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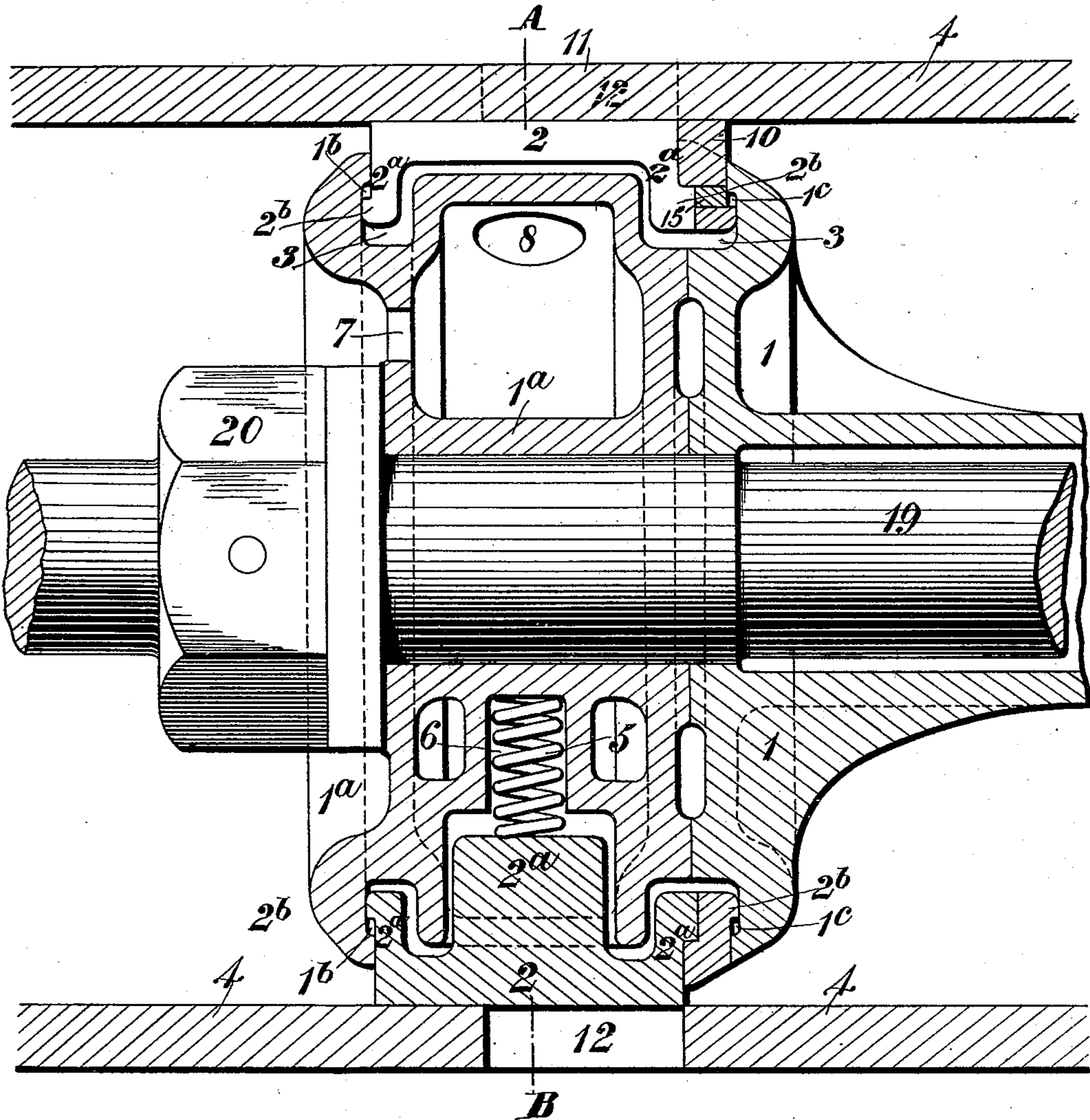
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W. M. SMITH.  
PISTON VALVE.

No. 488,096.

Patented Dec. 13, 1892.

Fig. 1.



Witnesses  
E. D. Duffer  
Hubert E. Beck

Inventor  
Walter M. Smith  
per O. E. Duffer

(No Model.)

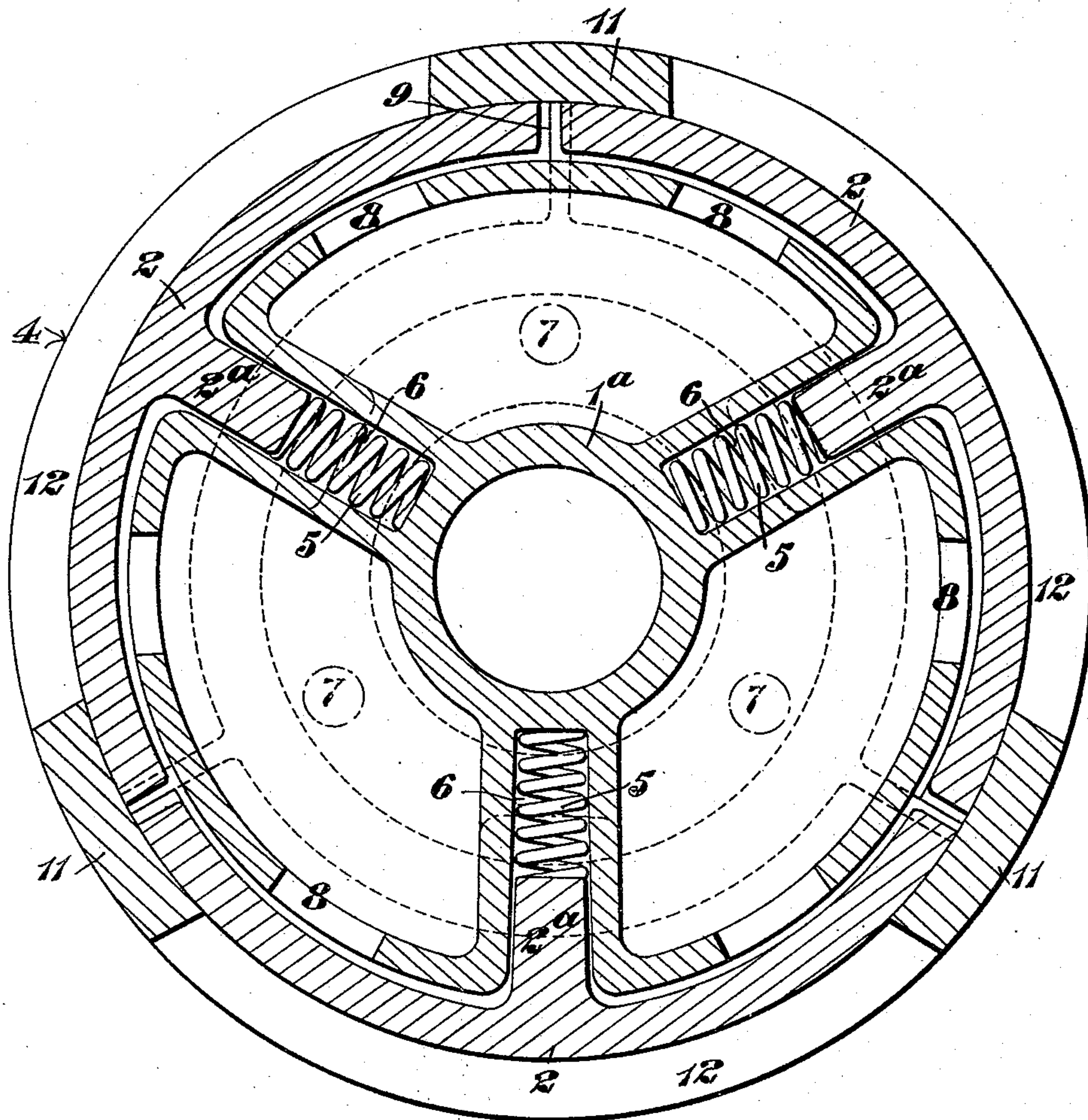
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Patented Dec. 13, 1892.

*Fig. 2.*



Witnesses  
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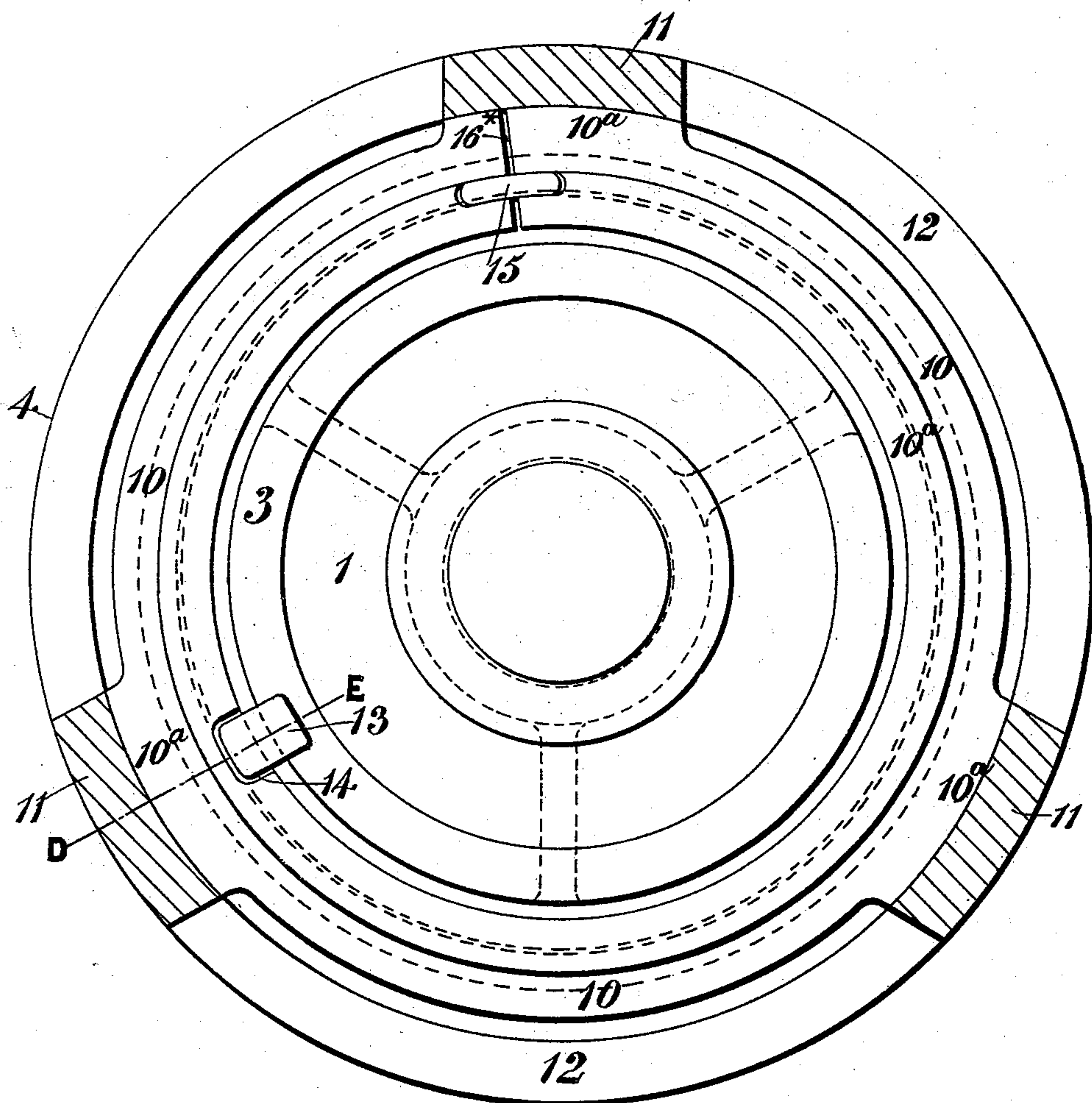
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*Fig. 3.*



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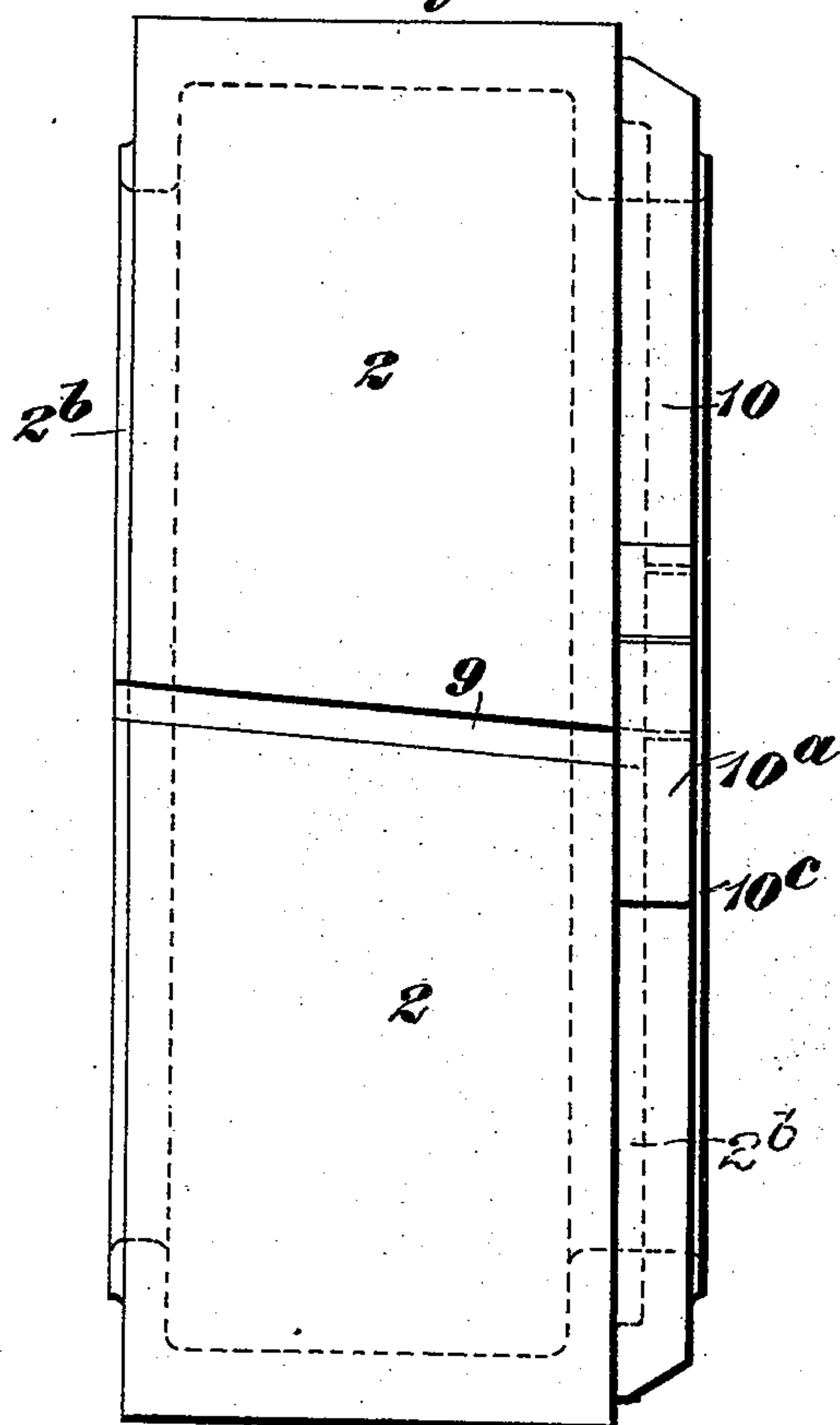
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W. M. SMITH.  
PISTON VALVE.

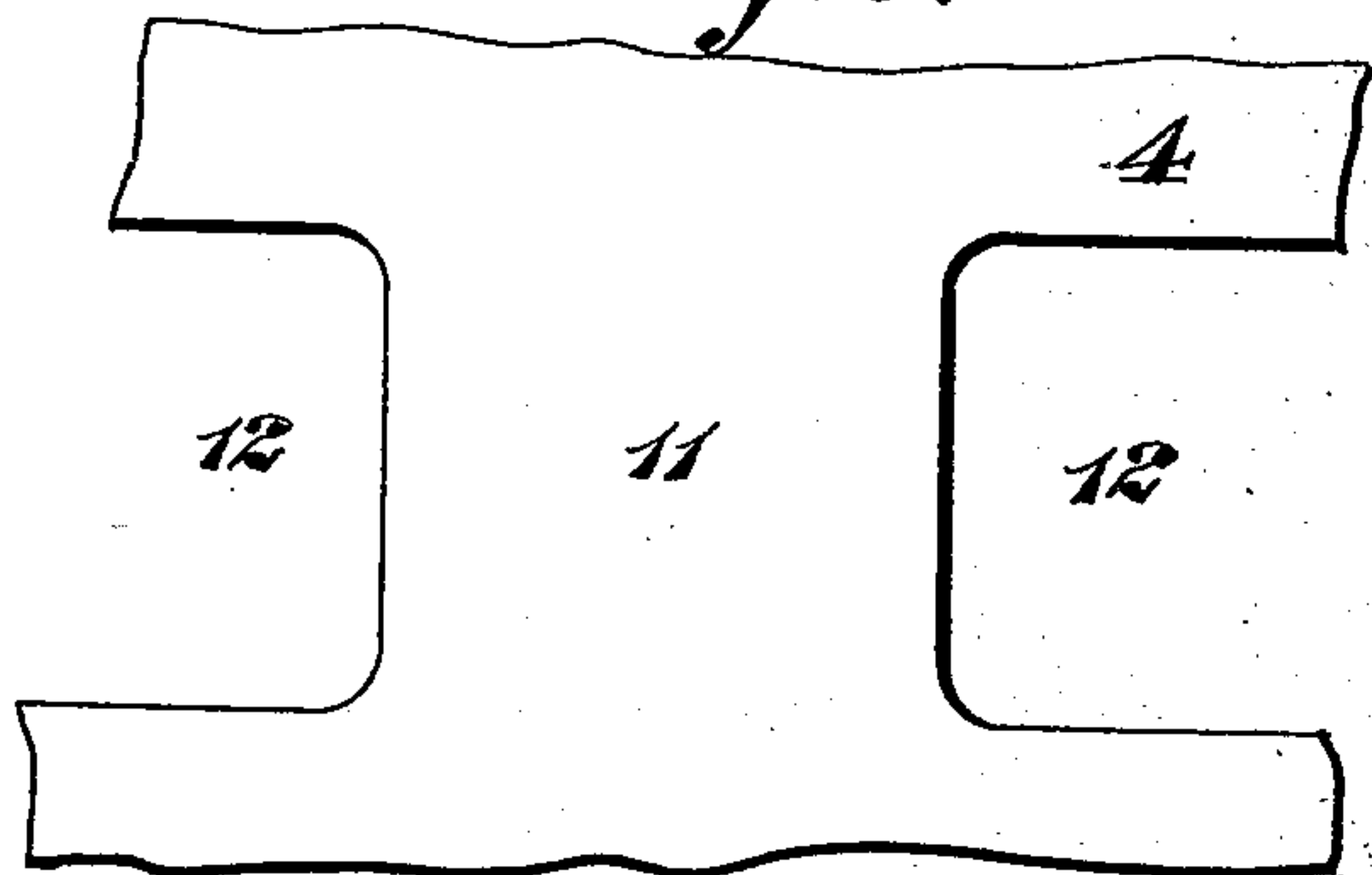
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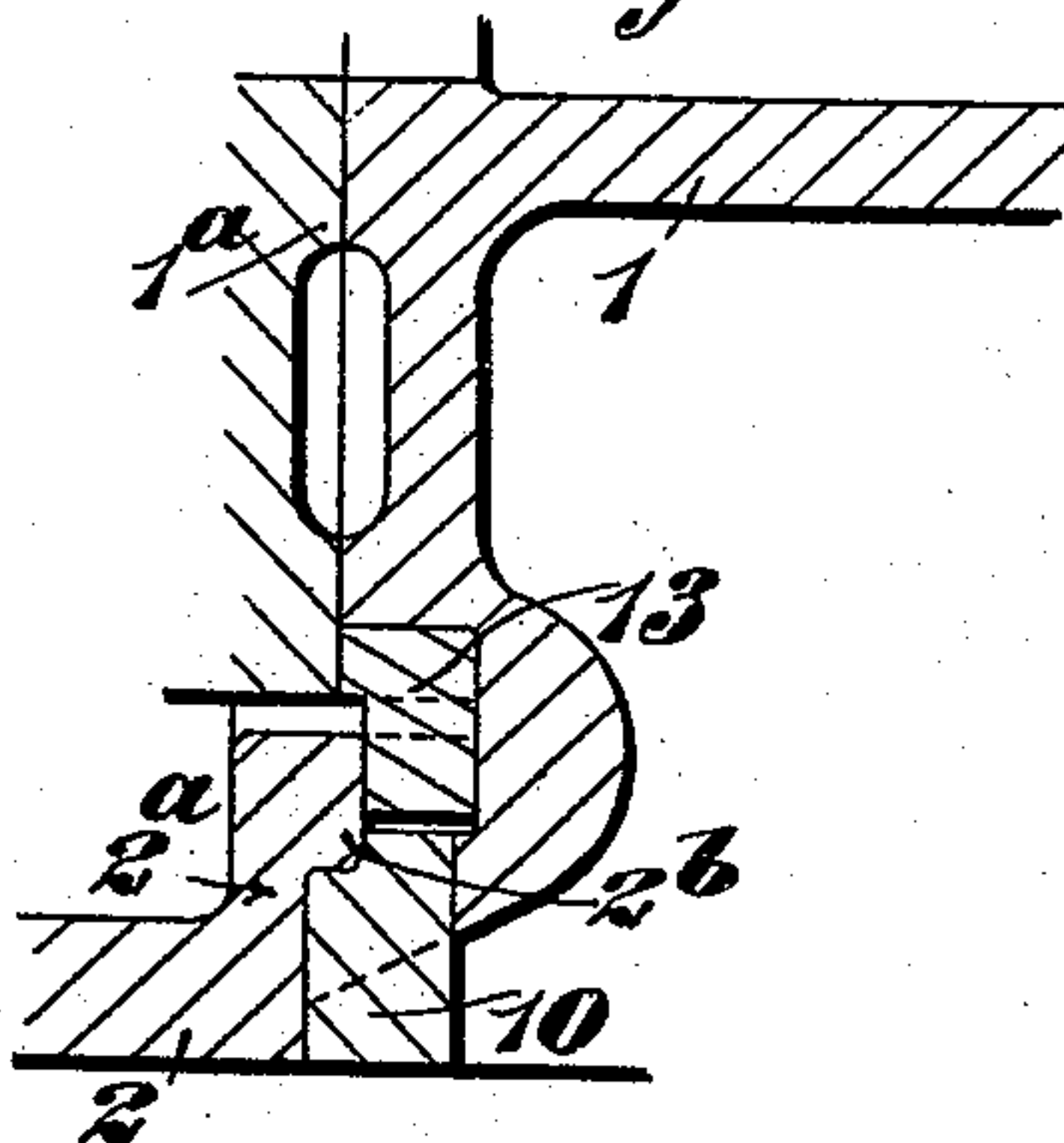
*Fig. 5.*



*Fig. 6.*



*Fig. 4.*



Witnesses  
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Inventor  
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(No Model.)

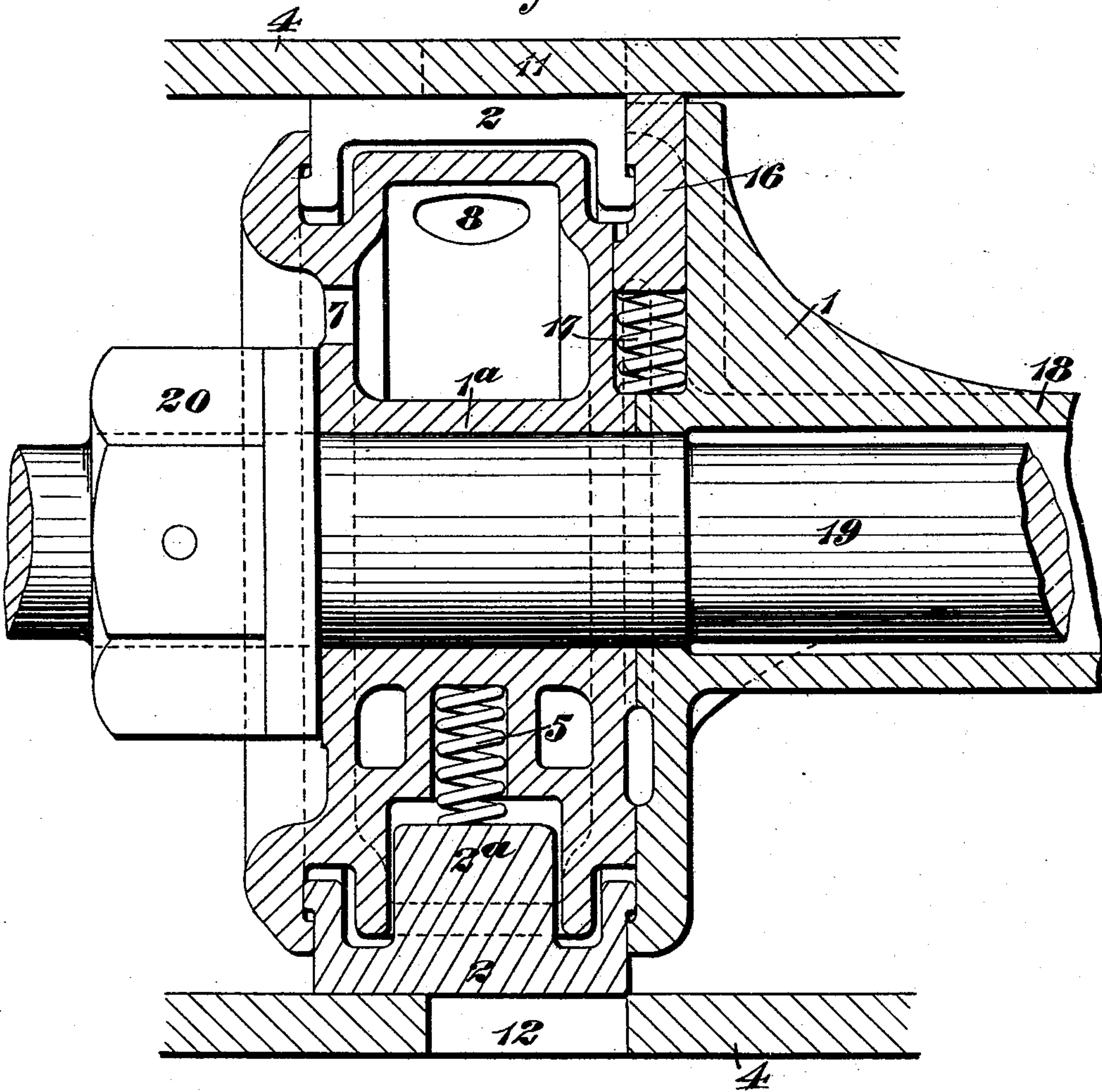
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*Fig. 7.*



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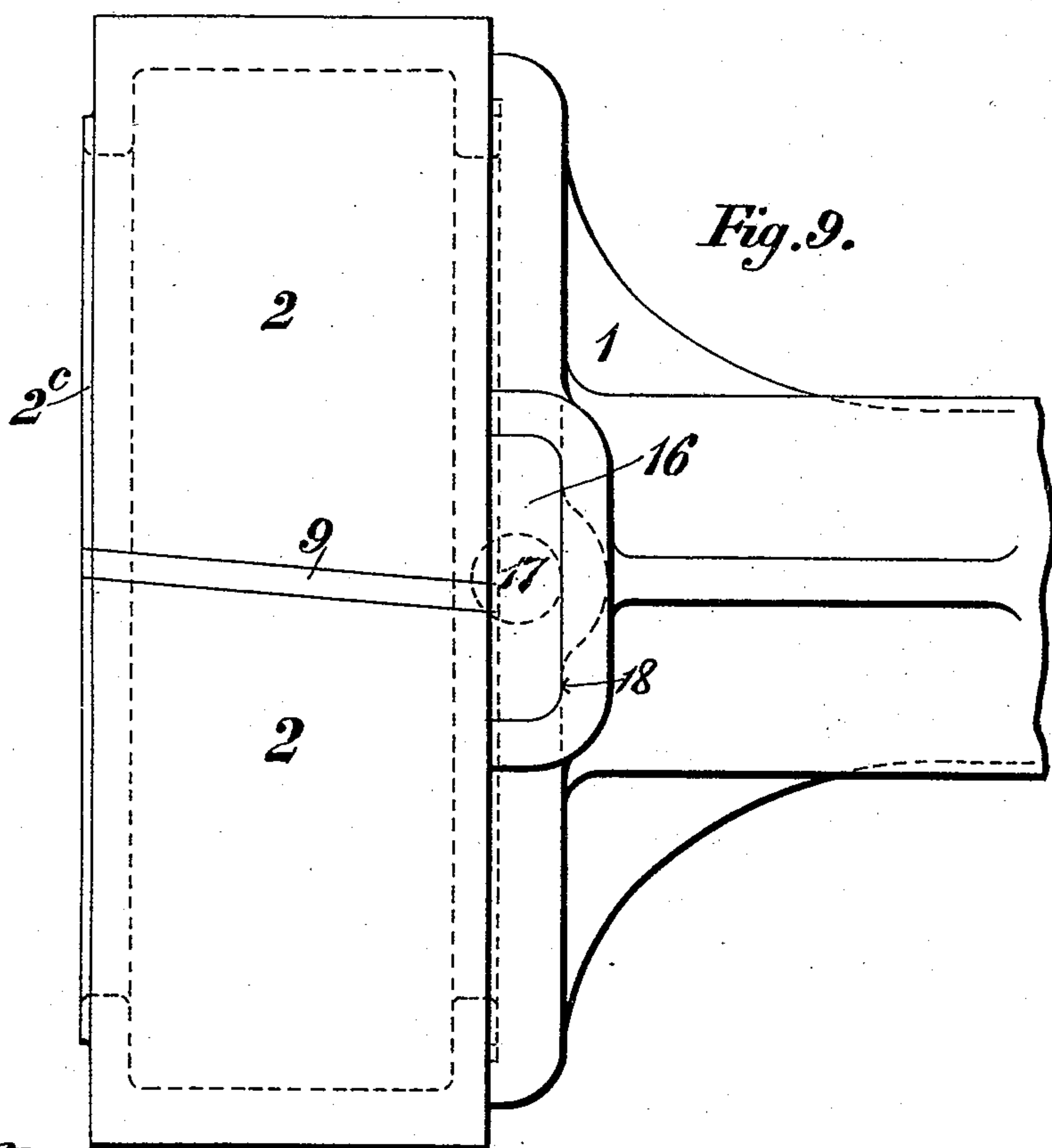
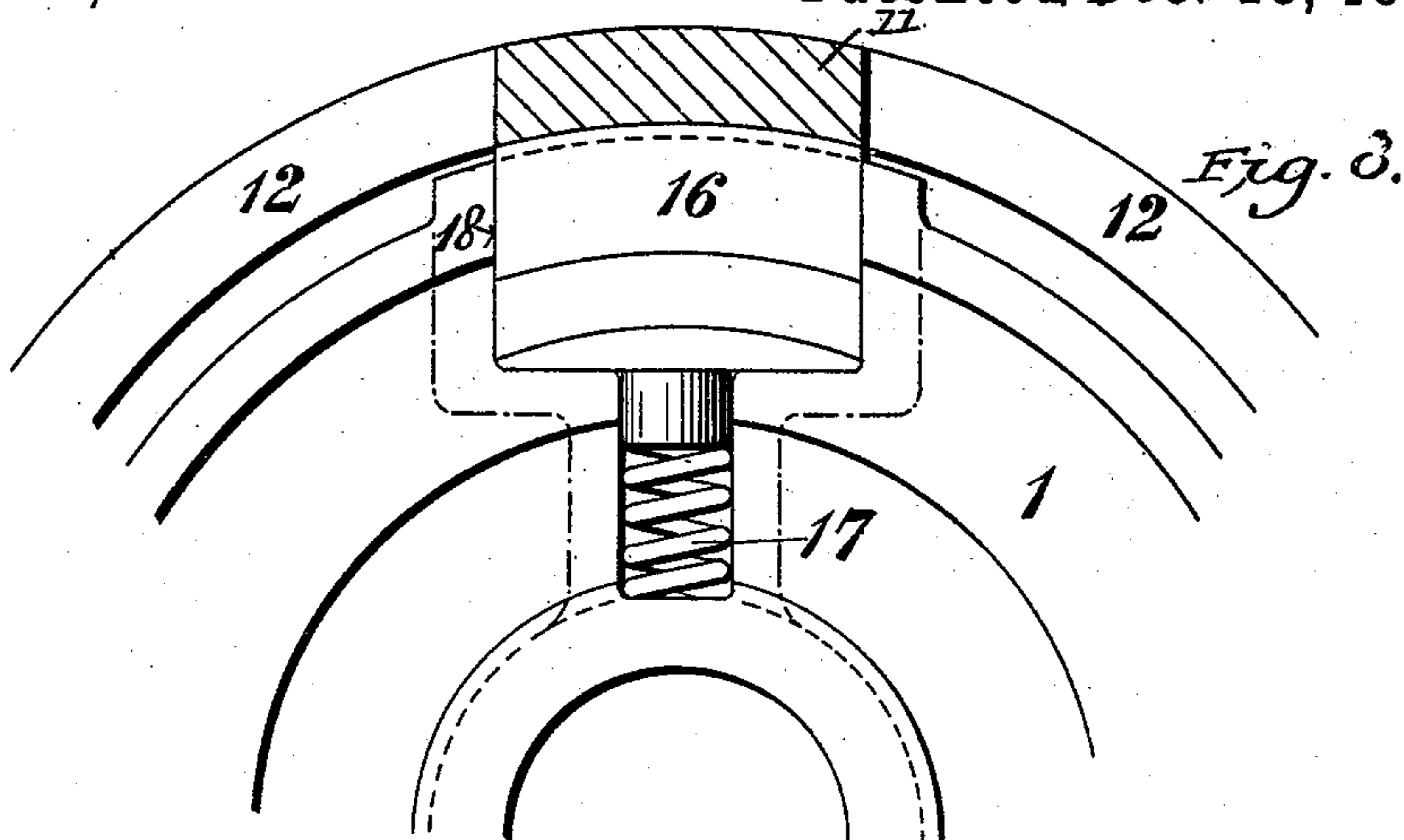
(No Model.)

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W. M. SMITH.  
PISTON VALVE.

No. 488,096.

Patented Dec. 13, 1892.



Witnesses  
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Inventor:  
Walter M. Smith  
per O. E. Druffy

# UNITED STATES PATENT OFFICE.

WALTER MACKERSIE SMITH, OF NEWCASTLE-UPON-TYNE, ENGLAND.

## PISTON-VALVE.

SPECIFICATION forming part of Letters Patent No. 488,096, dated December 13, 1892.

Application filed March 28, 1892. Serial No. 426,812. (No model.) Patented in England, August 20, 1891, No. 14,067.

*To all whom it may concern:*

Be it known that I, WALTER MACKERSIE SMITH, a subject of the Queen of Great Britain and Ireland, residing at Jesmond, Newcastle upon-Tyne, in the county of Northumberland, England, have invented certain new and useful Improvements in Piston-Valves, (for which I have obtained Letters Patent in Great Britain, No. 14,067, dated August 20, 1891,) of which the following is a specification.

When piston-valves are used as distributing-valves in steam-engines, and water due to priming accumulates in the engine-cylinder in greater quantity than is sufficient to fill the steam-ports and clearance between the piston and the end of the cylinder, it often happens that the cylinder, cylinder-cover, or some other part of the engine is fractured. Now my invention has for its object to remedy this disadvantage and so prevent serious accidents. For this purpose I construct a piston-valve with one or more packing-rings made or each made in two or more segments, so arranged that they are pressed outward by a spring or springs and are kept tight against the liner in which they work by steam-pressure, the arrangement being such that should the pressure on the outside of the packing ring or rings exceed that on the inside thereof to a sufficient extent to overcome the action of the springs the segments of such ring or rings will be forced from the face on which they work and will open a communication leading to the exhaust-chamber or to the steam-chest, as may be desired, and thereby relieve the excessive pressure.

In the accompanying drawings, Figure 1 is a longitudinal section of a piston-valve constructed according to this invention, arranged within a liner formed with steam-ports. Fig. 2 is a transverse section thereof on the line A B, Fig. 1. Fig. 3 is a transverse section through the steam-ports of the liner, showing the piston-valve in elevation, its end cap and one of the packing-rings being removed. Fig. 4 is a part longitudinal section on the line D E, Fig. 3; and Fig. 5 is a side elevation showing the relative positions of the openings in the packing-rings. Fig. 6 is a developed view of part of the liner, showing two of the steam-ports therein and the intermediate bridge over which openings in the packing-rings pass. Fig. 7 is

a longitudinal section showing a modification. Fig. 8 is a part elevation thereof, showing one of the small part rings and spring hereinafter referred to; and Fig. 9 is a plan of part of the body of the valve and part ring.

The body of my improved piston-valve may be made in one piece or in two pieces, as in the construction shown in Figs. 1 to 6, inclusive, which I will now proceed to describe. 1<sup>a</sup> are the two parts of the piston-body provided with a packing-ring, which, according to this invention, is made in two or more segments 2, there being three in the example shown. The segments 2 are formed at each side with a flange 2<sup>a</sup>, that enters a recess 3 in the part 1<sup>a</sup> of the body of the valve, which is made hollow, as shown. When the valve is in use, the segmental packing-ring is arranged to work inside a cylindrical liner or seat 4, the left-hand side of the valve being the steam side and the right-hand side of the valve being the exhaust side. Each segment is forced outward and into close contact with the liner 4 by a spring 5, arranged in a hole 6 in the part 1<sup>a</sup> of the body of the valve, and acting against a projection 2<sup>b</sup> on the inside of the segment. Each segment is also forced outward when the valve is in use by the pressure against its interior of steam that passes from the steam-chest through the hollow portion 1<sup>a</sup> of the valve by the openings 7 and 8 in such hollow portion and by the openings 9 between the segments.

10 is a second ring carried by the valve. It is split and formed with projections 10<sup>a</sup>, each arranged opposite the openings 9 between two adjacent segments 2 of the packing-ring, so as to prevent the passage through such opening of steam from the steam-chest to the exhaust-chamber. Each projection 10<sup>a</sup> of the ring 10 is arranged to travel over a bar 11, between two adjacent steam-ports 12 in the liner 4, the said ring being kept in the proper position by a projection 13, that is carried by the valve-body and enters a recess 14 in the ring, as shown in Figs. 3 and 4.

15 is a tongue arranged to close the opening 16\* between the ends of the spring-ring 10 and prevent the passage of steam there-through from the interior of the packing-ring to the exhaust. This space 16\* is arranged so as not to come opposite either of the openings



9 between the segments. As will be seen, the arrangement is such that when the valve is in position to admit steam to the steam-ports 12 in the liner 4 the pressure of steam on the inside of the segments 2 will be counterbalanced by the pressure of steam on the outside thereof, and when such pressure—due to the compression by the motor-piston of priming-water or water of condensation—becomes sufficiently greater than that of the steam on the inside to overcome the action of the springs 5 these segments will be forced from the inner face of the liner on which they normally work and permit the water to pass through the spaces between the projections 10<sup>a</sup> on the ring 10 and into the exhaust-chamber at the right-hand side of the valve.

The segments 2 may conveniently be formed by casting a ring of metal with the inwardly-extending projections and machining the same to the required diameter, after which it is cut into the required number of parts or segments, space being left between each to permit of the segments being pressed radially inward, either altogether or independently, so as to leave a space through which the priming-water can pass freely. Instead of using only one packing-ring in two or more segments, two such packing-rings may be used, arranged side by side. To prevent the segments 2 leaving the valve-body when the valve is removed from the liner 4, the flanges 2<sup>a</sup> of the segments 2 may be formed with outwardly-extending lips or projections 2<sup>b</sup>, those on one side fitting into a circular recess 1<sup>b</sup> in the outer end of the part 1<sup>a</sup> of the valve-body, and those on the other side fitting into the ring 10. The ring 10 is also formed with an outwardly-extending annular lip or projection 10<sup>c</sup>, that fits into a circular recess 1<sup>c</sup>, formed in the part 1 of the body of the valve.

If the body of the valve is formed in one piece, the segments 2 are formed without the flanges 2<sup>a</sup> and the body of the valve without the recesses 3. The springs 5 are made of sufficient strength to carry the weight of the segments and to prevent the segments clattering when the engine is running without steam.

In the modification shown in Figs. 7, 8, and 9 the valve-body and the segmental packing-ring are constructed like those shown in Figs. 1 to 6, inclusive; but instead of using a split packing-ring 10 part rings or packing-pieces 16 are used to prevent steam passing through the openings 9 between the segments 2. These part rings or packing-pieces (hereinafter called "part rings") fit into pockets or recesses 18, formed in the valve-body and are forced outward against the liner, in which

they work by springs 17, and it may be also by the pressure of steam. For each space between the part rings a bridge 11 is formed in the liner to prevent the escape of steam from the inner side of the packing-ring to the adjacent steam-port 12.

In some cases, instead of using part rings 16 corresponding parts may be cast in one with the body of the valve, in which case these parts should be a working fit in the liner.

19 is the valve-rod, and 20 a nut for securing the two or more parts of the valve-body together.

What I claim is—

1. A piston-valve comprising the hollow body, the packing-ring made in segments, and spaces between the segments to permit of the packing-rings moving radially inward, substantially as described, for the purpose specified.

2. A piston-valve comprising the hollow body, the packing-ring made in segments, and spaces between the segments, and means for preventing passage of steam to the exhaust through the said openings, substantially as described, for the purpose specified.

3. A piston-valve comprising the hollow body formed with openings, such as 7 and 8, a packing-ring made in segments 2, and means for preventing the passage of steam between said segments to the exhaust, substantially as herein described.

4. A piston-valve comprising a hollow piston-body formed with openings, such as 7 and 8, a packing-ring made in segments 2, a ring 4, having projections arranged opposite the openings between said segments and a tongue 15, and springs arranged to act outwardly upon said segments, substantially as described.

5. A piston-valve comprising the hollow piston-body 1 1<sup>a</sup>, with steam inlet and outlet openings 7 and 8, and recesses 6, a packing-ring made in segments 2, each having a projection 2<sup>a</sup>, springs 5, arranged to act against said segments, a ring 10, with projections arranged opposite the openings between said segments, and means to prevent rotation of said segments and ring 10, substantially as herein described, for the purposes specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WALTER MACKERSIE SMITH.

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