

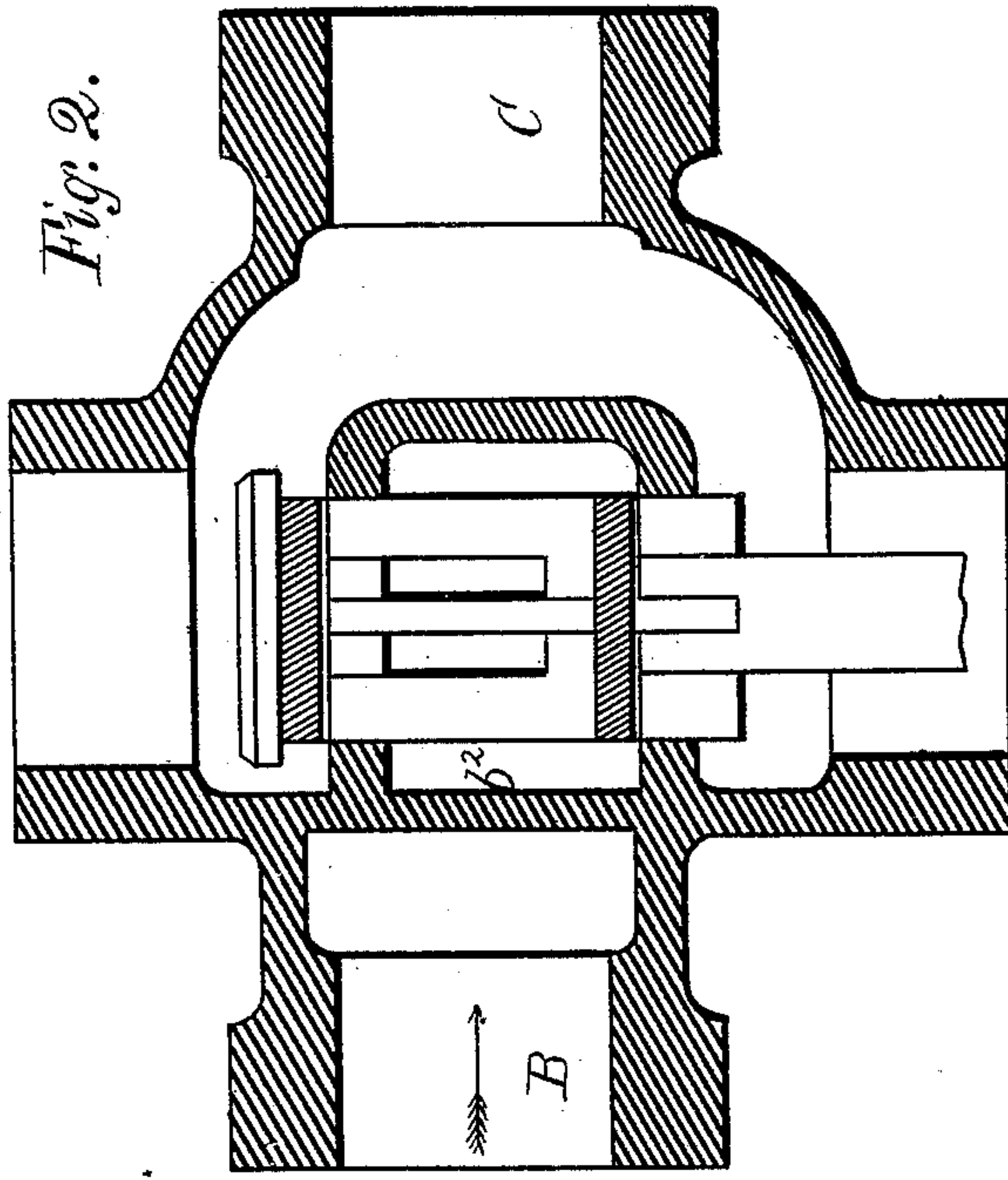
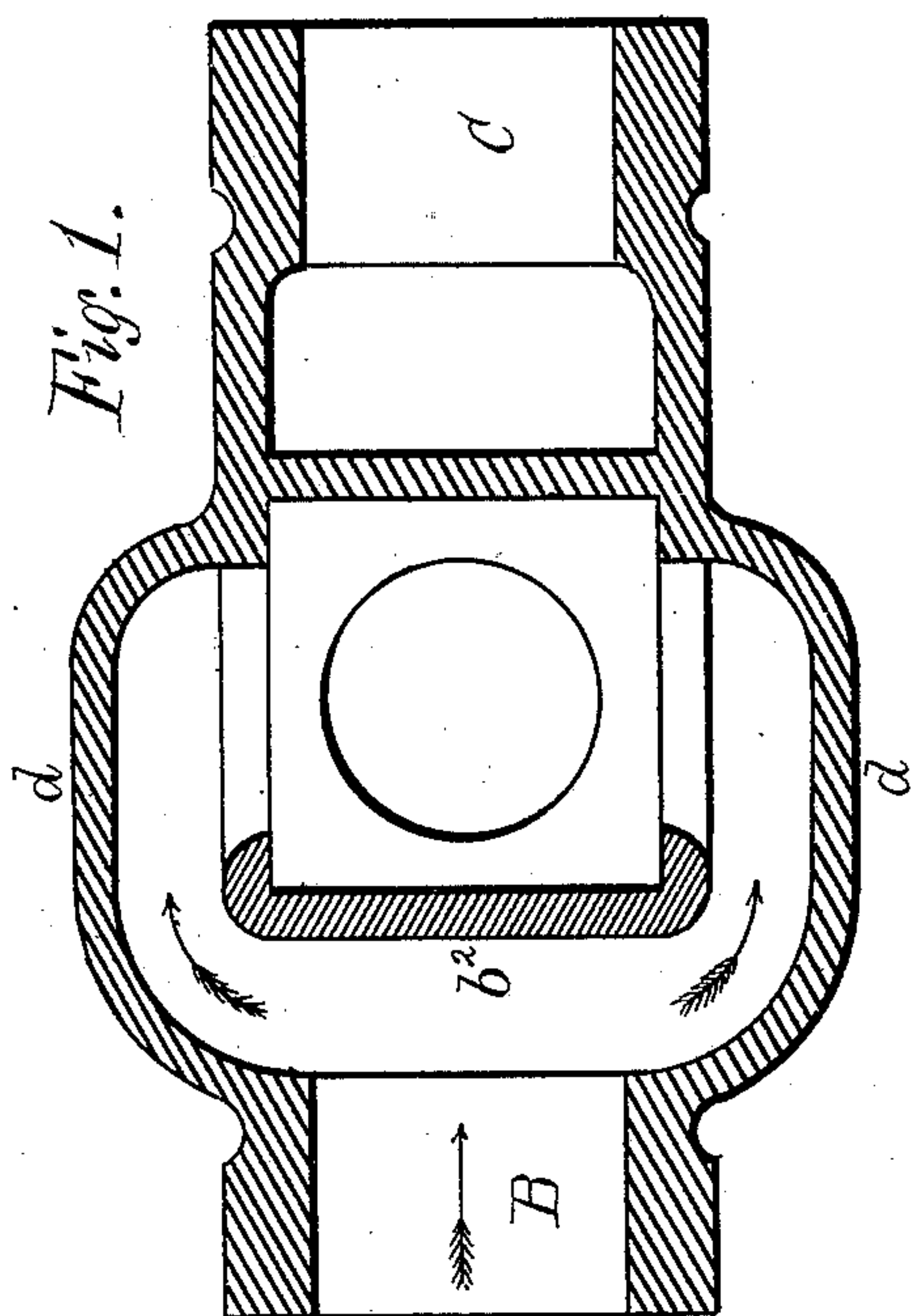
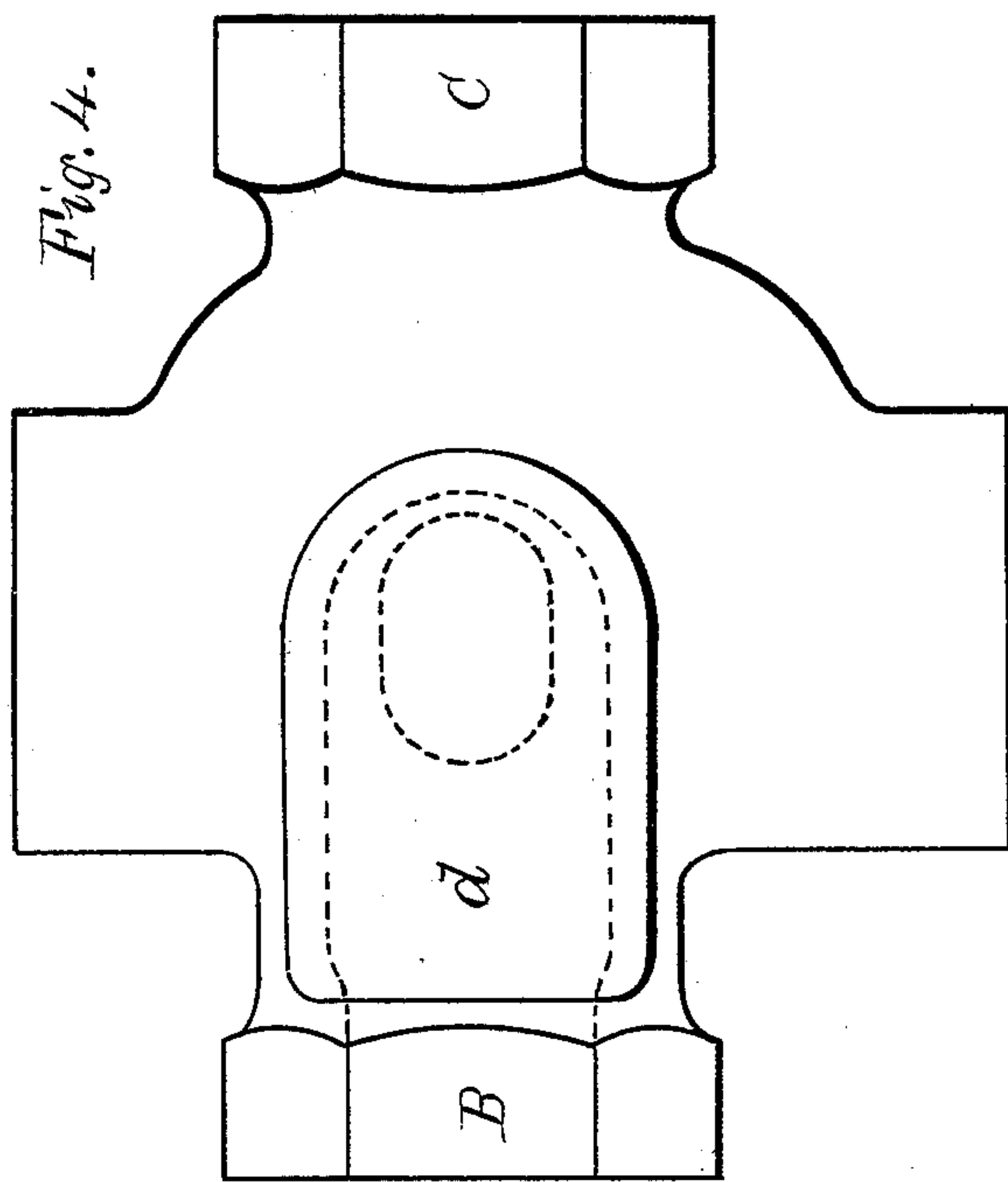
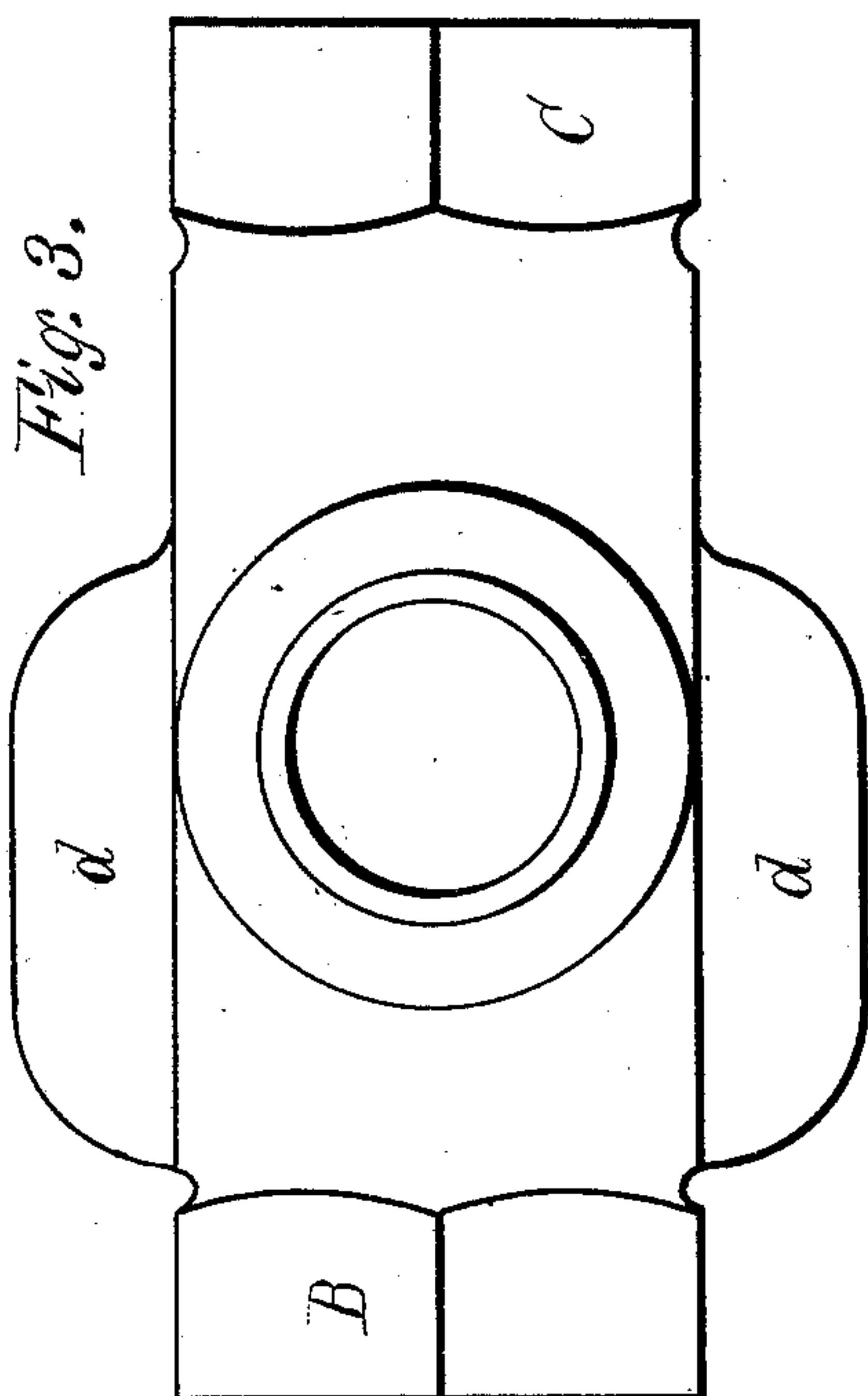
(No Model.)

2 Sheets—Sheet 1.

J. E. WATTS.
Pressure Regulator.

No. 235,186.

Patented Dec. 7, 1880.



Witnesses.
C. Gott.
H. B. Lodge.

Inventor.
Joseph E. Watts.
Y. Curtis. Atty.

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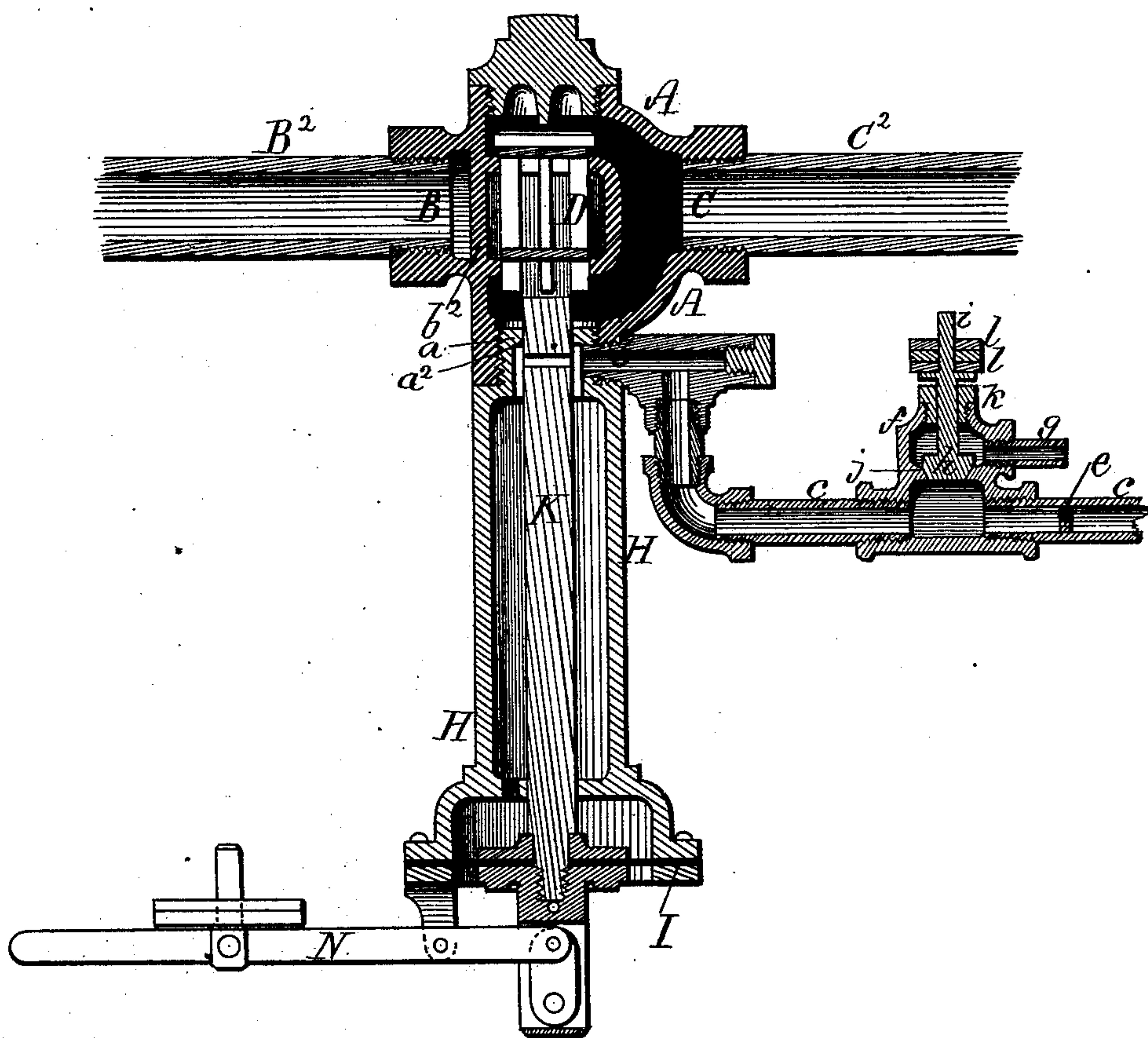
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Fig. 5.



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UNITED STATES PATENT OFFICE.

JOSEPH E. WATTS, OF LAWRENCE, MASSACHUSETTS.

PRESSURE-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 235,186, dated December 7, 1880.

Application filed July 27, 1880. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH E. WATTS, a citizen of the United States, residing at Lawrence, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Pressure-Regulators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form part of this specification.

These improvements are based mainly upon a class of pressure-regulators shown and described in Letters Patent of the United States issued to myself on the 13th day of April, 1875, reissued March 12, 1878, in which the stem of the valve is supported at bottom upon an elastic diaphragm arranged in a closed chamber at the lower part of a pipe or tube, such stem and diaphragm being connected to a weighted lever or spring to act upon the valve-stem and valve to open or close the latter in consonance with the variations in pressure in the distributing-pipe or drum as the apparatus is supplied with steam or other fluid, and in which also is employed a pipe connecting at one end with an orifice leading from the well-tube above the water therein and at the other end with the interior of the supply-pipe or drum under such an arrangement that should the pressure in the same pipe fall below the maximum the pressure upon the column of water in the well-tube and upon the diaphragm will be lowered to such an extent that the lever partially overcomes the pressure and opens the regulator-valve and admits an increased amount of steam to the drum until the maximum pressure is restored, while should the pressure at the point of use exceed the proper point steam will return *via* the pipe to the well-tube and actuate the diaphragm to close the regulator-valve.

In this patented regulator the fluid in its passage strikes against one side of the valve and crowds it upon the opposite side of its bearing or seat with a force due to the pressure of the fluid, the result being friction and wear between the parts. Again, in this patented

regulator it is possible under some circumstances for steam to enter the top of the water-well by way of the return-pipe to such an extent as to exert upon the elastic diaphragm a pressure greater than the latter is intended to bear. For instance, if an obstruction should lodge between the regulator-valve and its seat, or from any other cause steam should leak through the latter after the apparatus using the steam was stopped, or if a portion of the steam being used was shut off without closing the regulator-valve to a corresponding degree, as in the case of dye-houses, for instance, in which a series of vessels, each governed by one cock, are supplied from a common service-pipe, in any of these instances sufficient steam under pressure from the boiler might accumulate in the return-pipe, and, after attaining in the latter a pressure higher than that at which the regulator-valve was adjusted to close, escape into the water-well and exert an injurious pressure upon the elastic diaphragm.

The purpose of my invention is, first, to overcome or avoid the unequal lateral pressure upon the regulator-valve and its seat, due to admitting the steam to one side only of the valve, as in my patent, and this object I accomplish by diverting the induction-fluid from direct access to the front of the valve and allow it to reach the latter with uniform pressure upon two opposite sides, thereby balancing the valve to the lateral pressure, it being already balanced to the vertical pressure, and as a consequence distributing the wear and friction uniformly over its bearing-surface. Secondly, the purpose of my invention is to avoid the possibility of the increased and injurious pressure upon the diaphragm before alluded to, and I effect this result by contracting the area of the return-pipe to such an extent as to retain within the latter the greater part of the higher pressure, steam escaping into it by leakage through the regulator-valve, and reducing the velocity and pressure of steam escaping through the pipe to the water-well; and I add to or combine with said return-pipe a safety-valve, which permits of blow-off of any undue pressure of steam in the said water-well, the whole being so arranged that the safety-valve will open when the pressure in the well exceeds that at which the regula-

tor-valve is adjusted to close and permit this excess to escape into the atmosphere.

The drawings accompanying this specification represent, in Figure 1, a horizontal section, in Fig. 2 a vertical section, in Fig. 3 a plan, and in Fig. 4 a side elevation, of a valve-case and valve containing one portion of my improvements. Fig. 5 is a vertical section of a pressure-regulator containing my invention.

In these drawings, A represents the case of the regulator-valve, the inlet-port of such valve-case being shown at B and its eduction or discharge port at C, while the fluid-supply pipe, which supplies fluid to the valve-case through the said port B, is shown at B², and the service-pipe, which connects with the port C and receives the fluid as it leaves the valve-chamber at C². The service-pipe C² communicates with or itself constitutes the first part of the distributing-pipe or drum, to which allusion is hereinafter frequently made, the connections of the pipe varying with the class of machines to which the regulator is attached.

The upper part of the well-tube H is closed by a horizontal shelf, *a*, which, in addition to closing the well, constitutes a guide or bearing to steady the valve-stem or spindle K. The tube H has an orifice, *b*, which communicates with the interior of such well, and I dispose this orifice preferably at the extreme upper part of the tube, as shown, in order that a considerable column of water may stand over the elastic diaphragm to protect the latter from contact with hot steam. I next provide a pipe, *c*, and connect one end of such pipe with the orifice *b*, and the other end of such pipe, whatever the distance from the regulator such end may be, I connect with the interior of the service or distributing pipe C² at such a point in the latter as circumstances and the nature of the machine supplied shall dictate, for while my invention is not dependent upon any precise point at which this connection shall be made, I prefer it shall be at the remote end of the distributing-pipe, as by so doing I am enabled to govern the regulating-valve from this point and maintain a uniform pressure where the connection of the pipe *c* is made.

We will suppose, for illustration, that a valve with my improvement added is to be applied to a stack of drier-cylinders, such as are used in print-works. Heretofore, as greater or less quantities of cloth pass over the cylinders, or such cloth contains a greater or less percentage of moisture, the pressure of steam at the remote end of the pipe C²—say at or near the last cylinder—varies considerably, owing to the varying condensation in the previous cylinders, and at times—say, for instance, when few or no cloths are running over said cylinders, or said cloths contain a small percentage of moisture—steam runs to waste.

When great work is put upon the cylinders and a large amount of steam required and used at the point of intersection of the pipe *c* with

C² the pressure in the first part of the distributing-pipe C² would be increased very considerably and a great difference exist between the pressure at this point and at the last cylinder, where the pipe *c* is connected, while if work is taken off the cylinders the pressure at these two extreme points would be nearer equal, as it would rise considerably at the point of intersection of the pipe *c* with C² and blow off to waste.

Should the pressure at the remote end of the distributing-pipe C², or at any point therein between the connection of the pipe *c* and the valve D, fall below the average degree which is expected to be maintained, the pressure upon the column of water in the well H and diaphragm I through the pipe *c* will be lowered to such an extent that the lever N or its weight partially overcomes the pressure and raises the rod K and valve D and admits an increased amount of steam to the pipe C² until the maximum pressure at the point of connection of the pipe *c* is restored. Should the pressure in the pipe C² at the point of connection of the pipe *c* exceed the desired point the pressure in such pipe C² is exerted by means of the pipe *c* upon the body of water within the well H, and through this water, as an intervening medium, upon the diaphragm I, and the latter, as a consequence, is distended outward or downward, and the valve-stem K and the valve D lowered, thus partially closing the valve and reducing the amount of steam passing through it into the pipe C².

It will thus be seen that by the employment of the pipe *c*, or its equivalent, an independent return route is established for pressure from the pipe C², or the steam-drum, or receiver, whatever it may be, to act upon the diaphragm I, which is independent of the pressure in the valve-chamber A. As a consequence the diaphragm is influenced by the pressure from the pipe C², or its substitute, and not by the pressure direct from the valve-chamber, as has been the case prior to my invention. Therefore I govern or control the valve, as before stated, from the point of connection of the pipe *c* with the pipe C², and maintain a uniform pressure at this point; whereas heretofore, the pressure being governed only at the valve, great fluctuations in pressure take place at various points intermediate between such valve and the remote distributing-pipe, which the pipe *c* overcomes at any point in C² where it is connected.

In carrying out the first feature in my present improvements I cast the valve-case A with a wall, *b*², which is interposed between the inlet-port and the front side of the valve, and with hollow side wings, *d d*, of equal area, the interiors of which connect with the inlet-port B of such case, thereby providing a continuous inlet-port, which permits steam or other fluid to have access to two opposite sides of the valve D with uniform pressure, and in so doing equalize the pressure upon the valve,

and obviates undue friction between it and its seat at any one part.

In carrying out the second feature of my improvements I contract the area of the return-pipe *c* (preferably at a point near the valve-case *A*) to a considerable extent, as shown at *e*, by which means I lessen the volume, velocity, and pressure of the fluid passing through such pipe on its return to the water-well.

It may not be absolutely necessary under all circumstances to thus contract the area of the pipe, as if the valve is used only in connection with very low boiler-pressure the safety-valve will be sufficient to secure the diaphragm; but I prefer to contract the return-pipe in all cases where the service-pipe or receiver is sufficiently strong to bear the full pressure from the boiler; but in any event the capacity of the passage *e* must exceed that of the space intervening between the periphery of the valve-stem *K* and the passage *a*² in the shelf *a*, which receives such stem in order to permit of escape from the water-well through the safety-valve of steam leaking through such passage *a*² under pressure from the boiler.

The passage *e* must also be large enough to permit of entrance of sufficient steam to the water-well to properly regulate the pressure upon the diaphragm.

I also add to the pipe *c* a safety-valve, as shown at *f* in the drawings, the case of this valve having a blow-off pipe, *g*, leading from it. The valve is shown at *h*, its stem at *i*, and its seat at *j*, the stem extending upward through the cap *k* of the case, and being loaded with weights *l l*, &c., which regulate the pressure at which the valve opens. When the regula-

tor is adjusted for use the weights are added or removed, as is requisite, to load the valve *h* to open against a pressure somewhat higher than that at which the regulator-valve *D* is adjusted to close in order to insure the proper action of this valve *D*.

Should the pressure through the aperture *e* of the return-pipe *c* or through the passage *a*² be sufficient to overcome the stress of the weights *l*, the safety-valve *i* will open and permit of escape of the excess of such steam, thereby relieving the diaphragm from its influence.

Though I have described the first feature of my invention as mainly applicable to the class of regulator-valves shown in my said patent, it is evident that it may be applied with advantage to all valves to which it is susceptible of being applied, and I do not restrict its use to my own regulator-valve.

I claim—

1. A safety-valve, in combination with the regulator-valve, the water-well, and the return-pipe, substantially as and for purposes stated.

2. The pipe provided with the contracted openings, as described, in combination with the regulator-valve, service-pipe, water-well, and the flexible diaphragm, all substantially as and for purposes specified.

In testimony whereof I affix my signature in presence of two witnesses.

JOSEPH E. WATTS.

Witnesses:

H. E. LODGE,
WM. T. ANDREWS.