No. 617,855. Patented Jan. 17, 1899.

C. T. DÖRR & M. STÜHLER.

MEANS FOR AUTOMATICALLY OPERATING BULKHEAD DOORS.

(Application filed Oct. 6, 1897.)

(No Model.) 9 Sheets—Sheet 1.

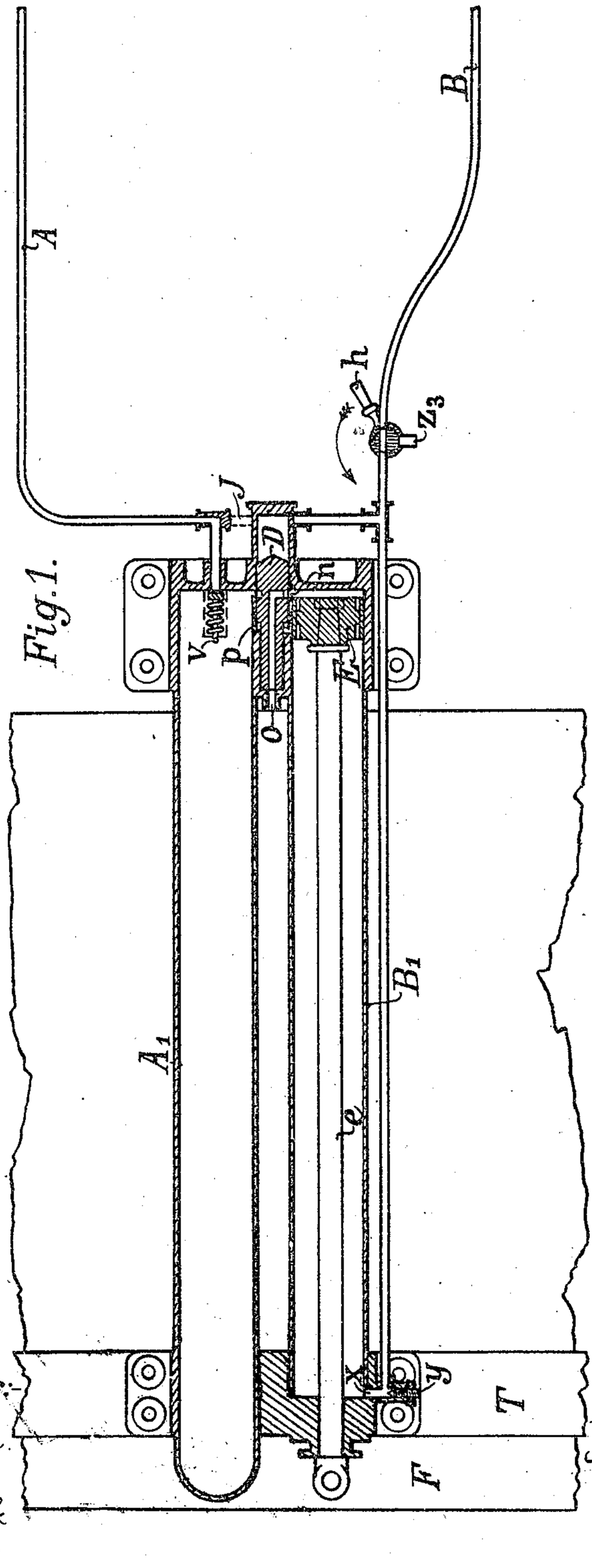

Fig. 1.

Witnesses:-
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Moritz Stühler
by attorneys
Brown & Kieser

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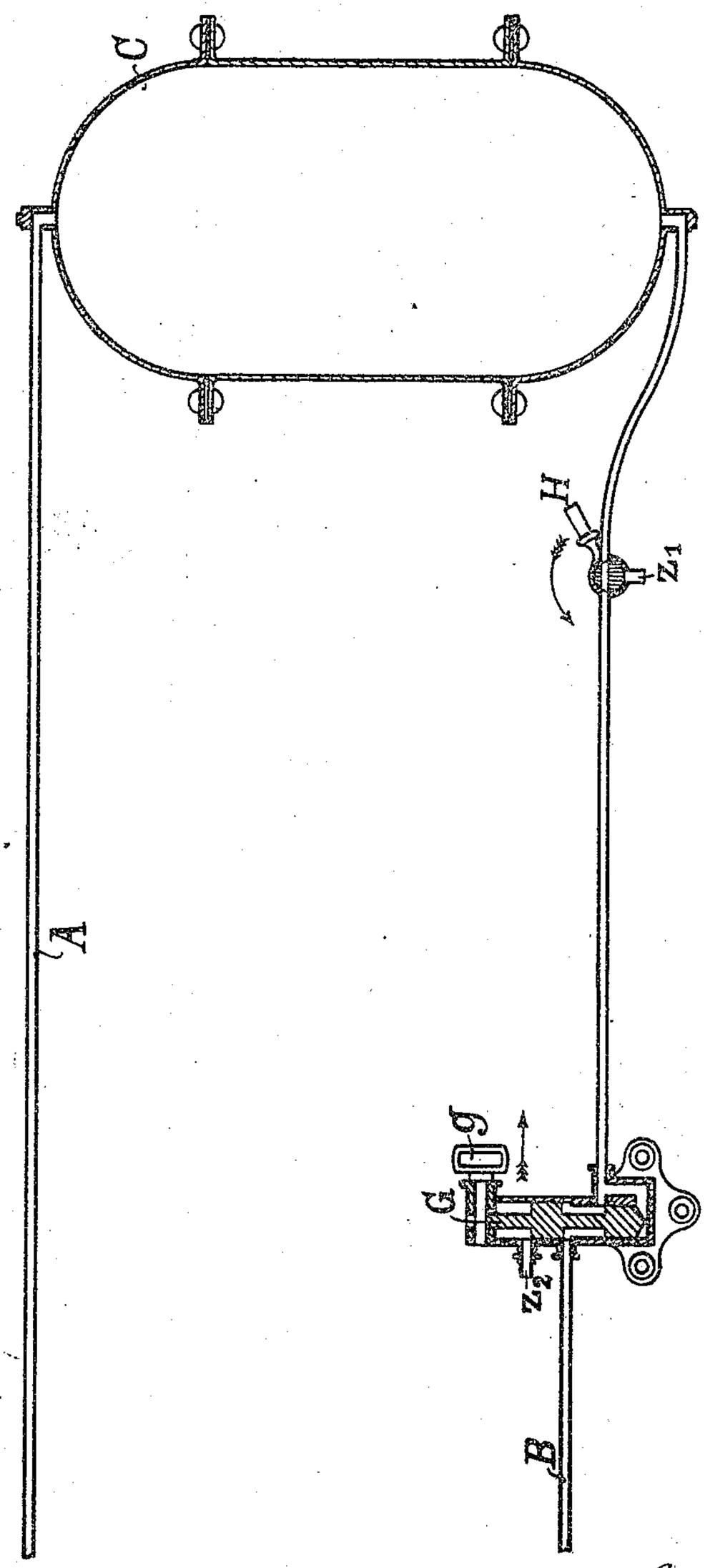

Fig. 1.*

Witnesses:-
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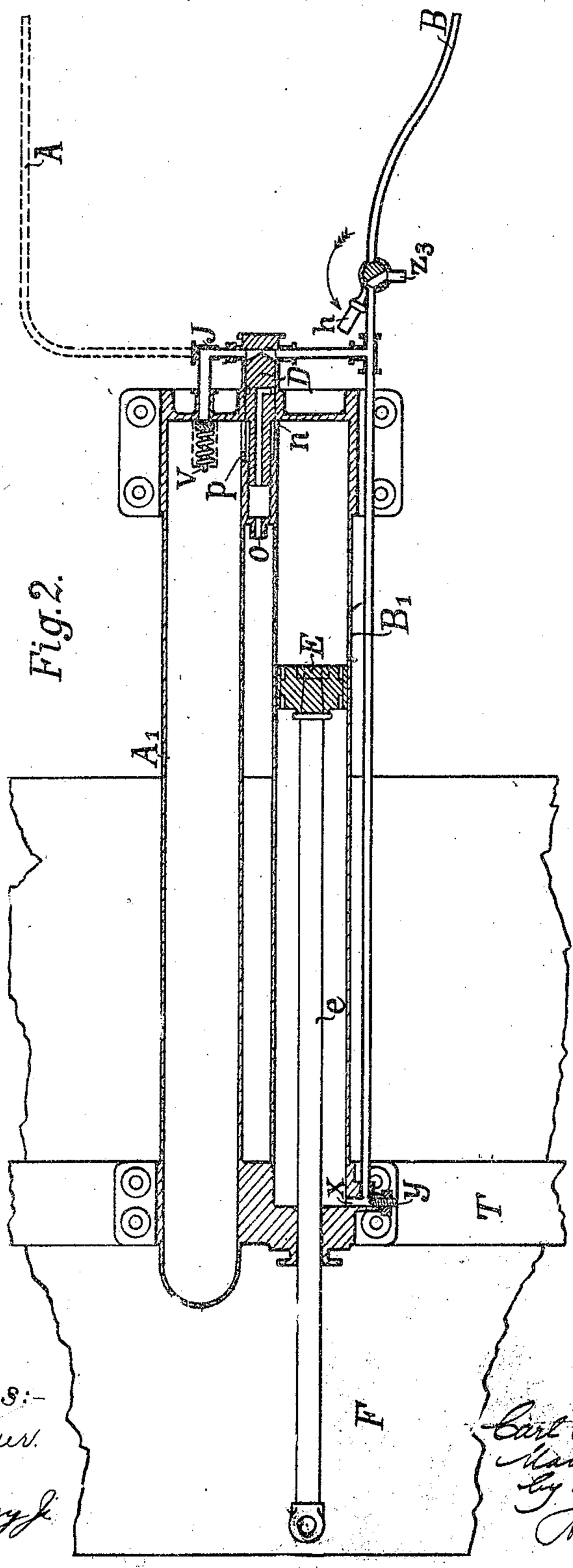
Fig. 2.



Witnesses:-
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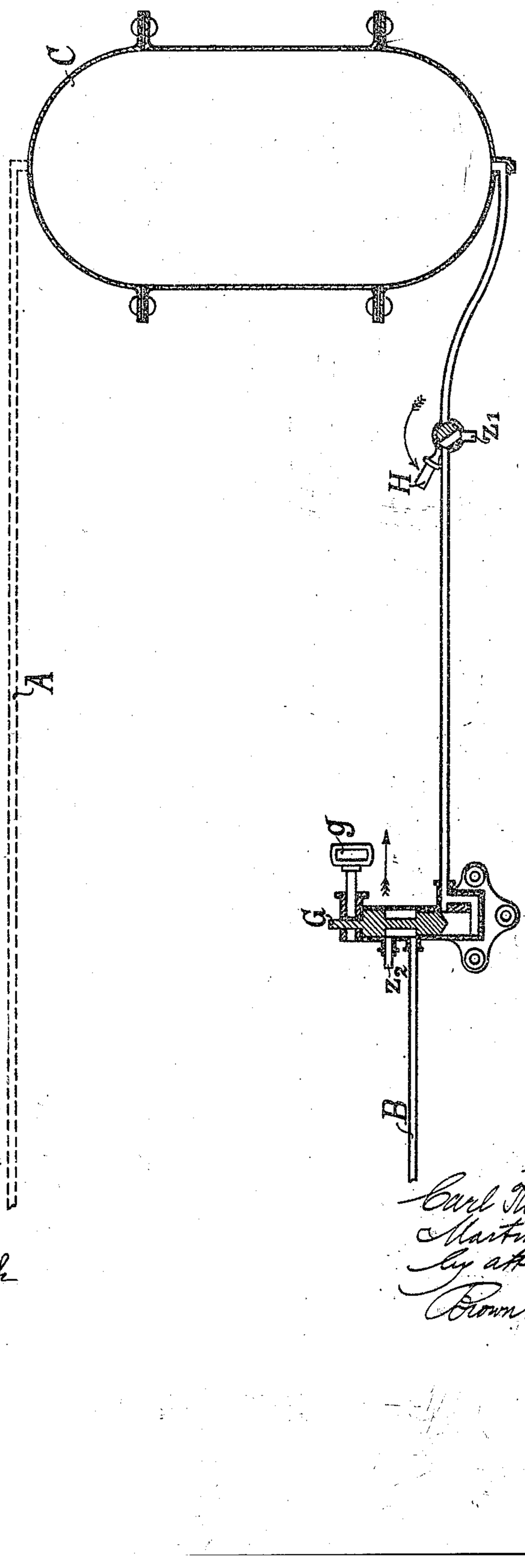

Fig. 2.*

Witnesses:-
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Fig.3.

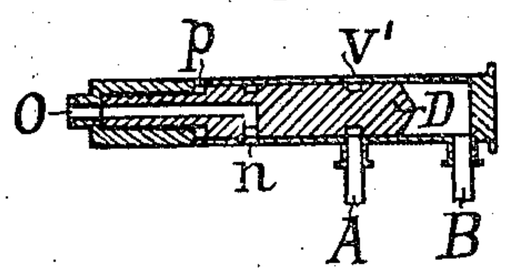


Fig.5.

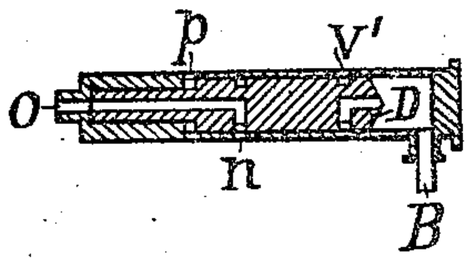


Fig.4.

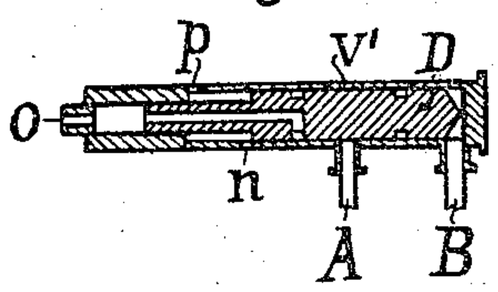
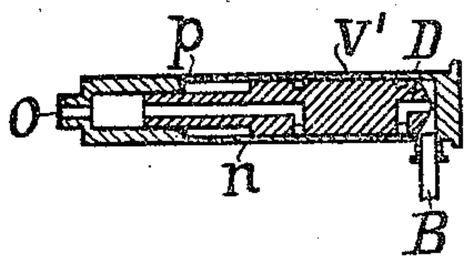


Fig.6.



Witnesses:-

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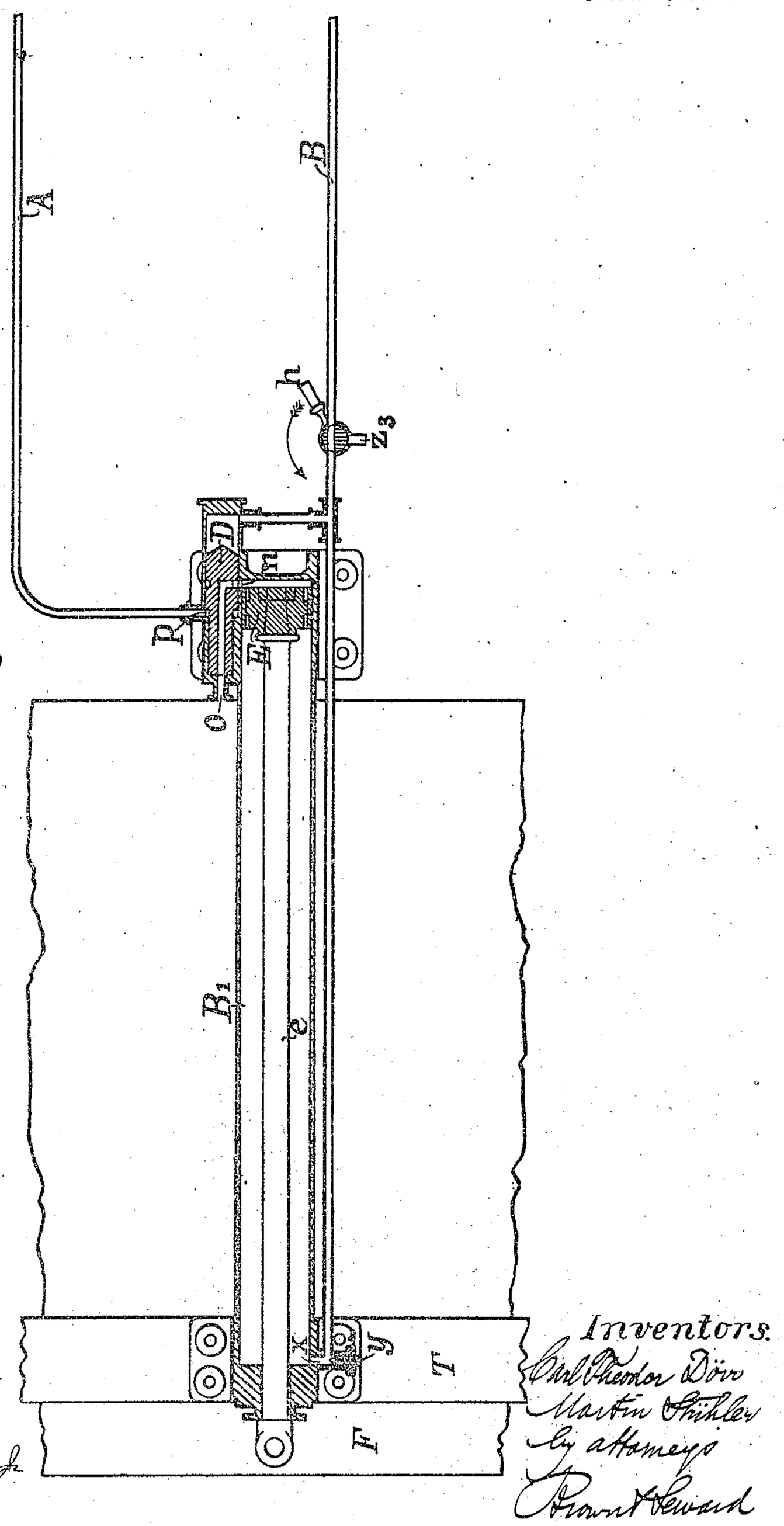
Fig. 7.



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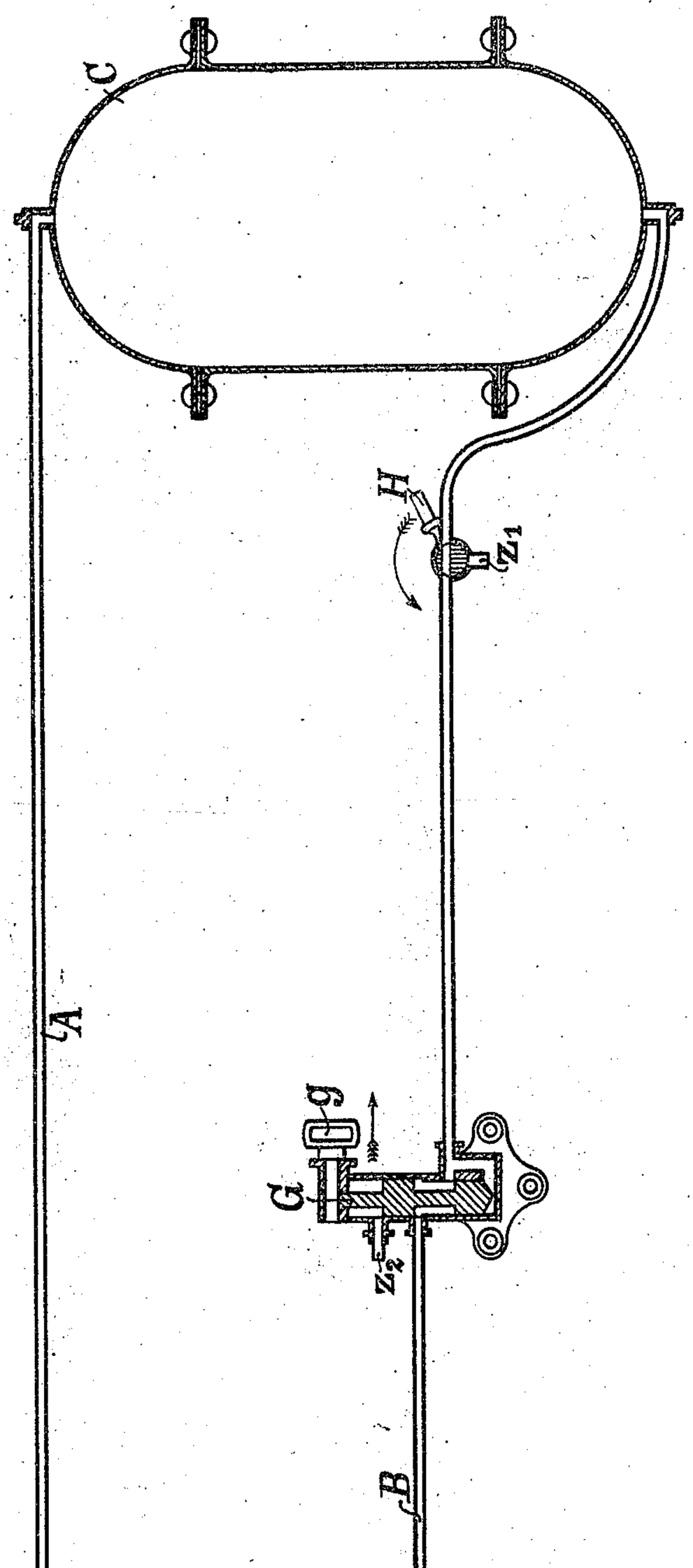

Fig. 7.*

Witnesses:-
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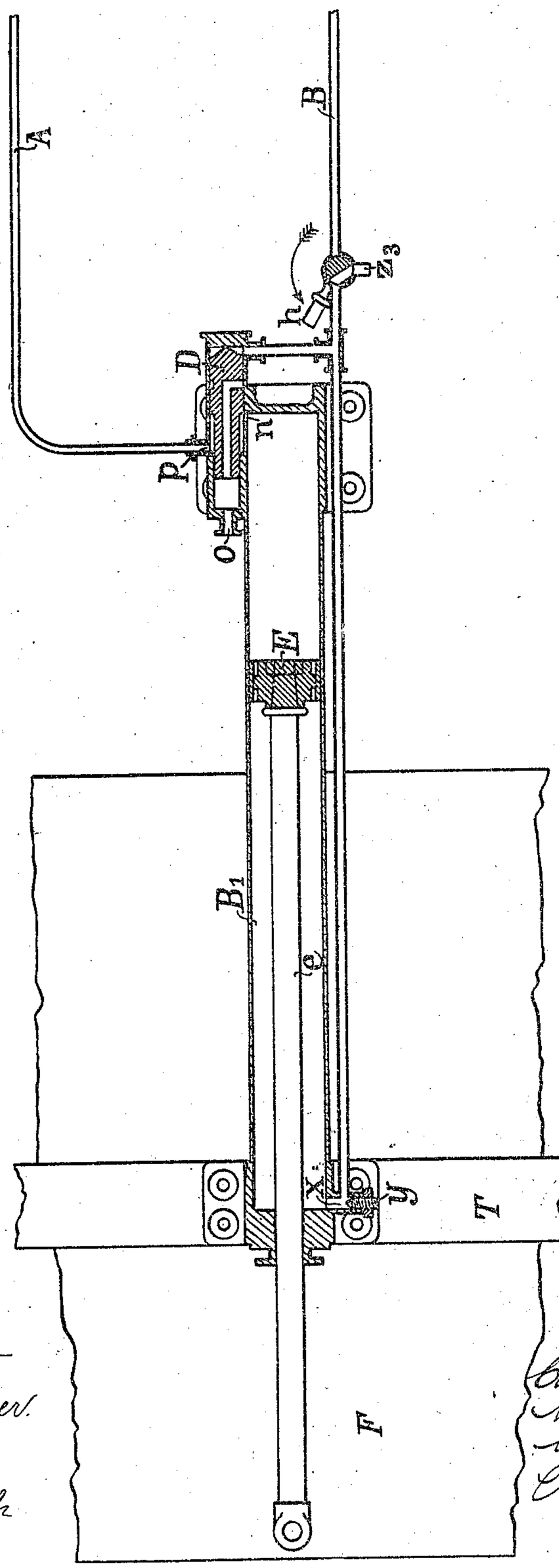
(Application filed Oct. 6, 1897.)

(No Model.) 9 Sheets—Sheet 8.

Fig. 8.



Witnesses:-
Edward Kieser.
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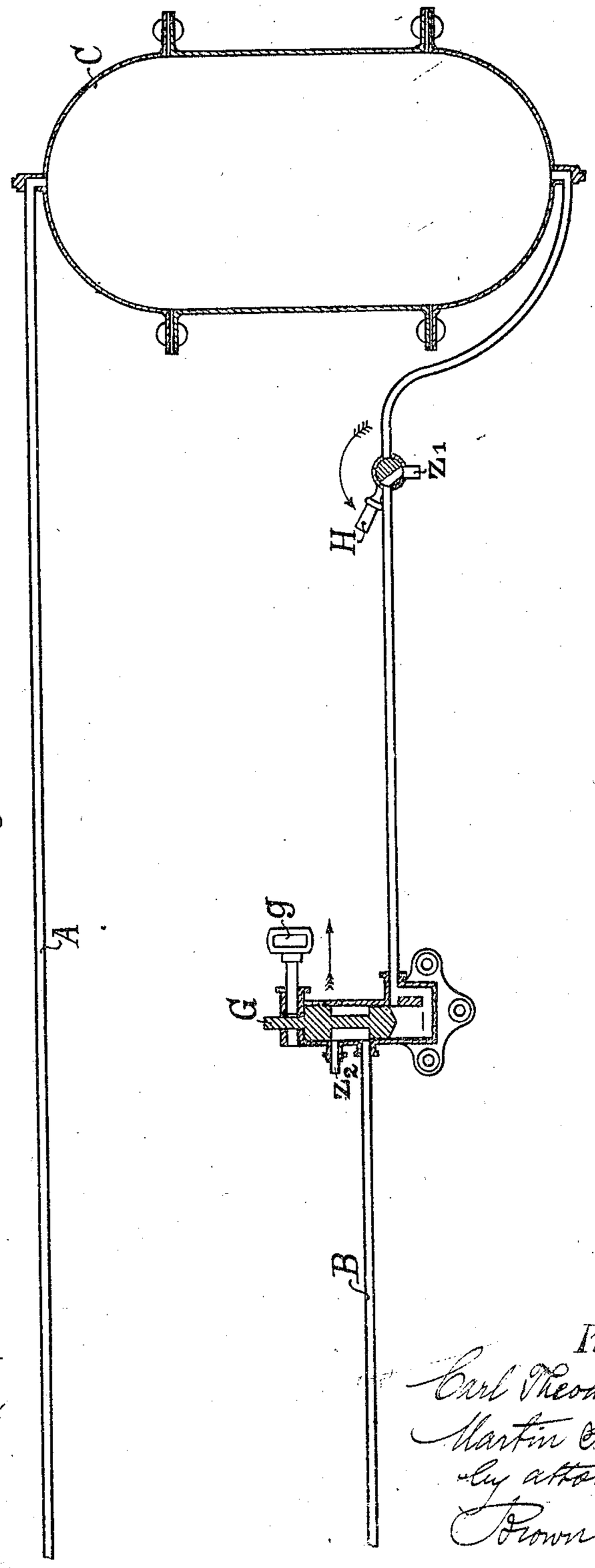

Fig. 8.

Witnesses:-
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Martin Stühler
by attorneys
Brown & Lewis

UNITED STATES PATENT OFFICE.

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

MEANS FOR AUTOMATICALLY OPERATING BULKHEAD-DOORS.

SPECIFICATION forming part of Letters Patent No. 617,855, dated January 17, 1899.

Application filed October 6, 1897. Serial No. 654,228. (No model.)

To all whom it may concern:

Be it known that we, CARL THEODOR DÖRR and MARTIN STÜHLER, of Cologne, in the Kingdom of Prussia, German Empire, have invented a new and useful Improvement in Means for Automatically Operating Bulkhead-Doors, of which the following is a specification.

This invention has reference to apparatus for automatically closing and opening bulkhead-doors, and especially to improvements in the means which are described for the same purpose in the United States Patent No. 588,793, granted to us on August 24, 1897.

By these improvements the apparatus may be essentially simplified in its construction, several parts may be entirely dispensed with, and by some modification in the parts of the apparatus the latter may be capable of working with compressed air or with liquid under pressure instead of working with compressed air and liquid under pressure combined.

The main improvement includes a differential steering-valve used in the apparatus for controlling the passage of the pressure medium or mediums in order to make a piston working in a cylinder operate to automatically close or open the bulkhead-doors.

The differential valve, which may be either a piston-valve or a slide-valve provided with pistons of different areas, against which the pressure medium or mediums act, is placed, according to the present invention, parallel with the secondary receiver and with the cylinder and piston and may have its passages organized to work in combination with a back-pressure valve provided for the secondary receiver and with two conduits for compressed air and liquid under pressure, or the said differential valve may have its passages so organized as to work in combination with the back-pressure valve of the secondary receiver, but dispensing with one of the conduits for the pressure medium, in which case the apparatus is operated by compressed air only from the remaining conduit. By another modification of the apparatus passages of the differential piston-valve may be organized in such manner as to dispense with the back-pressure valve, the differential valve being in such case actuated either by the alternate action of the two pressure mediums (air and liquid) or by one of these mediums alone. By a further modification we dispense with the secondary receiver and its back-pressure valve, arranging the conduits for the pressure mediums and the passages in the differential pressure-valve so as to operate (without the secondary receiver) the piston in the cylinder to automatically close and open the bulkhead-doors. It is well understood that the automatic operation of the said doors depends, as in our former patent referred to, upon the relief of pressure in the conduit conveying the pressure medium to the differential valve, by which medium the valve has up to such relief kept the bulkhead door open.

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

Figures 1 and 1* together represent a vertical section of an apparatus for operating horizontally-moving doors, showing the main pressure-receiver, the secondary receiver with its back-pressure valve, the cylinder with its piston, the two conduits for pressure mediums, and the differential valve, the latter in such a position (called hereinafter "at rest") so that the bulkhead-door is kept open. Figs. 2 and 2* together represent in vertical section the same elements, except that of the conduit for pressure medium is dispensed with by means of a modification of the remaining conduit near the differential valve, the piston being, as shown in Fig. 2, in such a position (called hereinafter "at work") so that the bulkhead-door is in the act of closing. Figs. 3 and 4 show vertical sections of a differential valve at rest and at work, respectively, in connection with two conduits for pressure mediums and with passages so organized as to dispense with the back-pressure valve of the secondary receiver. Figs. 5 and 6 show vertical sections of a differential valve at rest and at work in connection with one conduit for a pressure medium and with passages so organized as to dispense with the back-pressure valve of the secondary receiver. Figs. 7 and 7* together represent in vertical section, with the differential valve at rest, an apparatus in which the conduits for

pressure mediums and the passages in the valve are so arranged that the secondary receiver is dispensed with. Figs. 8 and 8* together represent in vertical section an apparatus like that represented in Figs. 7 and 7*, with the differential valve at work.

The differential piston-valve D, according to Figs. 1, 1*, 2, and 2*, consists of a casing and a piston, the latter having a central boring and a branch passage at the end of said boring and at a right angle to the latter. The said piston and cylinder are at one end smaller in diameter than at the other end. The casing of the valve has two openings p and n, not opposite to each other. From this arrangement it will be obviously understood that if pressure is admitted to the greater diameter or area of the piston it will adopt the position Fig. 1, in which the central boring communicates with the part of the cylinder B' behind or at the right-hand side of the piston E and with the open air; but if the pressure against the greater area be released and pressure be admitted against the annular surface of the valve-piston through p the piston will be shifted and the pressure medium proceeds by n into the cylinder B for causing the outstroke of piston E.

Now, according to Figs. 1 and 1*, the compressed air may traverse from the receiver C through the conduit A and the back-pressure valve v and pass to the secondary receiver A', thence by p into the casing of the differential valve D and may operate upon the differential annular surface of the latter, as explained above. The pressure-water from the receiver C flows through the conduit B, provided with the escape-valves II G h, acts upon the larger surface of the differential valve D, and holds this, as well as the main piston E, securely in its innermost position. The main piston E is connected by the piston-rod e with the door F, which is shown open or at rest. The water which escapes past the piston E through the packing passes by n and o out of the apparatus through an escape-pipe. A suitable number of relief-valves G II h are inserted in the pressure-water conduit B, which as soon as they are actuated relieve the branch or subbranch to which they correspond from pressure and simultaneously close the communication with the conduit B, leading to C.

If and h are three-way cocks or slides either of which, h for example, may conveniently be situated near each door and one or more, II, inserted at suitable principal parts of the conduit. If, for example, h be turned in the direction of the arrow, the portion of the pressure-water conduit B leading from the main cylinder or receiver C will be closed and the other portion, leading to the cylinder B' and in communication with the exit-pipe z^3, will be opened. This will be clear on comparison with Figs. 2 and 2*, which represent the apparatus and all the valves at work. The unrelieved compressed air in the secondary receiver A' consequently now moves the differential valve D, by acting against the smaller annular pressure-surface, to the opposite end position, passes through the channels p n into the cylinder B', and moves the piston E, and with it the door F, while the water in the cylinder B' is driven through the aperture x, which is capable of regulation by means of a screw y and serves to utilize the escaping water as a brake or buffer, the water passing away by the pipe z^3.

G is a differential valve which in the one end position, Fig. 1*, connects the portion of the pressure-water conduit B leading to B' with the receiver C and in the other end position, Fig. 2*, with the exit-pipe z^2 in exactly the same way as this is attained by the three-way cock. This differential valve G is actuated by the elasticity of the locked-up pressure-water, which so acts upon the lower surface of the piston that G always tends to assume the position shown in Fig. 2. In order to now securely retain G in its position of rest, the hand-actuated bolt g shown in the drawings, for example, may be employed, or other suitable stop mechanism which is adapted to be automatically released by the rising of a float or the excitation of an electric magnet may be employed. When the release is effected, G is driven out, the relieved pressure fluid expelled through z^2, and the door closed.

If the previously-actuated escape-valves of the compartments which are free of water be returned to their initial position, the differential valves D are automatically reversed by the pressure of water in the conduit B and the compressed air which is behind the pistons exhausts through the channel n o into the atmosphere. By the return stroke of the piston the door has been opened again.

The arrangement permits of a number of modifications in its practical application, which nevertheless do not affect the essence of the invention. For example, in the arrangement described with reference to Figs. 1 and 1* compressed air may be employed as the pressure fluid, so that the apparatus may be actuated exclusively by compressed air; or the apparatus may be actuated with only one compressed-air conduit, Figs. 2 and 2*, by omitting the conduit A and leading the compressed air through a branch J of the relief-conduit B by way of v into the secondary receiver A'. Further, the back-pressure valve v may be dispensed with if the modifications of the differential valve D shown in Figs. 3 to 6 or any modification of a like nature is adopted. When two conduits A and B are employed, (see Fig. 3, which shows the position at rest, and Fig. 4, which shows the position at work,) the compressed air from the conduit A passes through a circular groove of the valve D and through the aperture v' into the cylinder A'. If the conduit B is relieved of pressure, the circular groove

is displaced by pressure exerted through the opening *p* on the annular area of the valve's piston and *v'* is closed. (See Fig. 4.)

If only one conduit B is employed, (see Fig. 5, rest position, and Fig. 6, working position), the compressed air from the conduit acts first upon the larger bottom surface of the differential valve D, drives this into the end position, Fig. 5, and passes by suitably disposed impediments or obstacles in the form of an annular groove through the aperture *v'* into the secondary receiver A'. If the pressure in conduit B is suddenly relieved, the differential valve D is driven by the compressed air acting upon the differential annular surface into the opposite end position, whereby *v'* is again closed. (See Fig. 6.)

In order to dispense with the secondary receiver A' and to employ the cylinder B' only, then for sliding doors two conduits are necessary—namely, the pressure-relief conduit B and the pressure-conduit A, through which the operating pressure medium is led from the central receiver. This modification, which is represented in Figs. 7, 7*, 8, and 8*, differs from the form of apparatus shown in Figs. 1 and 1*, the back-pressure valve *v* and secondary receiver A' being omitted. With this modification of apparatus there may be employed as the pressure medium either compressed air in the one conduit and pressure liquid in the other or pressure liquid or pressure air may be employed in both conduits. In case of the pressure liquid the latter must, in accordance with the above description, be under the elastic reaction of a column of compressed air from suitable pumping apparatus.

It is obvious from the above statements that the differential piston-valve or a differential slide and piston valve may be arranged to work with or without a secondary receiver, with or without a back-pressure valve in the latter, with two conduits for the same or for two different pressure mediums, or with one conduit for compressed air or for liquid under pressure, the facts being that the change of position of the differential valves, piston, or slide, which causes the door to open or to close, is always caused by a relief of pressure in the one pressure-medium conduit or in a branch of such conduit.

What we claim as our invention is—

1. In an apparatus for automatically operating bulkhead-doors, a working cylinder with piston connected to the door, pressure-medium conduits, a differential piston-valve arranged parallel with said cylinder and having within itself a central bore with a laterally-branching passage for communication with the open air and temporarily with the working cylinder, and openings provided in the casing of said valve to form communication temporarily through that portion of said valve which is of smaller diameter for the shifting of said valve and the entrance of pressure medium into the cylinder to produce the outstroke of the working piston therein; all substantially as herein described.

2. In an apparatus for automatically operating bulkhead-doors, a working cylinder with piston connected to the door, two pressure-medium conduits, a differential piston-valve arranged parallel with the said cylinder and having a central bore with lateral branch passage and having openings in its casing, a secondary pressure-receiver, and a back-pressure valve in said receiver communicating with one of the pressure-medium conduits, the other pressure-medium conduit communicating with said cylinder and with the larger area of the differential valve, substantially as herein described.

3. In an apparatus for automatically operating bulkhead-doors, a working cylinder with piston connected to the door, a secondary receiver with back-pressure valve, a differential piston-valve arranged parallel with said cylinder and said receiver and having in itself a central bore and lateral branch passage for communication with openings in its casing, and a source of pressure for communication with said cylinder and said receiver through said piston-valve, substantially as herein described.

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

CARL THEODOR DÖRR.
MARTIN STÜHLER.

Witnesses:
CARL ARNT,
CHRISTINE PFEIFFER.