(No Model.) 5 Sheets—Sheet 1.

A. BELDAM.

PUMP VALVE.

No. 402,647. Patented May 7, 1889.

FIG 1

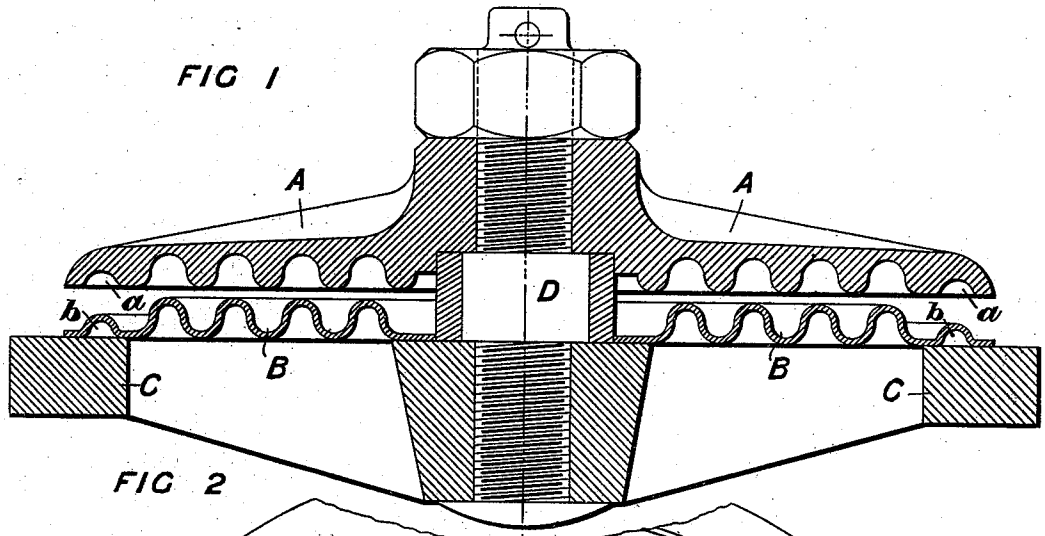
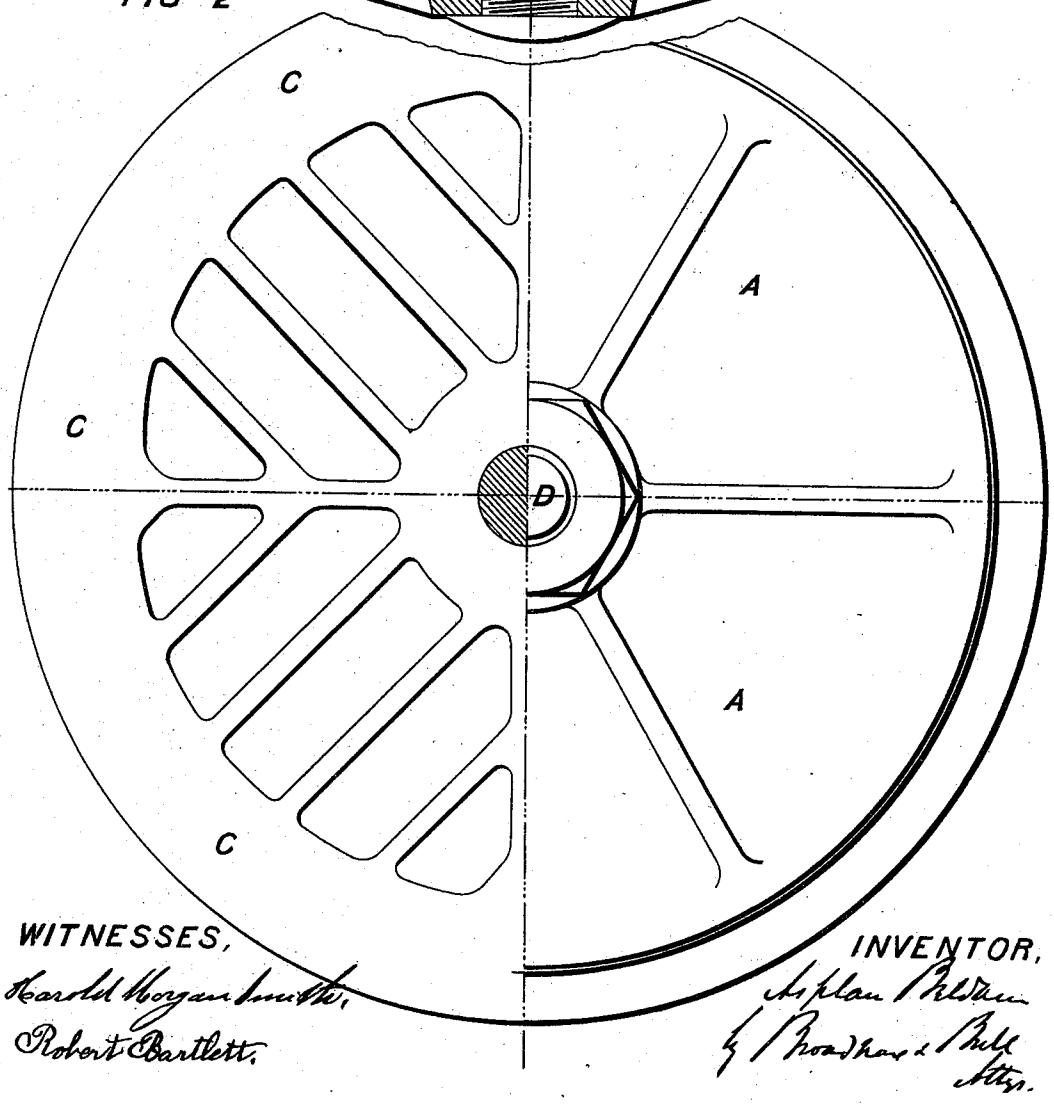


FIG 2



WITNESSES,

Harold Morgan Smith,

Robert Bartlett.

INVENTOR,

Adolphe Beldam

by Broadhead & Bull

Attys.

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 5 Sheets—Sheet 2.

A. BELDAM.

PUMP VALVE.

No. 402,647. Patented May 7, 1889.

FIG 3

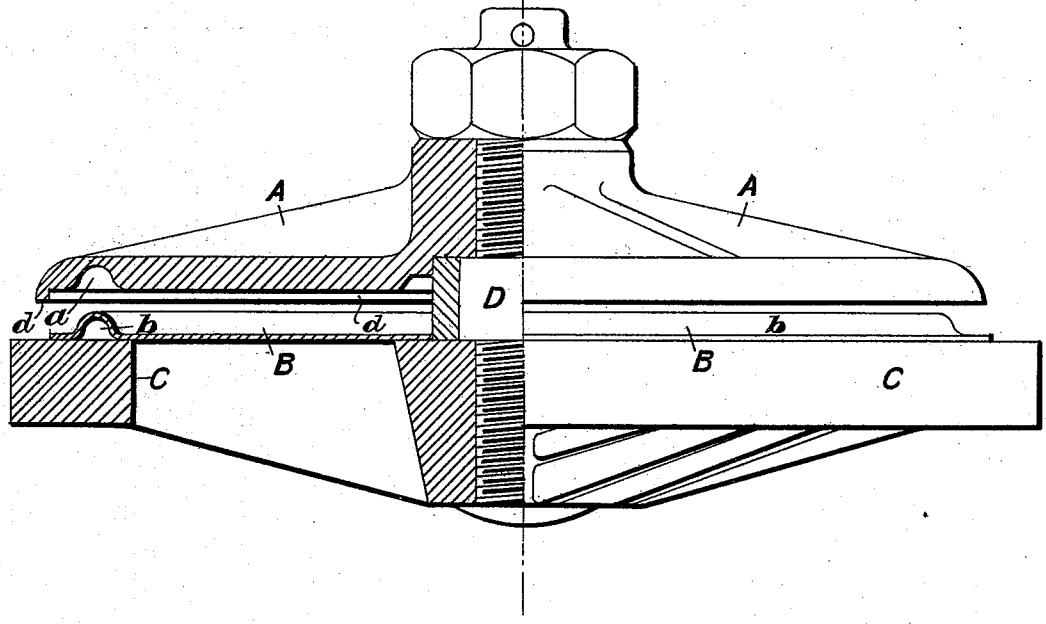
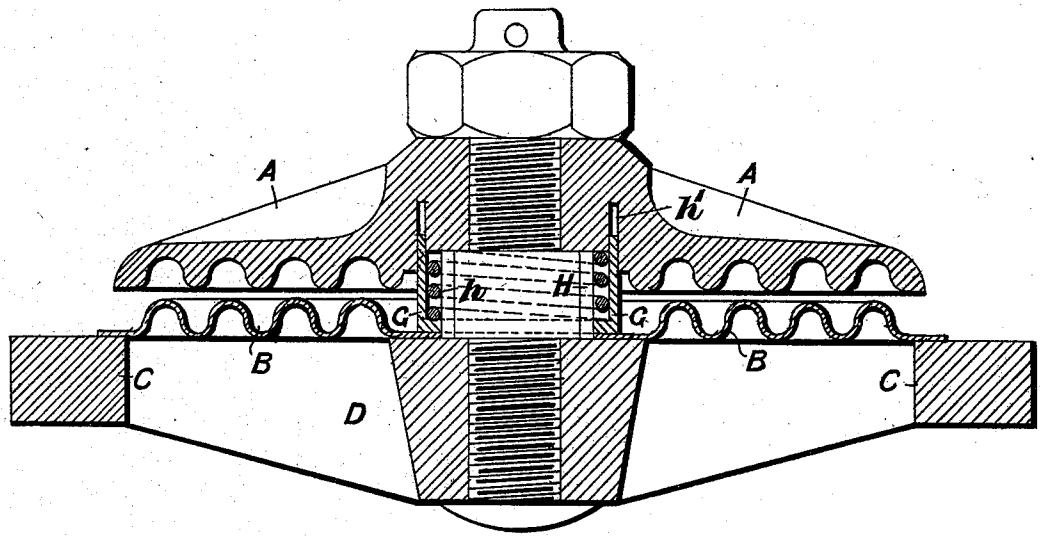


FIG 4



WITNESSES

H. M. Smith &
Robert Bartlett,

INVENTOR.

Asplan Beldam
by Brown & Bull
Attys

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 5 Sheets—Sheet 3.

A. BELDAM.

PUMP VALVE.

No. 402,647. Patented May 7, 1889.

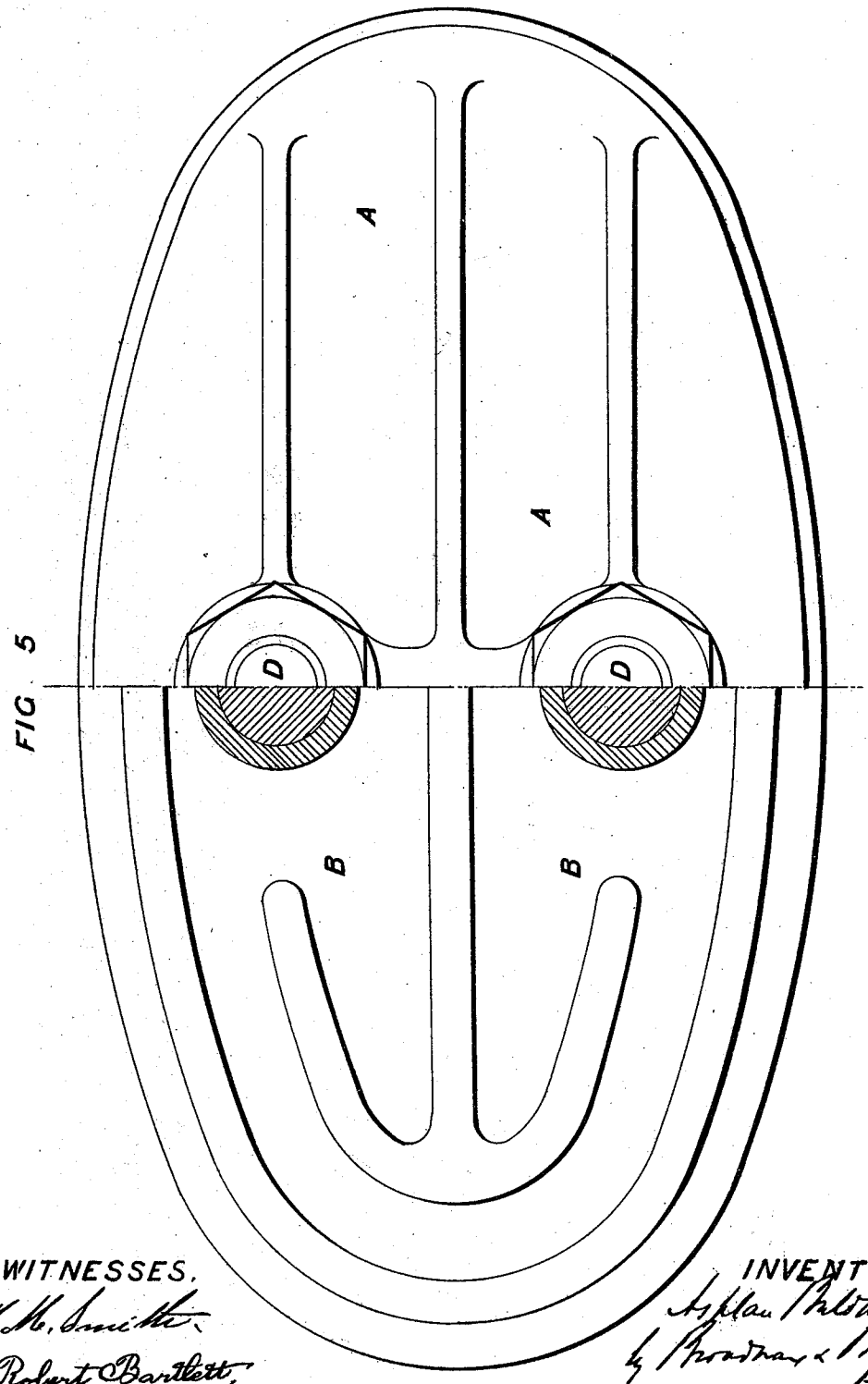


FIG. 5

WITNESSES.

H. M. Smith.

Robert Bartlett.

INVENTOR.

Asplan Beldam

by Broadman & Bull

Attys.

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 5 Sheets—Sheet 4.

A. BELDAM.

PUMP VALVE.

No. 402,647. Patented May 7, 1889.

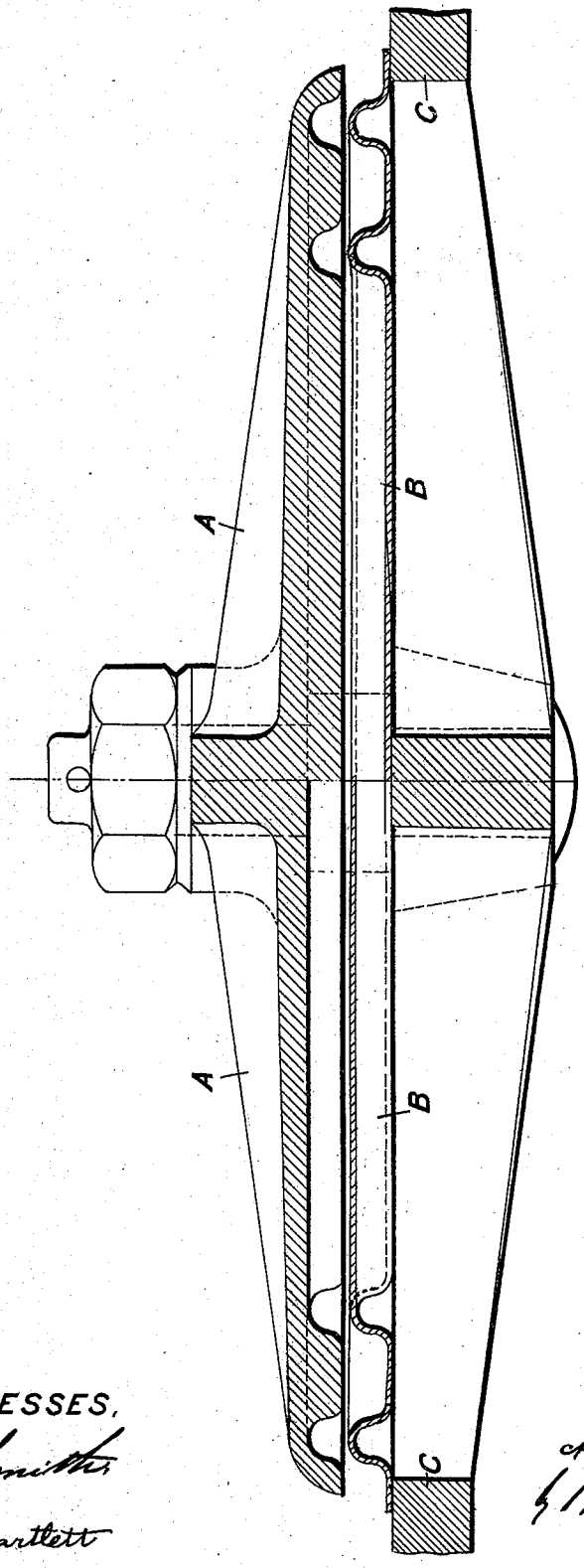


FIG 6

WITNESSES,

H. M. Smith

Robert Bartlett

INVENTOR.

Asplan Beldam

by Brown and Bill

Attys

N. PETERS. Photo-Lithographer, Washington, D. C.

(No Model.) 5 Sheets—Sheet 5.

A. BELDAM.

PUMP VALVE.

No. 402,647. Patented May 7, 1889.

FIG 7

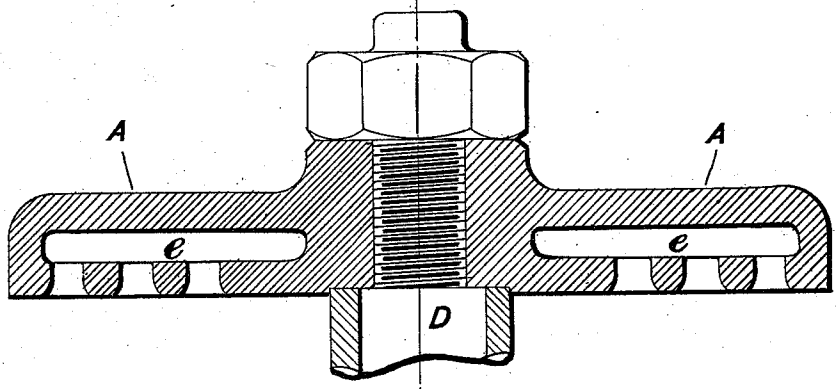
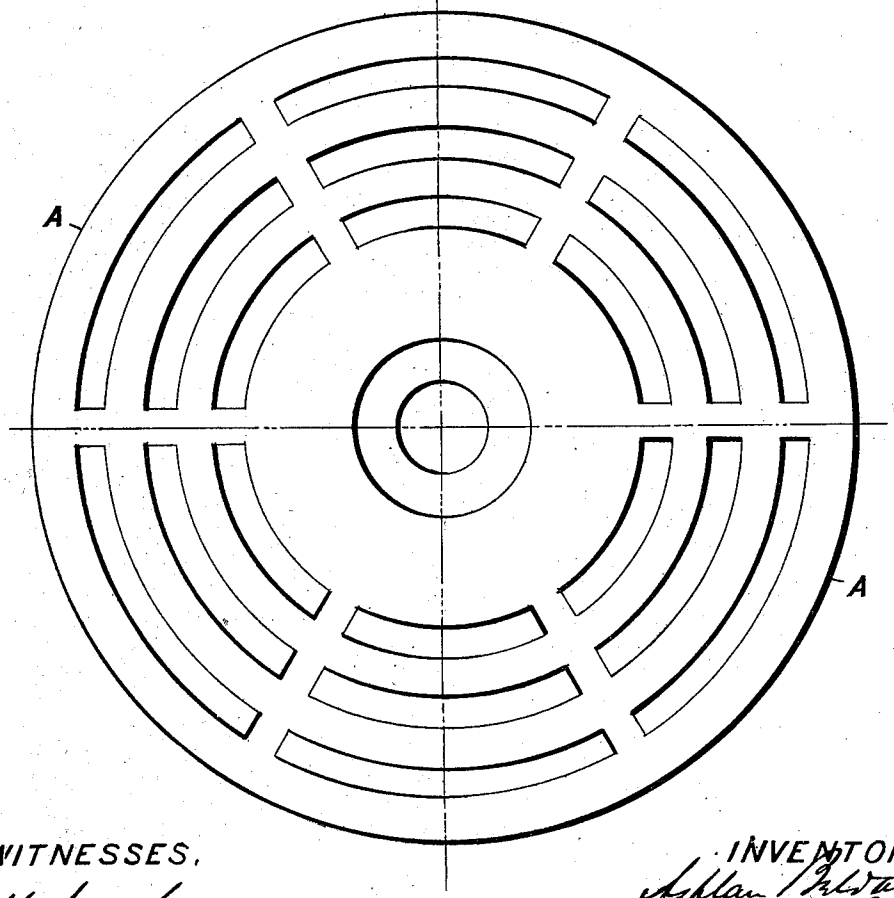


FIG 8



WITNESSES.

H. M. Smith

Robert Bartlett

INVENTOR.

Adolphus Beldam

by Brownell & Pell Attys

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

ASPLAN BELDAM, OF LONDON, COUNTY OF MIDDLESEX, ENGLAND.

PUMP-VALVE.

SPECIFICATION forming part of Letters Patent No. 402,647, dated May 7, 1889.

Application filed September 22, 1886. Serial No. 214,219. (No model.) Patented in England September 10, 1885, No. 10,730; in France June 18, 1886, No. 176,837; in Belgium July 1, 1886, No. 73,689; in Germany July 3, 1886, No. 38,228, and in Italy December 28, 1886, XLI, 228.

To all whom it may concern:

Be it known that I, ASPLAN BELDAM, engineer, a subject of the Queen of Great Britain, residing at 77 Gracechurch Street, in the city of London, in the county of Middlesex, in that part of the United Kingdom of Great Britain and Ireland called England, have invented certain new and useful Improvements in and in Connection with Valves Especially Applicable to Pumps, (for which Letters Patent have been granted to me in Great Britain, No. 10,730, dated September 10, 1885; in Germany, No. 38,228, dated July 3, 1886; in France, No. 176,837, dated June 18, 1886; in Belgium, No. 73,689, dated July 1, 1886, and in Italy, No. 228, XLI, dated December 28, 1886;) and I do hereby declare that the following is a full, clear, and exact description of my invention, sufficient to enable others skilled in the art to which it appertains or with which it is most nearly connected to make, use, and put the same into practice, reference being had to the sheets of drawings making a part of this specification, and to the letters and figures of reference marked thereon, which correspond with those used in the specification, like letters and figures being used to denote the same or corresponding parts throughout the various views and figures.

My invention relates particularly to the type of valve ordinarily employed in air-pumps and buckets of marine and other engines; but, as will be readily seen from the description and illustrations hereinafter given, the types of pump and pumping machinery and the conditions and purposes of its application may be various.

My invention consists of certain improvements, hereinafter described, in and in connection with valves, whereby the effect of the concussion or "beat" which takes place in ordinary valves of the type herein specified between the valve and its seat and the valve and its guard is rendered harmless or neutralized, and even when they are subjected to abnormal and varying pressures and stresses which such gear and other parts in some cases and under certain conditions do become subject to.

It is frequently found, more particularly in connection with high-speed pumps and engines, that valves and valve-guards become deranged or broken, which in a great measure may be attributed to the concussion or beat of the valves against their guards and seats. Sometimes the breakages are due to an extra or abnormal and, not unfrequently, sudden volume of the liquid being forced past the valve, which, it is obvious, puts a greater stress upon the valves and guards and also a more severe beat. As an instance of an abnormal stress being brought upon valves and their guards of this type, I will mention one: It is not an uncommon occurrence at sea for a circulating-pump of a surface-condensing marine engine to fail and become inoperative, in which case the condenser is made to work as an ordinary jet-condenser, and this may necessitate the air pump or pumps being called upon to perform this augmented duty. Under such conditions a greater amount of water than under normal condition would have to be delivered past the valves, thereby, as will be obvious, bringing greater concussion or beats and stresses to bear upon the valves and guards. It is under such abnormal concussions or beats and stresses as this that the breakages such as I have above mentioned occur, and which my invention provides for and prevents. An equivalent condition to the above exists when it happens, as it often does, that at starting the engines it is found that the condenser has become full of water. The air-pump under such a condition has to pass, and frequently rapidly, an excessive volume of water, often thereby causing breakages of studs and guards, and these breakages even occur when the material of which the valves consist is india-rubber.

To impart to a valve gentle and easy settling to its seat, I provide in its bearing portions, particularly at its periphery, a corrugation or corrugations or recesses, which will contain or be filled with the liquid being pumped, so that as the valve comes to its seat the imprisoned liquid affords the desired gentle settling. The same gentle settling or cushioning effect is obtained upon its upward or outward lift with respect to the guard—namely, by imprisoning liquid between the guard

and the valve as it comes against the guard. The example of valve and valve-guard by which these results are effected, as will be seen, consists of a corrugated valve of thin metal and a corrugated guard. In this case, the valve being corrugated, say, annularly, the guard is also correspondingly corrugated, so that as the corrugations of the one come against the recesses of the other the liquid in such recesses gives the cushioning effect, while the annular recess or corrugation in the periphery of the valve gives the cushioning effect when the valve settles upon its seat.

The material of which the valves and valve-guards are made will depend, as will be understood, upon the particular condition of application and requirements. For example, the valve may be made of thin phosphor-bronze or equivalent metals and other suitable known metal or metals which may be found suitable, or ebonite, vulcanized fiber, and the like.

I would also have it understood that the shape or configuration of the valves and guards is not material to my invention, as it is applicable to many and various shapes and configurations.

In the drawings, Figure 1 shows a valve and a valve-guard in section according to my invention. Fig. 2 is a plan of the valve seat and guard, Fig. 1. Fig. 3 shows a modified form of valve and guard according to my invention. Fig. 4 is a valvular arrangement according to my invention where a non-gravitating closing of the valve is required. Fig. 5 illustrates in plan a valve and valve-seat according to my invention of oval formation. Fig. 6 is a section through X X, Fig. 5. Fig. 7 is a modification of guard shown at Figs. 1 and 2. Fig. 8 is an inverted plan of the guard, Fig. 7.

With reference to the drawings, A designates the valve-guard. B is the valve. C is the valve-seat, and D is the valve-stud.

b shows the recess or corrugation by which the gentle settling of the valve upon its seat C is effected, and *a* is the corresponding recess or corrugation in its guard.

In Figs. 1 and 2 the valve and guard are shown corrugated annularly, and, as will be seen, when the valve rises to the guard, the liquid which will be imprisoned in the respective recesses will give the cushioning effect, while the imprisoned liquid in the recess *b* will effect the gentle settling of the valve upon its seat.

Although the corrugated valves and guards shown in the drawings are mostly provided with annular corrugations or recesses, I would have it understood that so far as these corrugations are concerned, with the exception of the seat corrugation or recess *b*, they may be arranged in any suitable manner in the valve. For instance, the valve may be corrugated radially or diagonally. It will also be seen that the type of valve shown is well known, as well as its opening and closing operation.

In Fig. 3 is shown a plain valve having only the seat-corrugation *b*, according to my invention. The guard in this case is provided with a corresponding recess, *a*, and a lip, *d*, by which the upward cushioning effect is obtained.

Fig. 4 shows the means I employ to close the valve in cases in which the valve is not closed by gravity. The arrangement consists, as will be seen, of a circular box, G, resting on the valve B. Round the stud D, I provide the ferrule H, and between this ferrule and the interior of the box G there is provided a spring, *h*, which bears upon the end of the box G and the guard A at its opposite ends. In operation, as the valve is pressed off its seat, the box G will be pressed into the annular recess *h'* in the guard A, thereby compressing the spring *h*. As soon as the pressure at the opposite sides of the valve becomes equal, or nearly so, the spring *h* forces the valve B back onto its seat.

With reference to Figs. 5 and 6, it will be observed that the valve is of oval formation and the outer corrugations are arranged peripherically, while the inner corrugation consists of a longitudinal one having curved or semi-peripherical ends. The guard in this example is provided with cushioning recesses corresponding with the corrugations of the valve.

Figs. 7 and 8 illustrate a modified form of valve-guard according to my invention. The cushioning effect by the guard in this case is effected in the same manner as previously described—namely, the guard A is hollow and has recesses provided in it, which lead up into the hollow portion *e*, which will contain liquid. The valve to be used in connection with this guard would be corrugated, such as that set forth with reference to Figs. 1, 2, and 4, the corrugations being arranged to correspond with the recesses of the guard. Thus the corrugations of the valve will coincide with the recesses of the guard, and the water or other liquid in them will serve to cushion the valve and prevent injurious concussion to the valve and guard.

The beforegoing description sets forth some examples of valves and valve-guards with my improvements applied thereto, whereby the effect of the concussion or beat which takes place in ordinary valves of the type herein set forth between the valve and its seat and the valve and its guard is rendered harmless or neutralized, and further compensation is afforded against abnormal or excessive volumes and pressures; and I would have it understood that I do not confine myself to the precise construction and forms or configurations herein described and shown, or the materials of which they are made, as modifications in these respects may be varied to suit different and particular conditions of application without departing from my invention.

Having now particularly described and ascertained the nature of my said invention

and in what manner the same is to be performed, I declare that what I claim is—

1. In combination with a valve-seat of a pump or an analogous structure, a valve having a peripherical channel or channels or corrugations, whereby the gentle settling of the valve upon its seat is effected, substantially as described.

2. In combination with a valve-seat of a pump or an analogous structure, a valve having corrugations, and a guard having corrugations adapted to receive and correspond with the corrugations of the valve, whereby a cushioning effect is obtained between said valve and guard upon the left of the valve, substantially as described.

ASPLAN BELDAM.

Witnesses:
GEO. C. DOWNING,
8 *Quality Court, London, W. C.*
HERBERT E. DALE,
17 *Gracechurch St., London, E. C.*