

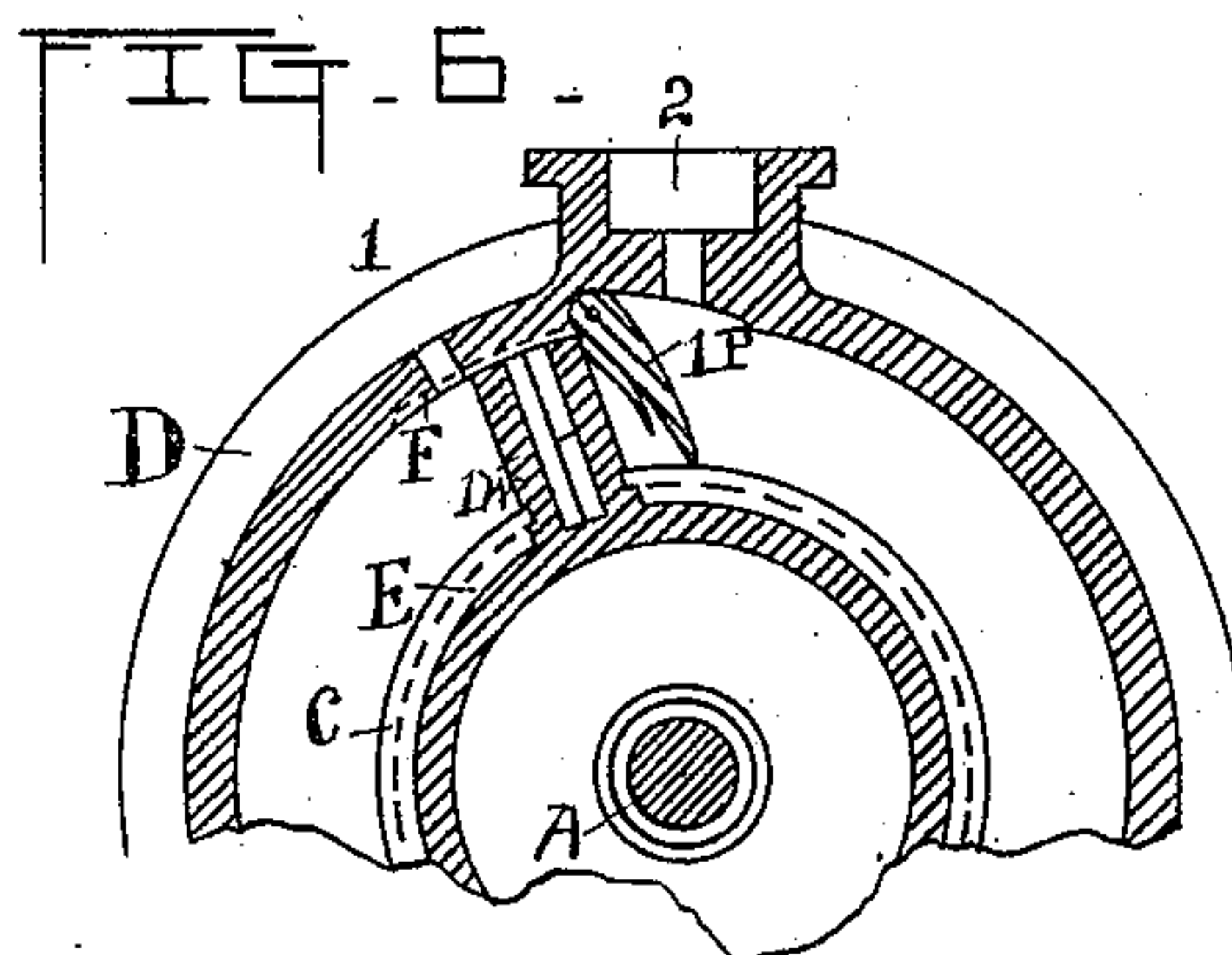
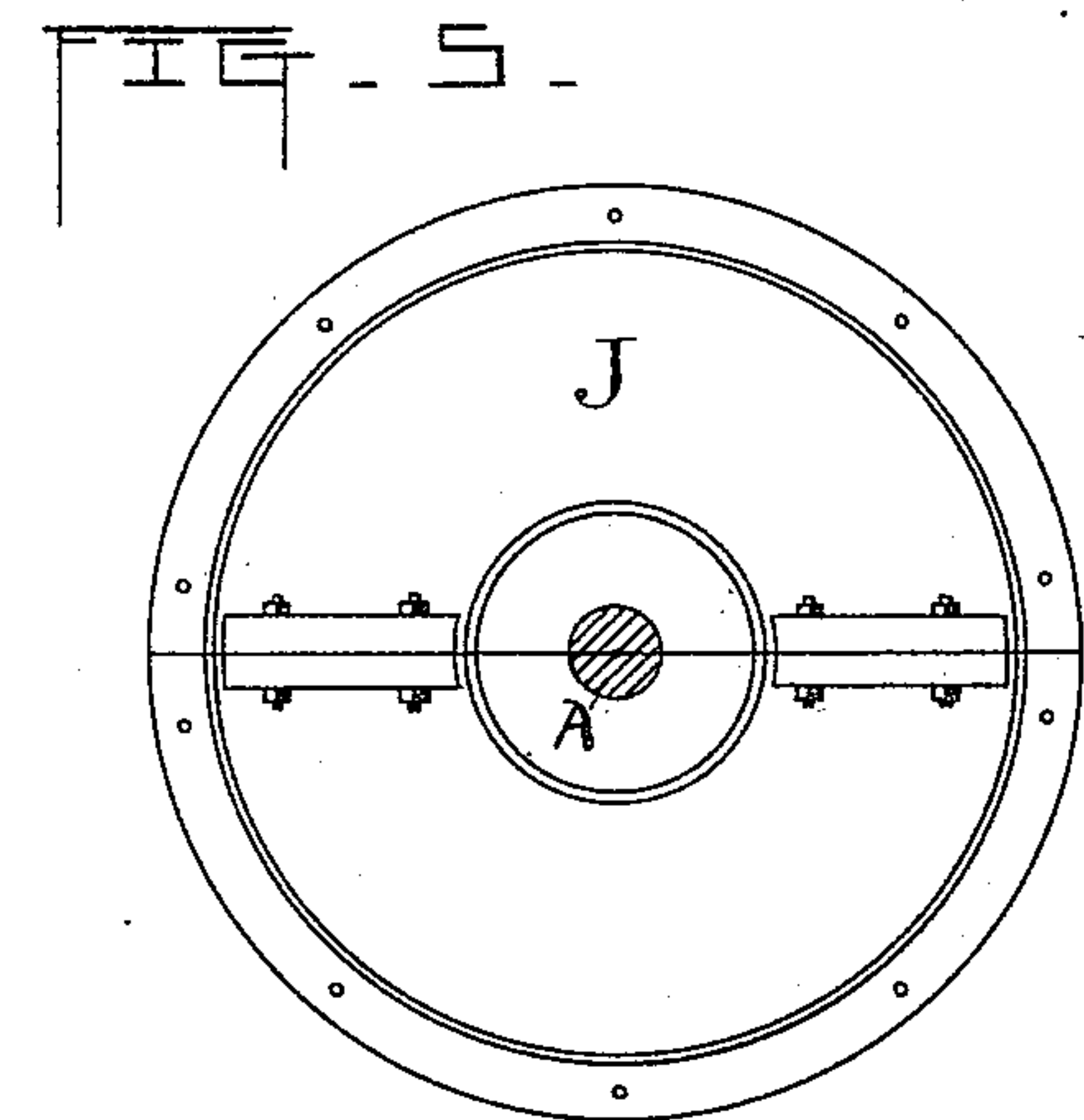
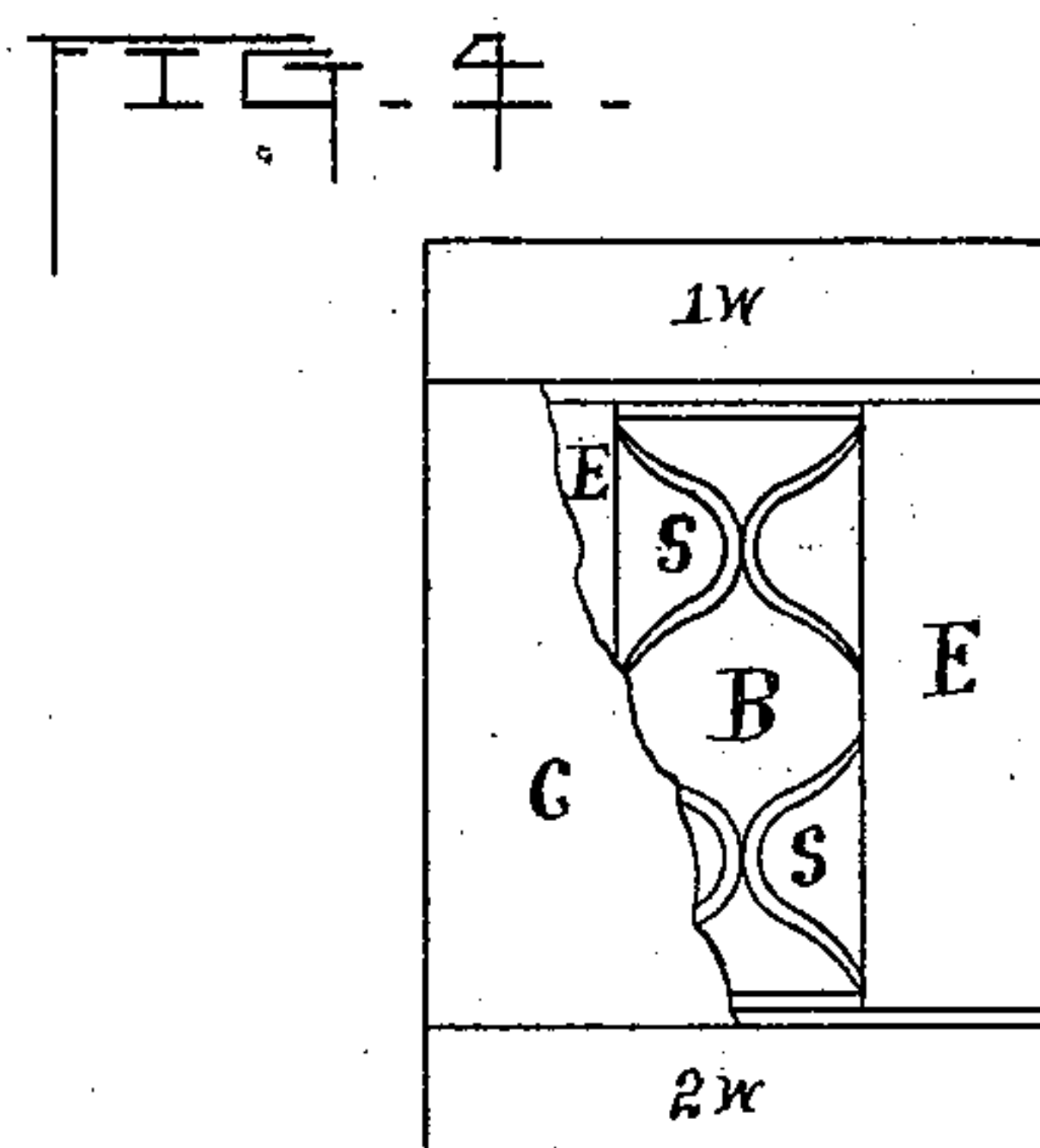
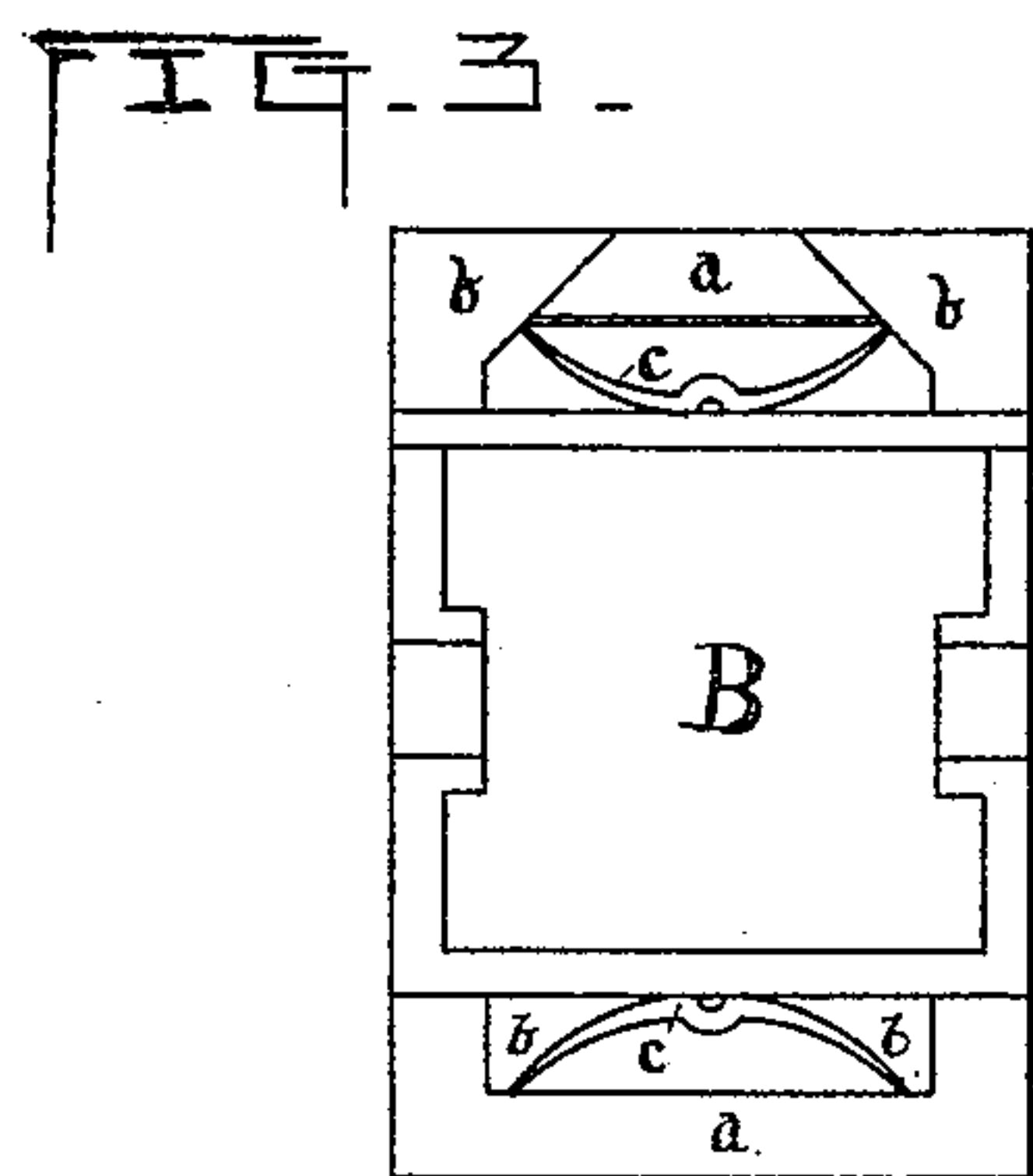
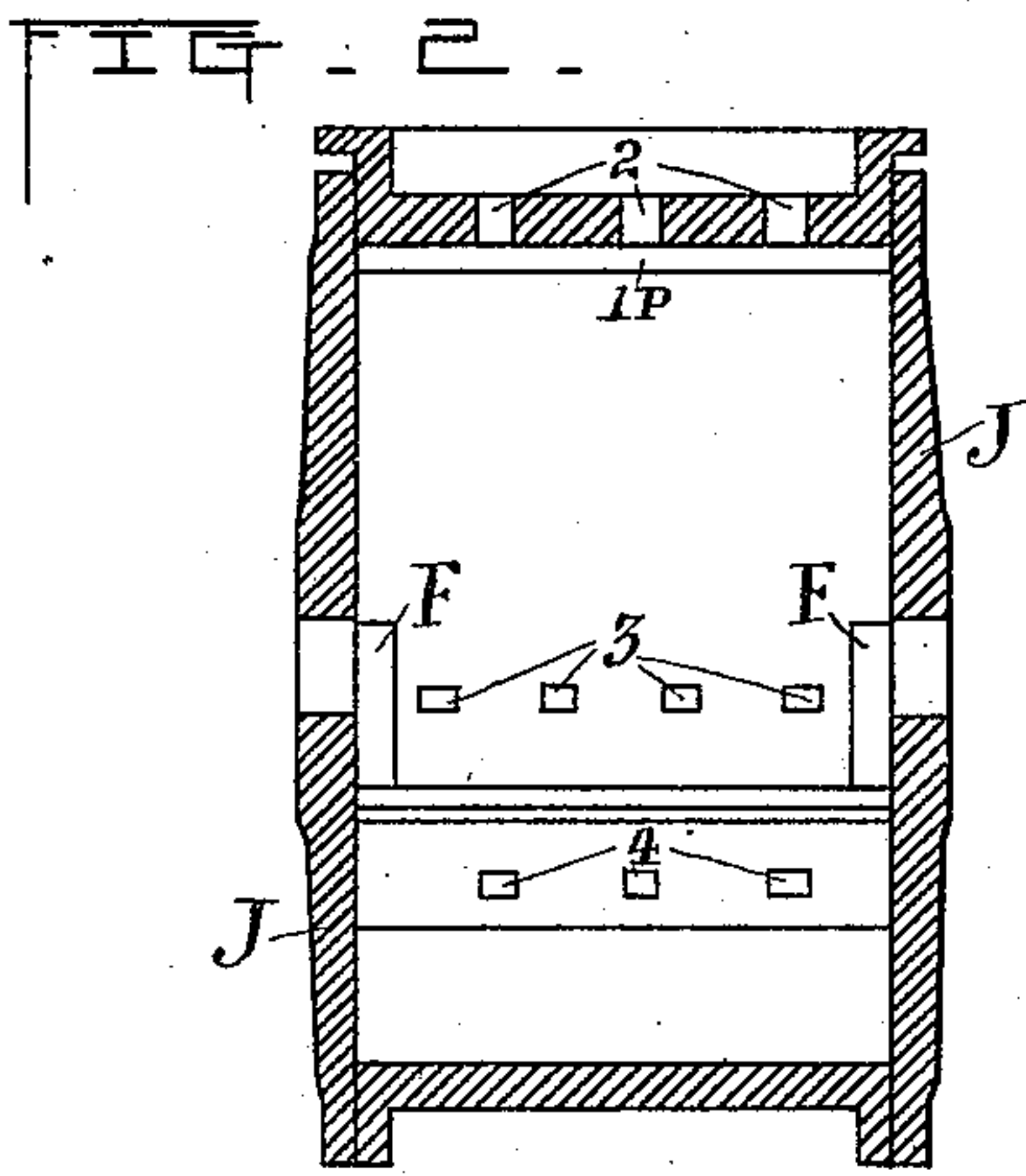
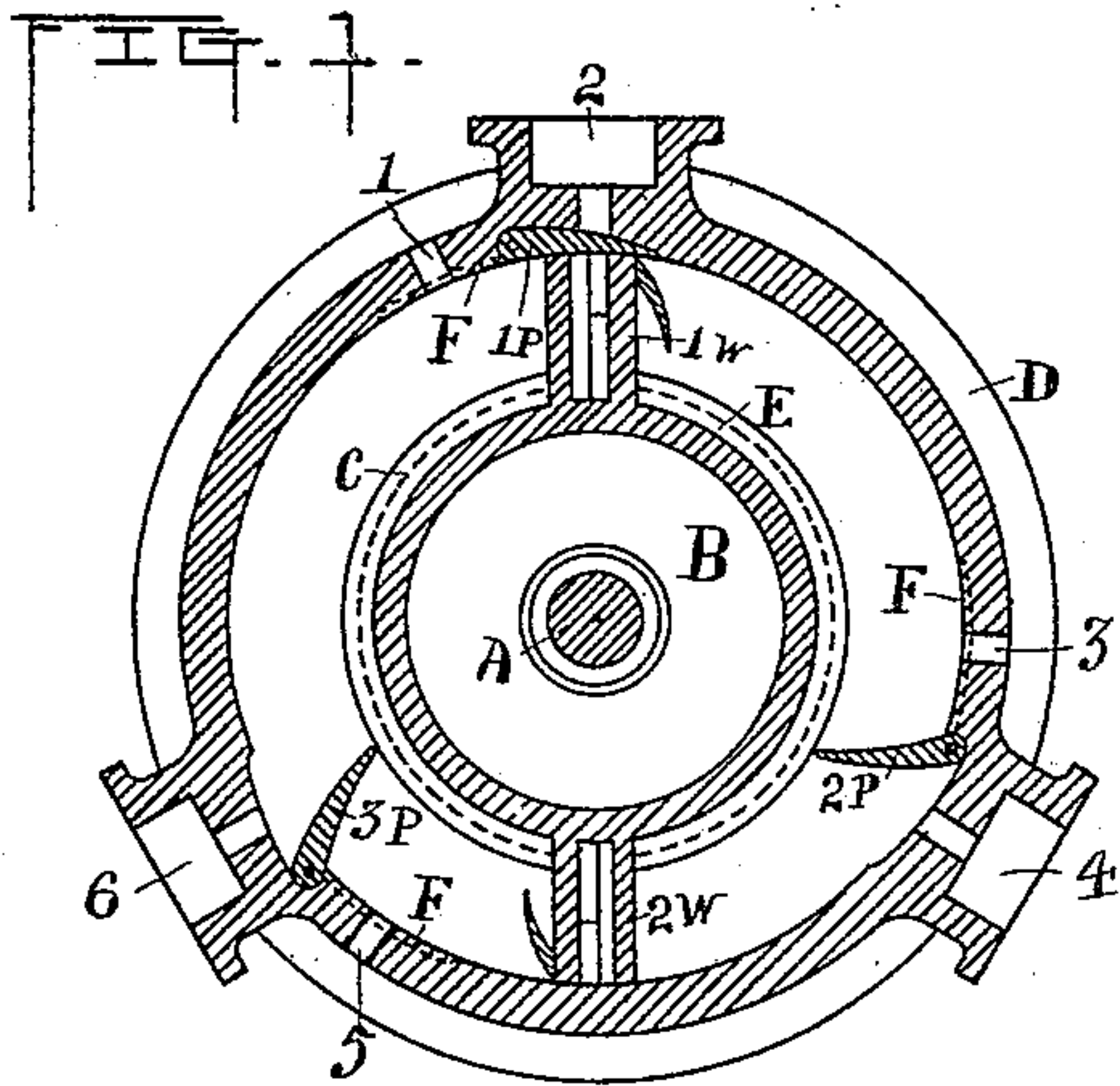
(No Model.)

2 Sheets—Sheet 1.

J. H. CARRIGER.  
STEAM ENGINE.

No. 442,572.

Patented Dec. 9, 1890.



Witnesses  
Archie M. Catlin.  
Alyx Leed

Inventor  
John H. Carriger  
By his Attorneys  
Benj. R. Catlin

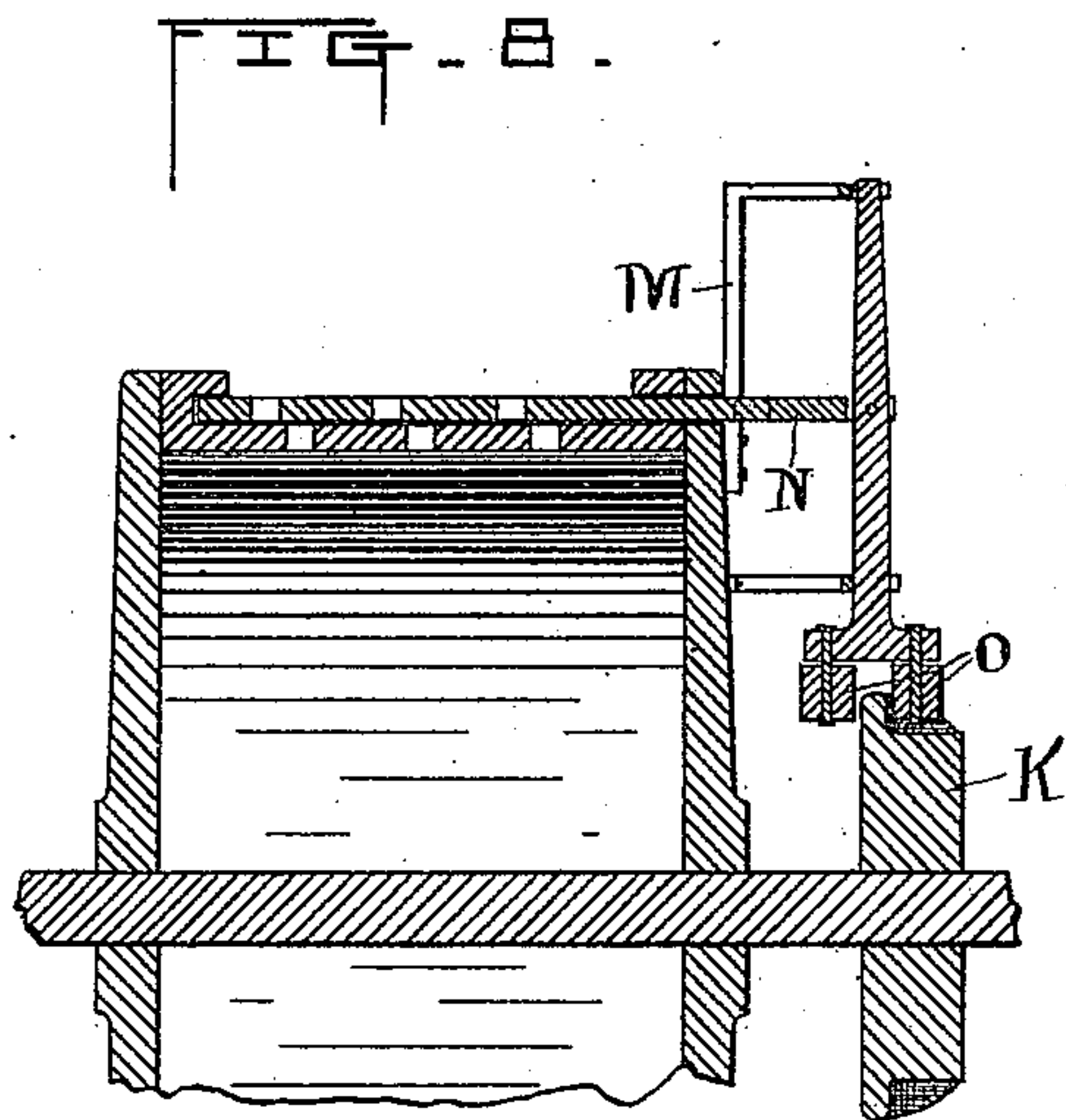
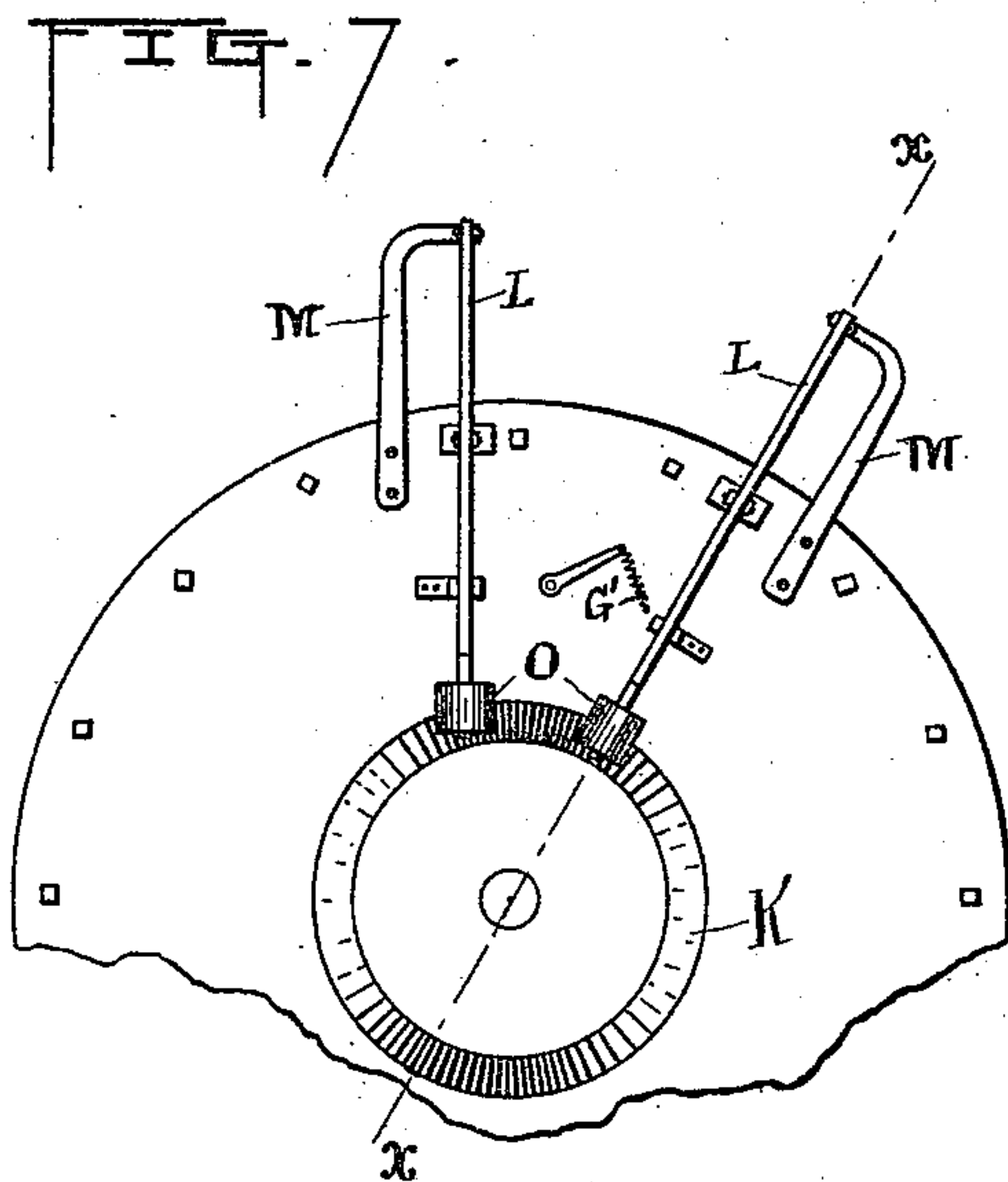
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2 Sheets—Sheet 2.

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Archie M. Catlin.

*Ally Scott*

Inventor  
John H. Carriger  
By his Attorneys  
Benj. R. Catlin



# UNITED STATES PATENT OFFICE.

JOHN HARVEY CARRIGER, OF KNOXVILLE, TENNESSEE.

## STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 442,572, dated December 9, 1890.

Application filed October 21, 1889. Serial No. 327,750. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN HARVEY CARRIGER, a citizen of the United States, residing at Knoxville, in the county of Knox and State of Tennessee, have invented a new and useful Improvement in Steam-Engines, of which the following is a specification.

The object of my invention is to improve the construction and efficiency of rotary engines; and it consists in the matters herein-after described, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a transverse section of a cylinder with hinged valves or partitions and piston with piston-wings. Fig. 2 is a longitudinal section of the cylinder. Fig. 3 is a similar view of the piston and wings. Fig. 4 is an elevation of the same partly broken away. Fig. 5 is an end elevation of the cylinder, the piston-shaft being shown in section. Fig. 6 is a partial view similar to Fig. 1. Fig. 7 is a partial end elevation showing valve-operating mechanism; and Fig. 8 is a section of same on line *x x* of Fig. 7.

A denotes the engine-shaft, which passes through the cylinder and piston and is keyed to the piston in any usual manner.

B indicates the piston, and D the cylinder.

E E indicate packings, (shown in full lines in Fig. 4 and in dotted lines in Fig. 1,) and C C are semi-cylindrical casings, which envelop and hold the packings. These latter are cylindrical and shorter than the drum or body B of the piston, and are pressed outward against the cylinder-heads by the springs S S, arranged between the cylinder B and the casings C C.

H is a recess in the drum B, to receive a catch attached to the interior of the casing C to hold it in position on the packing E E.

J J indicate the sections of a cylinder-head, provided with diametric flanges for securing bolts.

2, 4, and 6 are induction, and 1, 3, and 5 eduction, ports.

G is a spring to aid in opening the valve 1 P when steam is cut off at inlet 2. Each wing must be provided with such spring.

F F indicate ports in the cylinder-wall, along which and by the piston-wing steam

passes for a moment while the adjacent exhaust-ports are closed. The steam thus introduced between the wing and the valve opens or helps to open said valve co-operating with spring G, the main effect of the latter, however, being to prevent injurious concussion of the wing and valve. These valves—three in number in the present instance—are journaled or hinged in recesses in the cylinder-wall, and they and the recesses are shaped substantially as indicated, so that when a valve is open it lies in a recess out of the path of the piston-wing, the interior surface of the valve at such time being curvilinear and continuous with the inner surface of the cylinder. These valves and wings extend the whole length of the piston or of the cylinder interior, and the latter are adapted to divide or partition off the steam-space of the cylinder in three equal parts when closed or extended across the same. The valves are located adjacent to the inlet-ports, and the cylinder-wall is suitably thickened at such points, as shown. The wings are cleft or have two parts, and receive between these parts a packing *a*, which is pressed outwardly by a spring *c*.

*b b* indicate packings at the side of packings *a a*, and the springs *c* press the latter toward the cylinder-heads and the former toward the circumferential wall of the cylinder, having thus double action.

The operation of the engine is as follows: At suitable intervals live steam enters the ports 2, 4, and 6 and moves the valves P, so that they are closed or extended across the space between the piston and cylinder and prevent the backward escape of steam. They are sufficiently wide to stand at a slight incline and bear on the piston, whereby the piston revolves with little friction. The steam checked in one direction in the other presses the piston-wings W and moves them around together with the piston, driving exhaust-steam out of the ports 1, 3, and 5 until the said wings near said ports, at which time a portion of the exhaust-steam is forced through the channels F and opens the valves P, forcing them back into their recesses and out of the path of the wings, a spring G being preferably placed on each wing to obviate the concussion of the wings upon the valves.



Any known means may be employed for the suitable and timely opening and closing of the induction and eduction ports. In Fig. 7 are shown devices for this purpose.

5 G' is a spring located on the exterior of the cylinder and having one end attached to the cylinder-head and the other to a crank-arm on the axis of a valve P. Its effect is to aid in opening the valve, having sufficient tension to effect this only when live steam is cut  
10 off, and being then aided by the exhaust through passage F. Normally it is put under tension by steam, which closes the valve as it enters the cylinder. It will of course be  
15 understood that each valve-stem is provided with such spring.

K indicates a cam for operating the valves of the inlet and exhaust ports.

20 L L are levers pivoted in brackets M M, and pivotally connected with sliding valve-stems N N. Friction-wheels are indicated by O O. The revolution of the cam K moves the lower end of each lever L to and from the cylinder-head, as will be readily understood, the valves,  
25 one for the live and the other for the exhaust steam, being thereby suitably operated. Obviously this cam can be varied to move the valves more or less frequently, according to the number of piston wings and valves employed.  
30

Referring more particularly to Fig. 1 in the illustration, it should be understood that induction-ports 2 are assumed to be closed, but about to be opened, and that so soon as  
35 the piston-wing 1 W has moved by the valve 1 P the entering steam will close the valve across the space between the piston and cylinder and will drive the wing forward, forcing the exhaust-steam in front of it out at  
40 ports 3 until such time as the said eduction-ports are closed, whereupon steam passes

through channels F F and opens valve 2 P, as above described.

As shown in Fig. 1, steam should be conceived as entering at inlet 4, having been cut  
45 off at 6, and as about to be admitted at 2 while steam is exhausting at 3 and 5.

Having thus described my invention, what I desire to secure by Letters Patent is—

1. In a rotary engine, the combination of 50 the cylinder provided with adjacent induction and eduction ports and the by-pass conduit, a valve hinged in a recess in the cylinder and adapted to lie therein when open and thereby cover the inlet, a piston-wing, a spring  
55 G, secured to and carried by said wing and adapted to bear on the opening valve to obviate concussion, and a spring G', adapted to open the valve, substantially as set forth.

2. In a rotary engine, the combination of 60 the cylinder provided with exhaust-ports and a by-pass conduit, a piston provided with wings, a valve hinged in the cylinder and adapted to divide the steam-space between the cylinder and piston, and devices for suitably closing the exhaust-port, whereby exhaust-steam can be utilized to open the valve,  
65 substantially as set forth.

3. In a rotary engine, the combination of 70 the cylinder provided with exhaust-ports and a by-pass conduit, a piston provided with wings, a valve hinged in the cylinder and piston, a spring adapted to open said valve, and devices for suitably closing the exhaust-port, whereby exhaust-steam can be utilized  
75 to open the valve and co-operate with the said spring, substantially as set forth.

JOHN HARVEY CARRIGER.

Witnesses:

W. S. BRADLEY,

H. L. BRADLEY.