrange one, *h*, at each door or several, H, at suitable main points of the conduit or in the ship. If, for instance, *h* is closed in the direction of the arrow, Fig. 2, the part of the pressure-water conduit B coming from the main receiver C is closed and the other part leading to the cylinder B′ is opened or connected to the exit-pipe Z^3. In consequence of this the air-pressure *a*, which is not relieved of pressure, will drive the differential valve D in spite of the smaller area of its plunger into the opposite end position and will arrive through the passages *p n* into the cylinder B′ and move the piston E and with the latter the door F in forward direction, while the water within the cylinder B′ is driven through the brake-hole *x*, capable of being adjusted by the screw *y*, and is expelled at Z^3. If the three-way cock H, Fig. 1, is turned, (see Figs. 10 and 11,) the same will take place, with the difference that the water flows out at Z′.

G, Figs. 1, 3, 4, and 5, is a differential piston-valve which connects the part of pressure-water pipe B leading to B′ in its one end position, Fig. 1, with the main receiver C and in the other end position, Fig. 4, with the outlet-pipe Z^2, exactly the same as this was obtained by the three-way cock. The differential valve G is worked by the pressure of the closed-up pressure-water *b*, which acts upon the bottom areas of the pistons *r* and *s* in such manner that G always tries to attain the end position. (Shown in Fig. 4.) Now in order to constantly retain G in its normal position, Fig. 1, the arrangement shown in Fig. 3 is provided for.

G is arrested by the lever-arm K of the angle-lever K *k* by means of the nose of the float-lever *l*. Now while the float is at rest G is unable to move, but as soon as the float L rises the lever K and valve G will be freed. (See Fig. 5.) The pressure-water is capable of escaping at Z^2, and the door will be closed.

As in the differential valve G the area in cross-section of the piston *r* is smaller than that of the piston *s*, an intermediate position of G is excluded, for if by accident the piping leading to B′ should become broken the pressure of the pipe coming from C and acting on *v* would suffice to drive the piston-valve, while, moreover, the breakwater coming from B′ would escape through the broken pipe. If, on the other hand, the piping coming from C be broken, the piston-valve G, in consequence of the difference of area in cross-section, would be moved by the breakwater coming from B′, and this water could escape in the ordinary way.

G′, Figs. 7 and 9, shows a modification of the differential piston-valve G, inasmuch as the bottom area *r* coming into question is made independent of the cross-sections of pistons *r* and *s*, in order to be able to combine any chosen cross-section of the piping B for the pressure-water with any chosen momentum of working of the piston-valve. Again, the float is here replaced by an electromagnet M, the armature of which is shaped into the form of a lever *m*, provided with a nose *m′*. G′ is arrested in the same manner as above by means of the angle-lever K *k*. K is kept in position by the nose *m′* of the armature-lever *m*, if this lever is not attracted by the magnet. If the current exciting such magnet M is closed, *m* will be attracted, (see Fig. 9,) the angle-lever K *k* will be freed, the differential valve G′ will assume the end position, (shown in Fig. 8,) the water will escape at Z, and the door will close.

As by each of the escape-valves mentioned any part of the system may be relieved automatically or by hand, it is obvious that almost all combinations in the system may be realized.

If the exit-valves of the compartments free of water are returned after previous working into their initial position, the differential valves D will automatically reverse their position, and the doors will open again. The doors of the compartments still under water may, however, be opened again only if, after the water has been removed, the outlet-valves G G′ have been arrested again by the floats L.

The main features by which the present invention differs from other patents for the same purpose are the following:

First. The proposed device not only serves for the automatical closing, but also for the automatical opening, of the bulkhead-doors.

Second. The non-elastic pressure-liquid column which keeps the doors open is under elastic tension by the compressed-air column communicating with it, so that any quantity of liquid escaping by leaky joints of the piston or of the valves, &c., will be automatically replaced.

Third. The system will act as well locally as centrally.

Fourth. The full pressure which in working acts in the closing direction will act in the state of rest in the opening direction.

Fifth. The pressure of the liquid-conduit is inseparable from or integral with the pressure of the air-conduit. If therefore the

pressure in the apparatus should sink below the minimum, the trap-doors within the system will automatically close and will by this action call the attention of the attendant to the apparatus.

Sixth. The pressure-air does not act continuously upon the pistons E, but it remains inclosed in the receivers A′ until upon discharging of the water-column the valve D will automatically be reversed and allow the passage of the compressed air from A′ into B′.

Instead of using air under pressure and water under pressure the system will allow of using air under pressure alone without any alteration in the system whatever. In this case, however, the conduit designated with an A may be dispensed with, and the conduit B may be connected with the receiver A′ by means of a small branch above the valve *v*.

What we claim as our invention is—

1. An apparatus for automatically closing and opening bulkhead-doors in ships comprising a receiver C containing a liquid, and above the liquid, air under pressure, a cylinder B′ and a piston E therein connected with the bulkhead-door, conduits A for the air under pressure and conduits B for the liquid under pressure between the said receiver and the said cylinder, and means for regulating the entrance of the said liquid and air into said cylinder B′ for closing or opening said door, substantially as herein described.

2. An apparatus for automatically closing and opening bulkhead-doors in ships comprising a main receiver C for liquid and air under pressure, a separate air-receiver A′, a cylinder and a piston therein connected with the bulkhead-door, a conduit between said separate receiver A′ and the air-space of the main receiver C, a conduit between the water-space of the main receiver and one end of said cylinder B′, a conduit between the said separate receiver A′ and the other end of said cylinder and a differential valve D in the last-mentioned conduit for temporarily storing compressed air in the separate receiver A′ and for alternately charging such compressed air to one end of the cylinder B′ and liquid under pressure to the other side of said piston, substantially as herein described.

3. An apparatus for automatically closing and opening bulkhead-doors in ships comprising a main receiver for air and liquid under pressure, a cylinder and a piston therein connected to the bulkhead-door, a separate receiver for temporary storage of compressed air, a conduit between the said separate receiver and the air-space of the main receiver, a second conduit B between the water-space of the main receiver and one end of said cylinder, a third conduit *n p* between said separate receiver and the other end of said cylinder, a differential valve in said third conduit for distributing the air and liquid under pressure and valves H *h* G G′ in the said second conduit for regulating the flow of the liquid for action in or for exit out of the system.

In testimony that we claim the foregoing as our invention we have signed our names in presence of two subscribing witnesses.

CARL THEODOR DÖRR.
MARTIN STÜHLER.

Witnesses:
MARIA NAGEL,
W. H. MADDEN.