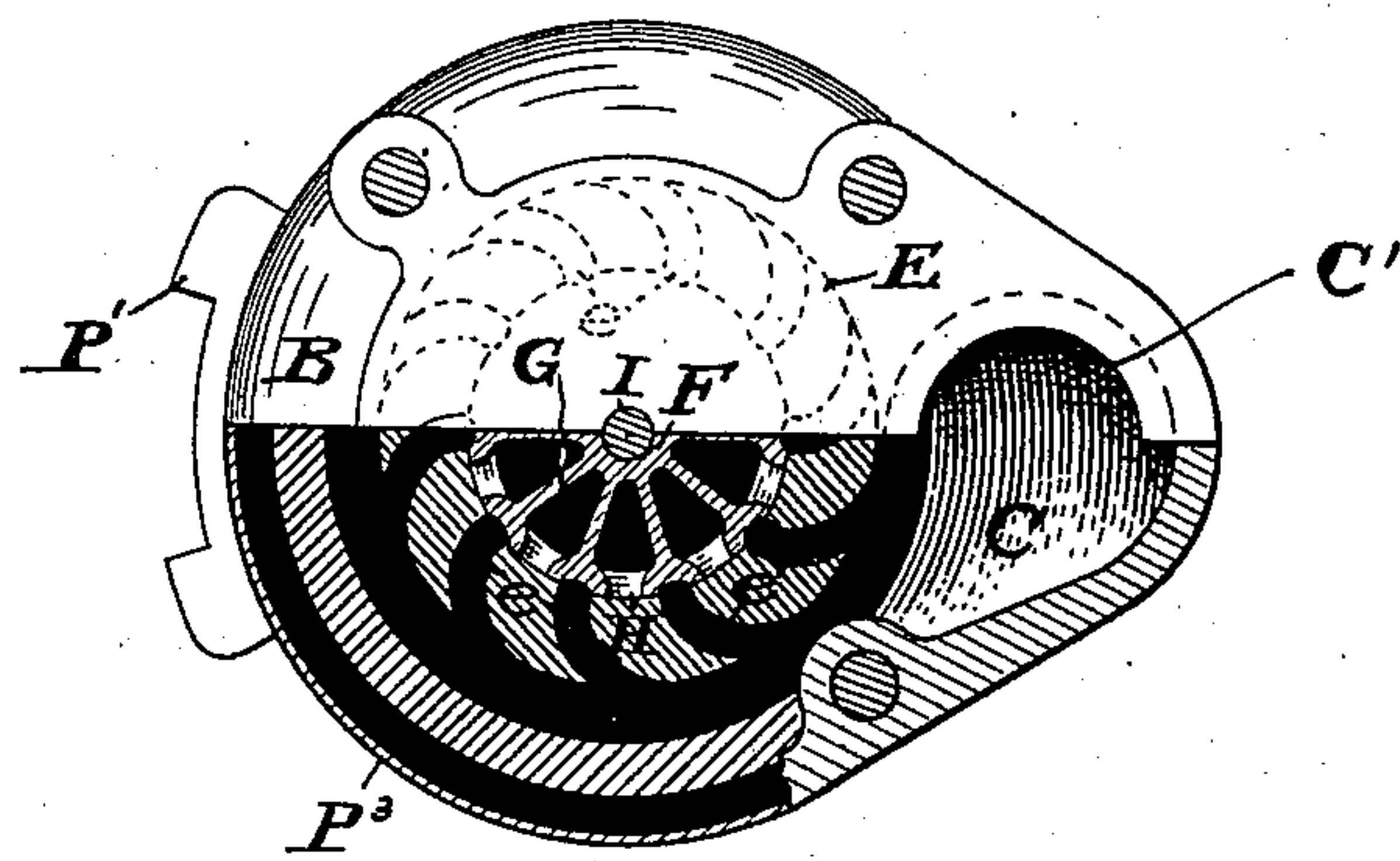
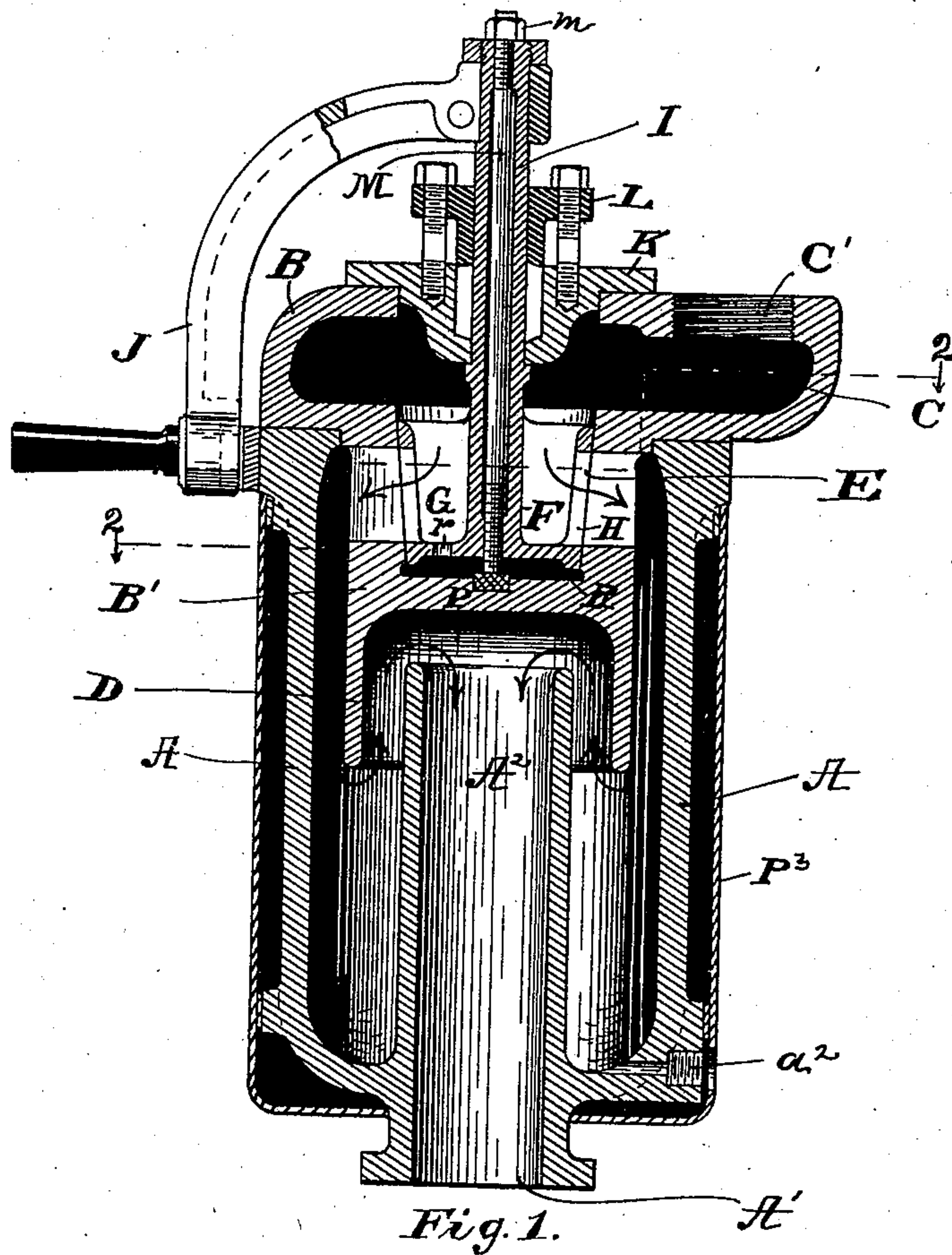


(No Model.)

J. B. ALLFREE.  
SEPARATOR.

No. 576,646.

Patented Feb. 9, 1897.



Witnesses,  
F. H. Hoerner.  
Will Hofer.

Fig. 2.

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# UNITED STATES PATENT OFFICE.

JAMES B. ALLFREE, OF INDIANAPOLIS, INDIANA.

## SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 576,646, dated February 9, 1897.

Application filed June 29, 1896. Serial No. 597,363. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES B. ALLFREE, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented certain new and useful Improvements in Separators; 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.

The object of this invention is to provide an effective means for taking the moisture out of steam, and is especially intended to separate the moisture from steam to be used in driving steam-engines.

Many different devices, technically termed "separators," for eliminating the moisture from steam have been invented and patented, but they have been only partially effective in accomplishing the purpose for which they were intended, and the failure has been largely because they rely on one agency, such as gravity, impact, or centrifugal force, to remove the water. The object of this invention is to employ all three of these agencies, *i. e.*, first, impact of the rapidly-moving body of steam against a solid surface, then centrifugal action, and finally gravitation, whereby I have found that I am able to produce practically dry steam.

The object also is to combine a throttle-valve with the separator, whereby the volume of steam passing through the separator into the cylinder of the engine can be regulated.

I accomplish the objects of this invention by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a view in longitudinal vertical section of my separator, the arrows showing the direction or course of the steam in passing through same. Fig. 2 is a view partially in plan and partially in horizontal section, the section being on the dotted line 2 2 of Fig. 1.

Similar letters of reference indicate like parts throughout both views of the drawings.

A represents the body portion of my separator, the cylindrical walls of which are preferably of cast-iron and form a chamber which is open at the top, and at the bottom the walls

are contracted on curved lines until a final opening A', approximately one-half or less than one-half of the diameter of the main chamber, is obtained. This outlet A' connects in any suitable manner with the supply-pipe through which the steam is carried into the steam-chest of the engine, but which it is not necessary to show in the drawings. Surrounding the outlet A' and of the same diameter as the outlet is the pipe A<sup>2</sup>, which is projected up into the chamber formed by the walls A for a distance approximating two-thirds of the length of the chamber. This pipe is open at its upper end.

B is a cap of peculiar construction by means of which the upper open end of the chamber formed by the walls A is closed. The upper part of this cap is cored out and expanded to form the chamber C, which is provided with a threaded opening C', into which the steam-pipe communicating with the boiler where the steam is generated is screwed. This pipe is not shown in the drawings. The cap B is also provided with an integral downwardly-projected portion B', of less diameter than the bore of the cylindrical walls A. The under side of this extension B' is provided with an inverted-cup-like cavity D, of greater diameter than the diameter of the pipe A<sup>2</sup>, into which the upper end of the pipe A<sup>2</sup> is projected in the manner as clearly shown in Fig. 1 and for the purpose which will be hereinafter fully explained.

Starting from the outside of the cap and extending through the upper and outer wall thereof and down into the extension B' is a tapering hole, which in the extension B' forms a valve-seat E. Formed through the side walls of this valve-seat are a number of vertical slots *e*, the walls of which are curved in the same general direction, in the manner as shown in cross-section in Fig. 2.

F is the valve, which is turned to fit the taper of the seat E. It is made with a series of vertical chambers which communicate with the chamber C, but are separated from each other by the vertical radial walls G. Vertical slots H are formed in the side walls of the valve opposite each one of the chambers in the valve. The remaining parts of the wall



of the valve between the slots II are wide enough to cover the slots *e* in the valve-seat, and the several parts are so arranged that a steam-tight joint results when the valve is properly adjusted in its seat, that is, when the valve is turned to a predetermined position. The valve is provided with the integral stem I, which is projected up through the cap B and has the hand-lever J secured to it, thereby providing means whereby the valve can be rotated in order to open and close the passage-way for the steam and regulate the size of the opening and consequently the volume of steam that will be allowed to go through the separator to the engine. If desired, some of the slots II may be filed wider than the others, so steam will pass through them before the entire series are opened.

The opening through the top wall of the cap B must be large enough to allow the valve to pass through into its seat, and this opening will be closed by the cap K.

L is a stuffing-box of usual construction, by which a tight joint is secured around the movable valve-stem. The valve-stem I is hollow and through it is projected the rod M, which is threaded near each end and screws into threaded portions of the opening through the stem. The rod bears against the bottom of the valve-seat and affords means for regulating the tightness of the valve in the seat by screwing the rod in or out. To this end the rod may terminate with a slot to give a hold for a screw-driver, or it may be provided with a lever or hand-wheel to turn it by.

*m* is a lock-nut on the end of the rod M to hold the adjustment.

A hardened-steel bearing-plug P may be set in the bottom of the valve-seat to prevent wear. As the downward pressure of the steam on the bottom of the valve would have a tendency to drive the valve down hard into its seat and make it difficult to turn, I have sought to counteract the pressure by making a chamber R under the valve and providing an opening *r* through the bottom of the valve, through which the steam will be admitted to the chamber R and exert a counteracting upward pressure.

The operation of my separator is as follows: The lever J is forced around so as to bring the slots in the valve opposite the slots in the valve-seat, whereby a passage-way for the steam will be provided. Then the steam entering the chamber C through the opening C' will pass down through the chambers in the valve F and out through the curved slots *e* in the walls of the valve-seat. The curvature of the slots *e* will impart a rotary movement to the body of steam, and the water being heaviest will be thrown out by centrifugal action. The steam issuing from the slots *e* will strike violently against the walls A of the main chamber, and the water, by impact, will be still further eliminated. Then the steam, as shown by the arrows, passes down

under the edges of the cup D and up again to the mouth of the pipe A<sup>2</sup>, whence it is conveyed to the engine, and by the return course which the steam is forced to take in passing from the main chamber to the pipe A<sup>2</sup> the force of gravitation is brought into play to extract whatever remaining particles of moisture may still exist in the steam. The water thus extracted will accumulate in the bottom of the main chamber and will be removed through the drain *a*<sup>2</sup>.

Surrounding the walls A and removed therefrom so as to provide an air-space is the jacket P<sup>3</sup>. This construction in a large measure prevents the radiation of heat from the separator.

P' are stops to regulate the throw of the hand-lever J.

Having thus fully described my invention, what I claim as new, and wish to secure by Letters Patent, is—

1. A steam-separator having a central inlet through which the steam is received, curved passages permitting of an outward and rotary flow of steam from the inlet, an exit-tube extending up into said chamber from the bottom thereof and a flange projecting down from the top of said chamber around and below the mouth of said exit-tube, substantially as shown.

2. In a steam separator and valve, a valve-seat having a series of curved exits, a valve having a series of passage-ways adapted to be brought into communication with the said exits in the valve-seat, and a chamber to collect the steam after it passes through the valve, substantially as described and for the purposes specified.

3. In a steam separator and valve, a valve-seat having a series of curved exits, a valve having a series of passage-ways adapted to be brought into communication with the said exits in the valve-seat, and a chamber to collect the steam after it passes through the valve, said chamber having walls against which the steam will be violently thrown, and an outlet for the steam from said chamber, shaped so as to cause the steam to travel down and then reverse its direction before discharging, all substantially as described and for the purposes specified.

4. In a steam-separator, the chamber C having communication with the boiler where the steam is generated, a valve-seat having a plurality of curved slots formed through the walls thereof in the manner shown, a valve having a plurality of chambers separated from each other by suitable partitions and having slots through the outside walls thereof whereby the chambers in the valve can be brought into communication with the curved slots in the valve-seat by rotating the valve, a collecting-chamber to receive the steam after it passes through the valve and having walls placed with relation to curved slots so the steam will be thrown against said

walls, said chamber having its lower end contracted in diameter to form an outlet and having a tubular extension surrounding the outlet and projected up into the chamber and  
5 terminating inside of an inverted-cup-shaped cavity, all substantially in the manner as shown and for the purposes specified.

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

JAMES B. ALLFREE.

Witnesses:

JOSEPH A. MINTURN,  
H. R. WILLIAMS.