

(No Model.)

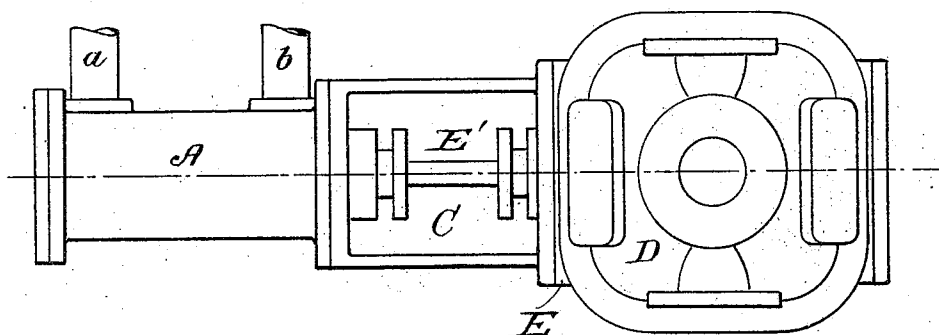
2 Sheets—Sheet 1.

G. DE LAVAL.  
PUMPING ENGINE.

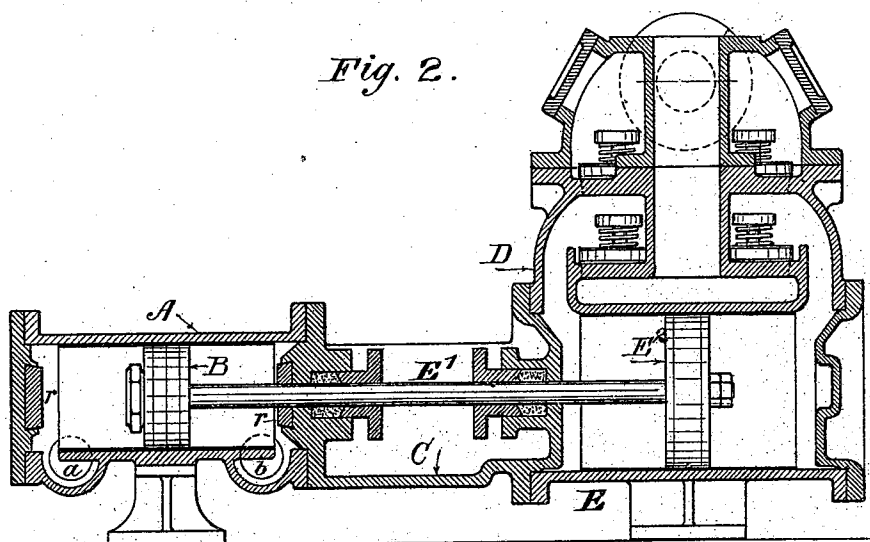
No. 502,521.

Patented Aug. 1, 1893.

*Fig. 1.*



*Fig. 2.*



*Witnesses.*

*Chas. H. Smith*  
*J. Stait*

*Inventor.*

*George de Laval*  
*per Lemuel W. Torrell*  
*Att'y.*

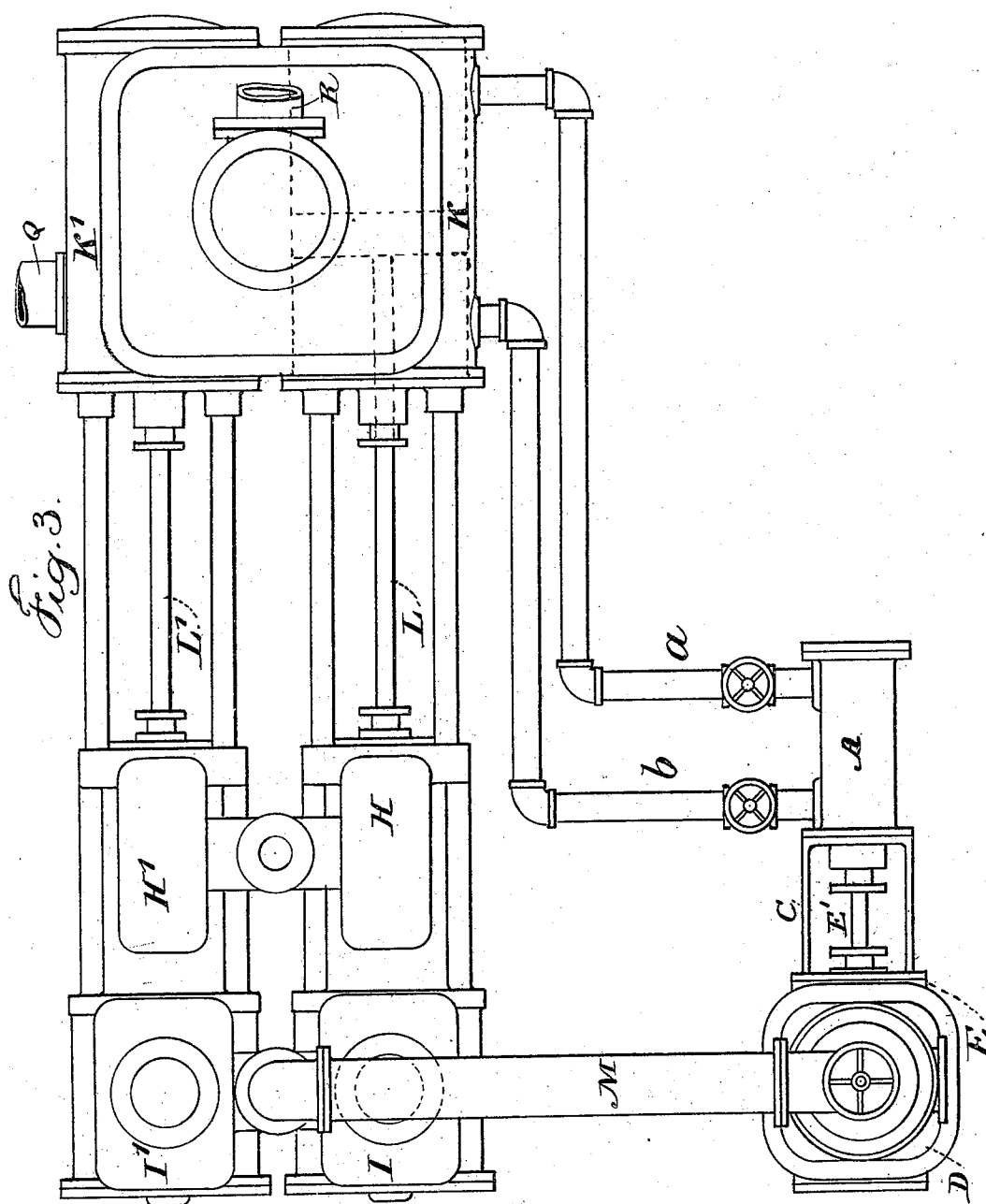
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Charles Smith  
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Inventor,  
George de Laval  
per Lemuel W. Serrell  
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# UNITED STATES PATENT OFFICE.

GEORGE DE LAVAL, OF WARREN, MASSACHUSETTS, ASSIGNOR TO THE GEO.  
F. BLAKE MANUFACTURING COMPANY, OF NEW YORK, N. Y.

## PUMPING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 502,521, dated August 1, 1893.

Application filed November 3, 1892. Serial-No. 450,810. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE DE LAVAL, a citizen of the United States, residing at Warren, in the county of Worcester and State of Massachusetts, have invented an Improvement in Pumping-Engines, of which the following is a specification.

Direct acting pumping engines have heretofore been made in which there is a steam cylinder acting directly upon the pump piston rod, and in many instances these pumps have been duplexed, and an air pump or vacuum pump has also been made use of in such pumping engines but it has been driven by a separate steam cylinder which of course rendered it necessary to provide valves, steam pipes and other connections rendering the apparatus complex.

In my present improvements I employ water as it is driven from the pump to act upon a piston first in one direction and then in the other to give motion to the piston of the air or vacuum pump, thereby dispensing with steam connections and valves to the power cylinder of the air pump.

In the drawings, Figure 1 is a plan view of the air or vacuum pump. Fig. 2 is a vertical section of the same, and Fig. 3 is a plan view illustrating the manner in which the connections are made to the power cylinder.

In Fig. 3 I have represented steam cylinders H H' and their piston rods L L' as acting upon pistons in the water cylinders or pumps K K'. The piston in the pump cylinder K is represented by dotted lines and the induction or water supply pipe is shown at Q, and the discharge water pipe at R, as usual in pumps, and I have also shown the single expansion cylinders I I' for receiving steam from the high pressure cylinders H H' respectively, and the pipe M is represented as passing to the air or vacuum cylinder E, and this cylinder E is of ordinary construction, as illustrated in Fig. 2, but the piston rod E' of the piston E<sup>2</sup> passes to a piston B in the cylinder A. This cylinder A is the power cylinder for actuating the air or vacuum pump E, and there are pipes *a* and *b* with cocks leading from the water cylinder

or pump K at opposite sides of the piston thereof to the power cylinder A at opposite sides to the piston B thereof, so that as the piston of the water pump K is reciprocated, the pressure of the water will act through the respective pipes *a* and *b* first at one side of the piston B and then at the other side of said piston, the suction or minus pressure being at the opposite side. Thereby the piston B will receive a movement first in one direction and then in the other for actuating the piston E<sup>2</sup> in the air or vacuum pump. By this means I am enabled to avail of a water motor for the pump, instead of requiring a steam engine to operate the air or vacuum pump.

Where the parts are arranged as shown in Fig. 3, the exhaust steam from the low pressure cylinders passes by the pipe M to the condenser and meets the injection water that condenses the steam, and the water is removed by the air or vacuum pump.

The power cylinder A and water cylinder E are connected by the casting C, and it is advantageous to employ cushions *r* at the inner surfaces of the heads upon the cylinder A to lessen concussion of the piston B at the ends of the stroke.

This improvement is available in removing the water of condensation from the condenser, and for maintaining a vacuum in the apparatus, and in consequence of the water passing backward and forward between the pump and the power cylinder there is no loss of water and the pressure of the water furnishes the power in the power cylinder of the air or vacuum pump.

I claim as my invention—

1. The combination in a pumping engine, of a pump for raising a liquid, a steam engine to actuate the same, a vacuum or air pump, a power cylinder and its piston for actuating the air pump and pipes leading from the water pump at opposite sides of the piston to the power cylinder at opposite sides of its piston whereby the air or vacuum pump is driven in the ordinary operation of pumping a liquid, substantially as set forth.

2. The combination with an air or vacuum pump, of a power cylinder and a connection

between the piston of the pump and of the power cylinder, a main pumping engine and water pipes leading from the cylinder of the main pumping engine at opposite sides of its  
5 piston to the power cylinder of the vacuum or air pump at opposite sides of its piston whereby the vacuum or air pump is driven

by the liquid of the ordinary pump, substantially as set forth.

Signed by me this 28th day of October, 1892.

GEORGE DE LAVAL.

Witnesses:

GEORGE P. ABORN,

C. F. STAPLES.