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PATENTED APR. 24, 1906.

W. A. DOWNES.  
STEAM INJECTOR.

APPLICATION FILED DEC. 23, 1905.

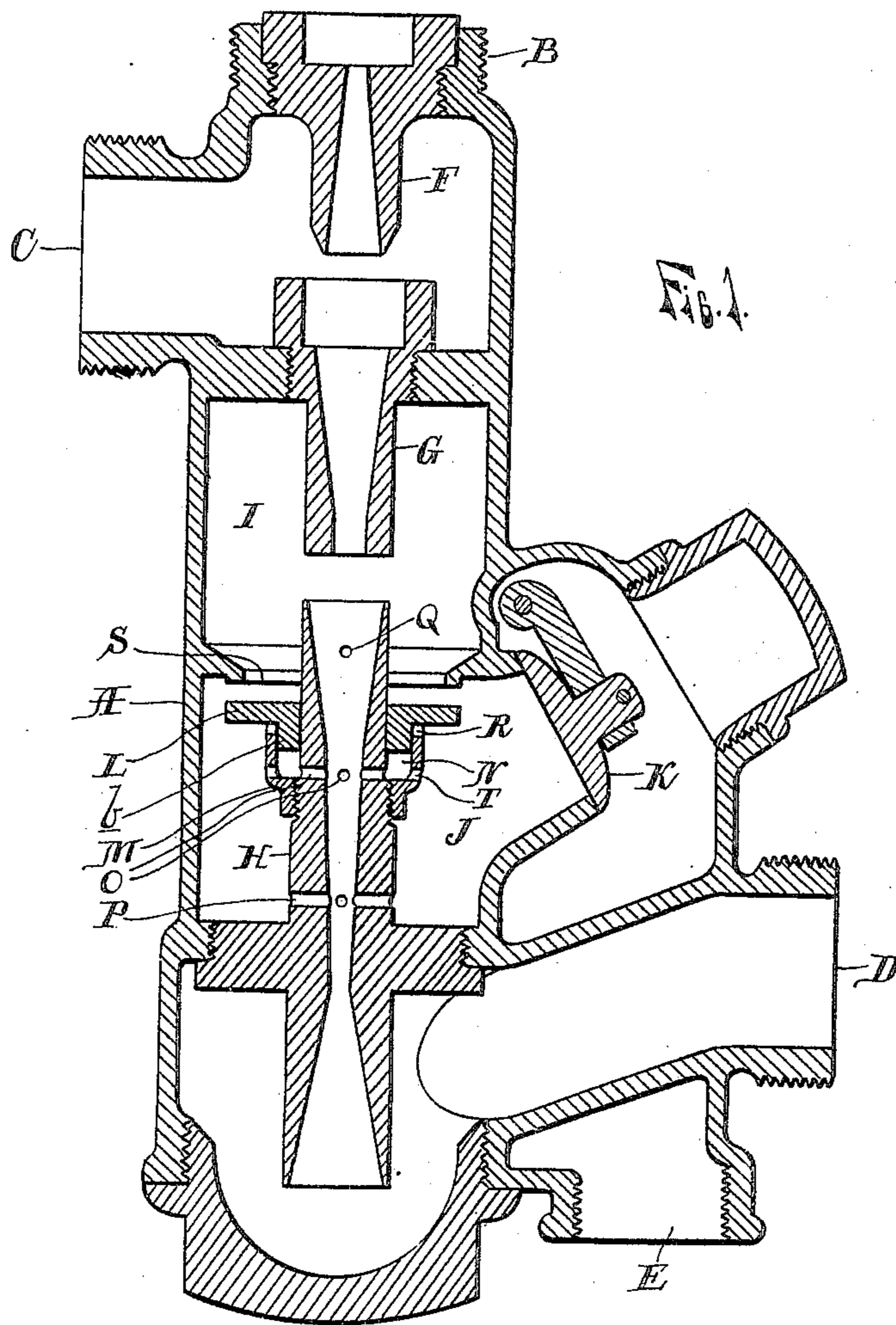


Fig. 1.

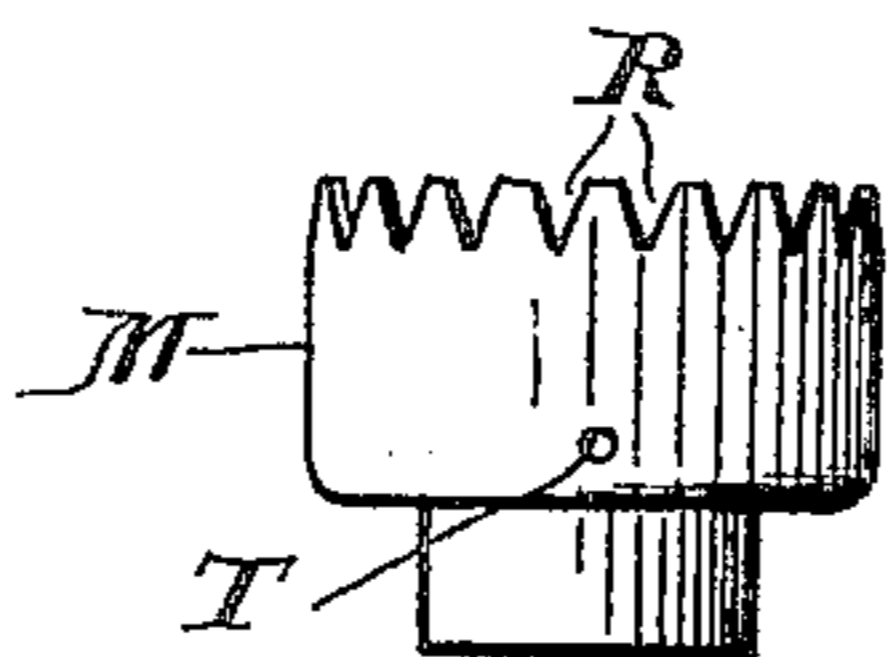


Fig. 2.

WITNESSES:  
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# UNITED STATES PATENT OFFICE.

WILLIAM A. DOWNES, OF DETROIT, MICHIGAN.

## STEAM-INJECTOR.

No. 818,422.

Specification of Letters Patent.

Patented April 24, 1906.

Application filed December 23, 1905. Serial No. 293,077.

*To all whom it may concern:*

Be it known that I, WILLIAM A. DOWNES, a citizen of the United States of America, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Steam-Injectors, of which the following is a specification, reference being had therein to the accompanying drawings.

10 This invention relates more particularly to that type of injector known as "automatic" by reason of its being adapted to start automatically. This type of injector is mainly characterized by having what is known as  
15 a "primary" overflow and a "secondary" overflow, each controlled by an automatically-operating valve.

My invention has particular reference to an improvement in the construction, arrangement, and operation of the primary overflow, whereby the automatic starting of the injector is accomplished more promptly and with greater certainty under all conditions of operation, and my improvement particularly involves an improvement in the construction of the primary overflow-valve in connection with novel means for its positive operation, all as more fully hereinafter described, and shown in the accompanying  
25 drawings, in which—

Figure 1 is a vertical central section of an automatic injector embodying my improvement, and Fig. 2 is a detached elevation of the jacket on the combining-cone.

35 A is the shell, integrally cast with the screw-threaded connecting-arms B, C, D, and E, suitably arranged, respectively, for connection with the steam-supply pipe, water-supply pipe, delivery-pipe, and overflow-  
40 pipe, all in a known manner.

F, G, and H represent in order the steam-jet, the suction-tube, and the combining and delivery tube, all of known construction and operation, except as more fully hereinafter  
45 described.

I is the primary overflow-chamber, J is the secondary overflow-chamber, and K is the automatic valve controlling the passage of the overflow from the chamber J into the  
50 overflow-arm.

L is the automatic valve, controlling the primary overflow. It is a plain disk valve sleeved upon the combining-cone and provided upon its under side with a cylindrical  
55 prolongation *b*. Below this valve is secured upon the combining-tube, preferably verti-

cally adjustable, a cylindrical cup M, with which the prolongation *b* has a sliding piston and cylinder engagement. The upper edge of this cup serves as the support upon which  
60 the disk L normally rests in its open position, while in its closed position it rests upon an annular valve-seat S, integrally formed in the inner wall of the shell.

The cup forms between it and the combining-cone an annular pressure-chamber N, which communicates with the interior of the combining-cone through the spill-holes O, which are substantially at a point about  
65 midway between the usual spill-holes P and Q. The cup is preferably provided at its upper end with perforations or, what is the equivalent, with indentations R, which are adapted to form relief-openings from the  
70 pressure-chamber into the secondary overflow-chamber, and it is provided at its lowest point or bottom of the cup with spill-openings T, which should not exceed in capacity that of the spill-holes O. The spill-holes T  
75 will always be open in whatever position the valve L may be drawn; but the relief-openings R will be wholly closed when the valve L is seated upon the cup, and they will remain closed until the valve L nearly ap-  
80 approaches its closed position.

In practice in starting the injector with a relatively high pressure of steam (referring to the range of steam-pressure for which the injector is designed to work) there will be considerable steam-pressure in the primary  
85 chamber, and the prompt starting of the injector depends altogether upon this steam-pressure being quickly relieved. While this is best accomplished by a normally open valve like the valve L, this kind of valve has  
90 the drawback that it will not be closed by the vacuum in the chamber I unless it is supported in close proximity to its seat S, and it thus restricts the outlet from the primary overflow-chamber. My construction, however, over-  
95 comes this drawback, for I can support the valve L upon the cup M at such a distance below its seat as is necessary to give it as full and ample an opening as the valve K has, and for its prompt closing at the proper moment I  
100 rely upon the operation of the pressure-chamber. There will be no pressure in the pressure-chamber at the moment of starting; but as the stream begins to form and enter the mouth of the combining-tube the overflow  
105 through the spill-holes O will gather more and more force, and by the time it reaches its maxi-

mum force, which is the very moment the proper conditions for the formation of the vacuum in the chamber I have been established, the openings T become inadequate to relieve the pressure in the chamber N, and as a result the valve L will be forced toward its seat without, however, positively closing the valve, since the pressure in the pressure-chamber is relieved by the indentations R; but the instant the conditions are formed for establishing the vacuum the valve will positively close and establish it, and the injector is then in proper condition to start automatically.

In my construction the spill-holes O, P, and Q are never closed, nor will an injector ever work satisfactorily in an automatic manner and through a large range of steam-pressure, if this is not the case, and it will also be understood that the spill-holes O, P, and Q should be arranged as they are as to their position and number.

Having thus fully described my invention, what I claim is—

1. In an automatic injector of the character described, the combination of the combining-tube having the usual spill-holes near its mouth and near its point of greatest contraction, and intermediate spill-holes between the same, a cup surrounding the combining-tube and adapted to receive the spill from said intermediate spill-holes, a valve-disk sleeved upon the combining-cone and normally supported upon the cup and a valve-seat above the valve-disk forming an overflow-passage around the combining-tube through which the chamber above the valve-seat is adapted to communicate with the chamber below, under control of the valve, said valve having a piston in engagement with the cup and forming a pressure-chamber therein operating to assist the valve in seating at a predetermined point in the starting of the injector.

2. In an automatic injector of the character described, the combination of the combin-

ing-tube having the usual spill-holes near its mouth and near its point of greatest contraction and intermediate spill-holes between the same, a cup secured upon the combining-tube in position to receive the spill from the intermediate spill-holes and provided with corresponding spill-holes, a valve-disk sleeved upon the combining-cone and normally resting upon the cup, and a valve-seat above the valve-disk forming a normally open overflow-passage around the combining-cone and dividing the space above and below the valve-disk into primary and secondary overflow-chambers, said valve-disk provided with a piston on its under side engaging with the cup and forming a pressure-chamber therein operating to assist in the closing of the valve at a predetermined point in the operation of starting the injector.

3. In an automatic injector of the character described, the combination of the combining-tube having the usual spill-holes near its mouth and near its point of greatest contraction and intermediate spill-holes between the same at a determined point in the length of the tube, a cup adjustably secured upon the combining-tube and in position to receive the spill from the intermediate spill-holes and provided with corresponding spill-holes at the base and with spill-openings on the upper edge, a valve-disk sleeved upon the combining-cone and normally resting upon the cup, and a valve-seat above the valve-disk forming a normally open passage around the combining-cone between the chambers above and below the valve-disk, said valve-disk provided with a piston on its under side forming a pressure-chamber in the cup and controlling the spill-openings on the upper edge of the cup.

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

WILLIAM A. DOWNES.

Witnesses:

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 OTTO F. BARTHEL.