3 Sheets—Sheet 1.

H. DAVEY.

PUMPING ENGINE.

No. 186,118. Patented Jan. 9, 1877.

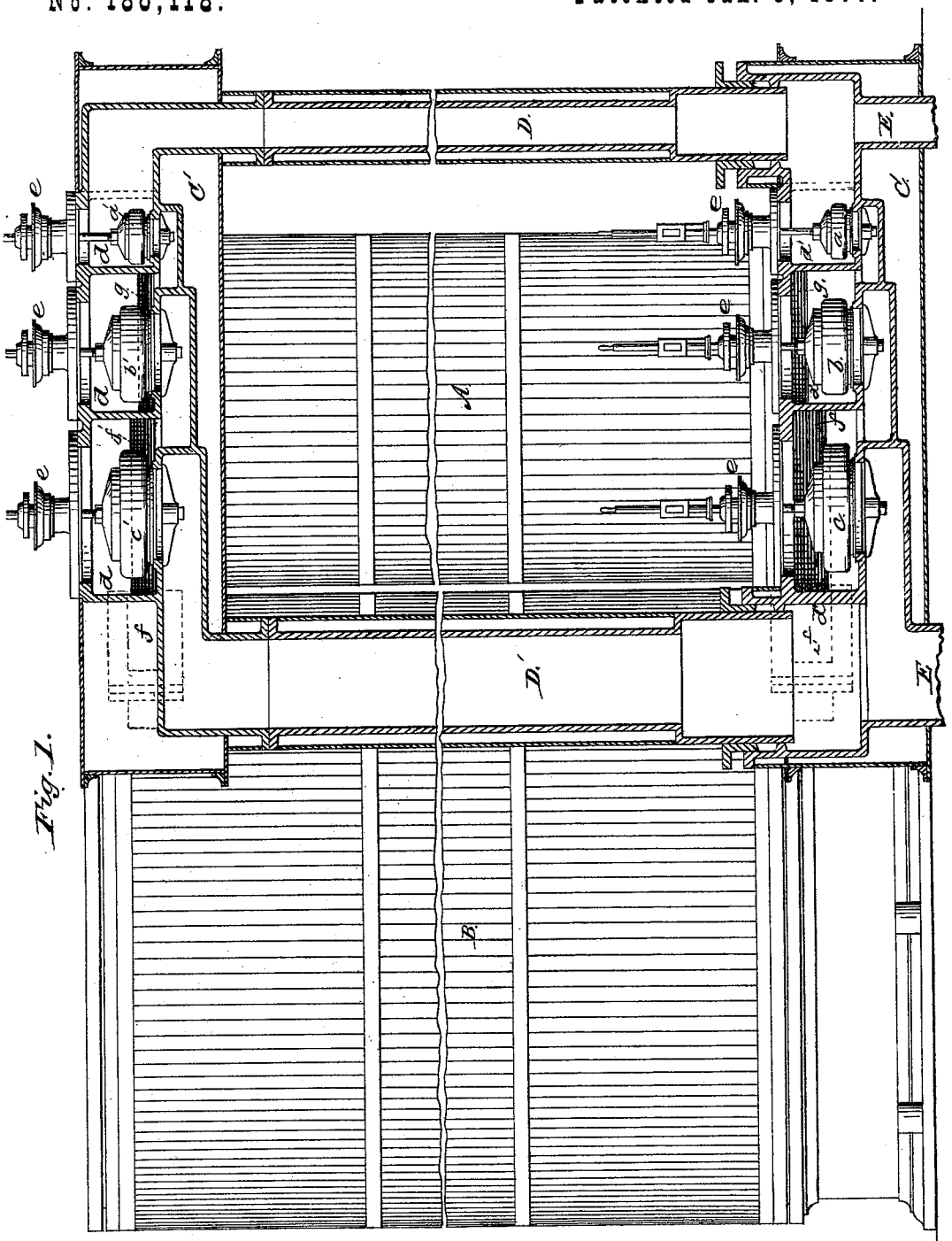

Fig. 1.

Witnesses:

Jos. L. Coombs

J. Frost Wagner

Inventor:

Henry Davey.

By James L. Norris.

Atty.

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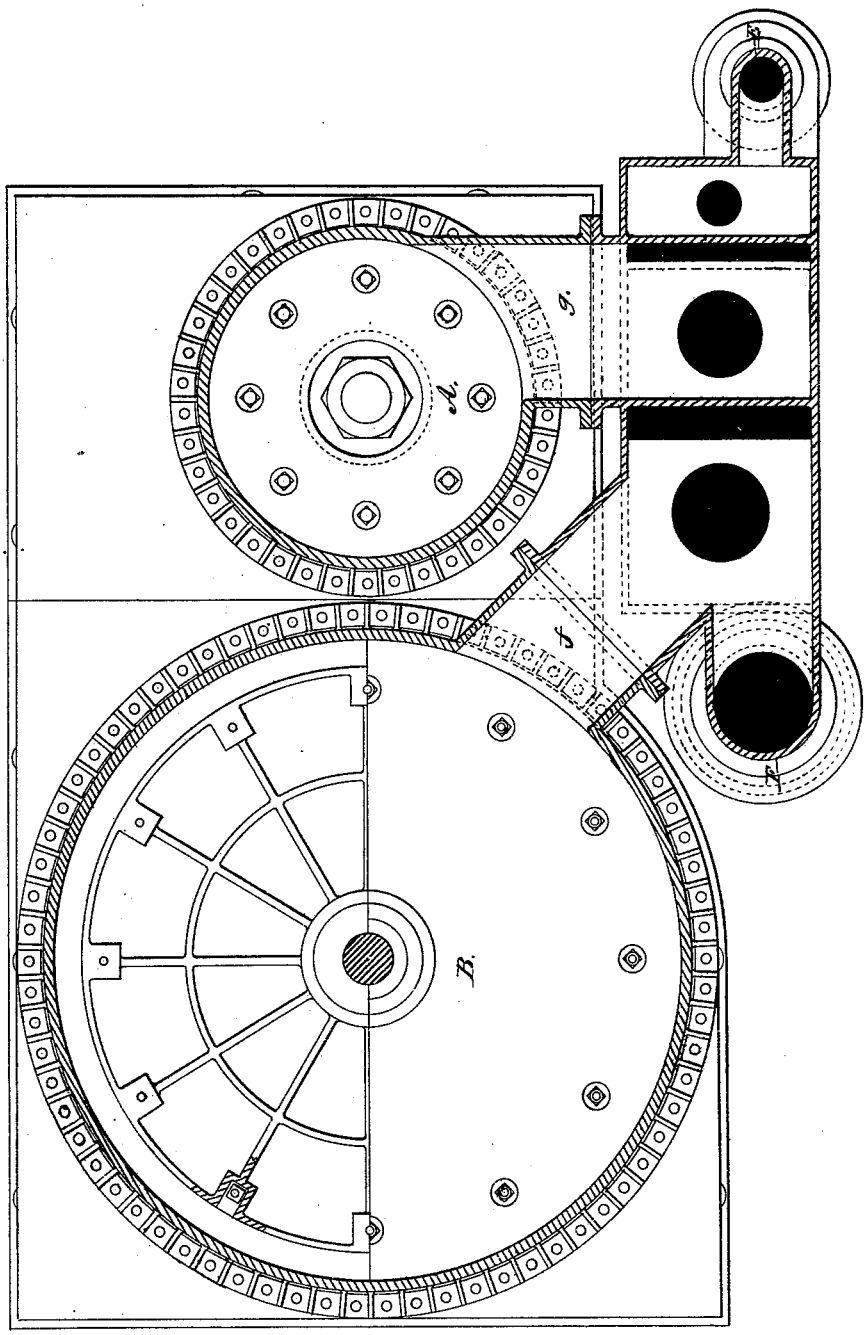

Fig. 2.

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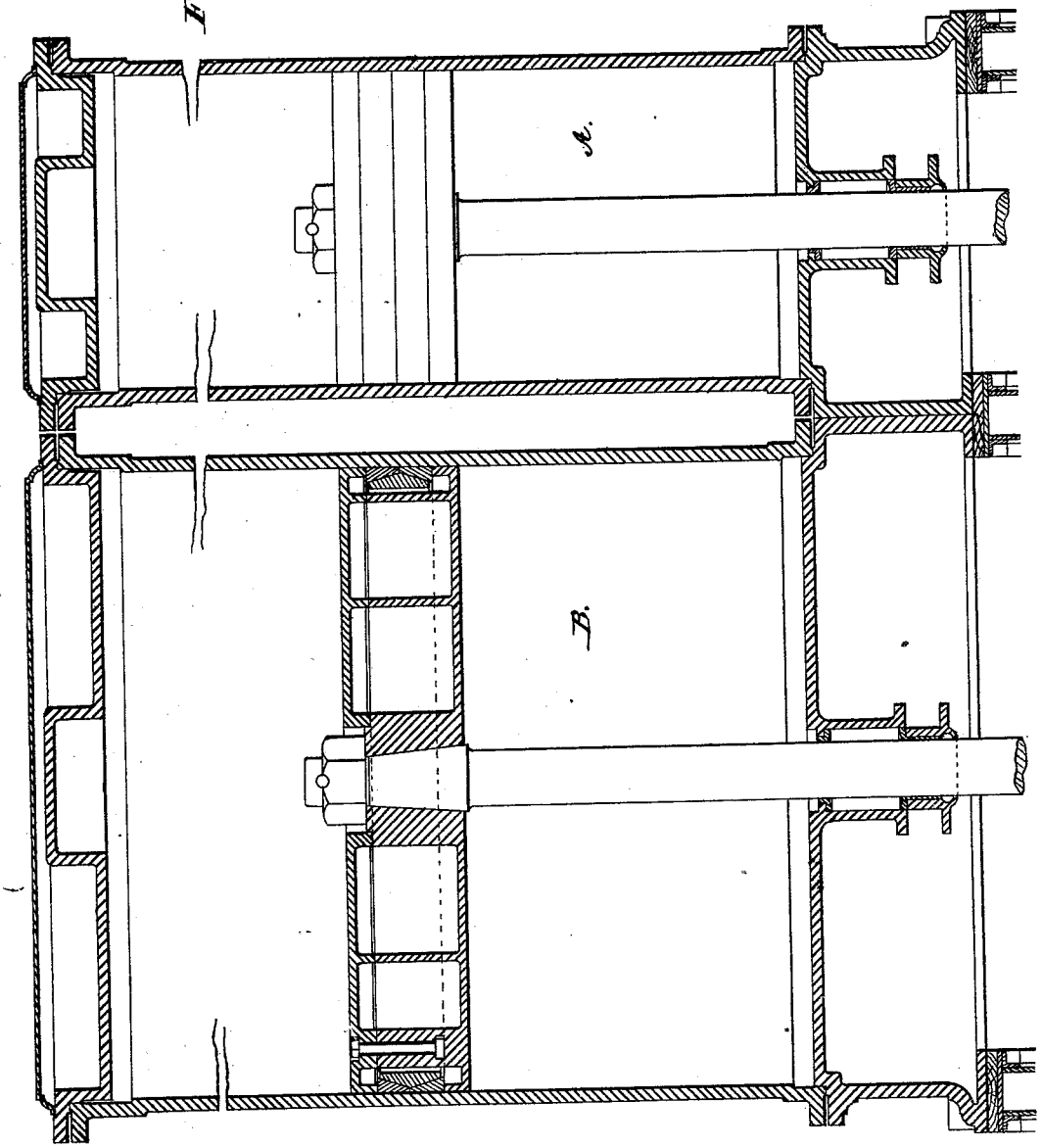
3 Sheets—Sheet 3.

H. DAVEY.

PUMPING ENGINE.

No. 186,118. Patented Jan. 9, 1877.

Fig. 3.



Witnesses:

Jos. L. Coombs

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Inventor:

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UNITED STATES PATENT OFFICE.

HENRY DAVEY, OF LEEDS, ENGLAND.

IMPROVEMENT IN PUMPING-ENGINES.

Specification forming part of Letters Patent No. **186,118**, dated January 9, 1877; application filed September 14, 1876.

To all whom it may concern:

Be it known that I, HENRY DAVEY, of Leeds, in the county of York, England, have invented certain new and useful Improvements in Pumping-Engines, of which the following is a specification:

The object of my invention is to produce a vertical compound engine for pumping water and other fluids, and for other purposes, in which the steam-passages are very short, and little loss is occasioned by condensation or leakage.

The invention consists of two cylinders, placed as close together as possible, whose pistons are connected together by suitable gearing, in such manner that the pistons travel in opposite directions, and the steam from the high-pressure cylinder passes direct into the same end of the low-pressure cylinder through a short passage, whereby the loss occasioned by condensation is obviated when the steam has to pass the opposite ends of the expansion-cylinder and through the necessarily long passage.

The invention also consists in the employment of six double-beat valves for the distribution of steam—three at each end of the cylinders in double-acting engines; or, as a modification, slide-valves may be employed—two for the two cylinders, one at each end, with additional ports in the valve-seats.

By this construction a more uniform distribution of strain on the parts of the engine is secured, as the pistons travel in opposite directions. The strains on the foundations are also rendered smaller, by which economy is secured in the construction of such foundation.

By preference, I employ the differential valve-gear secured to me in the Patent No. 167,509, granted to me September 7, 1875, for actuating the valves; but the improvements herein described can be used in connection with other forms of valve-gear.

In the accompanying drawing, Figure 1 is a side elevation, partly in section, of the two cylinders and valves. Fig. 2 is a vertical cross-section of the same. Fig. 3 is a horizontal section of the same.

In the drawing, A is the high-pressure, and B the low-pressure, cylinder. To the upper and lower ends of the cylinder A are cast or otherwise secured the steam-chests C C′, connected by the side pipes D D′, which pass through suitable stuffing-boxes at their lower open end, to allow for the expansion and contraction thereof. The steam-inlet pipe E enters the lower steam-chest at one side, and the exhaust F forms the exit at the other side.

In the steam-chests, at each end, are arranged the three double-beat valves for the distribution of the steam. The first or smallest ones *a a′* admit the high-pressure steam, when they are opened by the operating mechanism, to the opposite ends of the high-pressure cylinder. The steam, after having performed its duty here, passes, through the valves *b b′*, to the expansion or low-pressure cylinder B, and after having performed its duty therein it is exhausted through the valves *c c′*, by the exhaust-pipe F, to the condenser or atmosphere. Between each valve is arranged a partition, *d d′*, and the toes and lifters of the valve-gear are arranged in such manner that the valves are alternately opened and closed, for the admission and exhaustion of steam to either the high-pressure or low-pressure cylinders.

The cylinders, as also the steam-chests and side pipes, are either provided with steam-jackets or with wooden lagging, felt, or other material, to prevent the condensation of the steam from condensation or radiation. The valve-stems pass through the usual stuffing-boxes, (shown at *e e e*, Fig. 1,) and said valve-stems are connected to the valve-gear in the ordinary manner.

The valves *a b c* and *a′ b′ c′*, and the respective valve-openings which they cover, are made of increasing diameter, the valve-opening leading into the expansion-cylinder being larger than the induction-valve opening to the high-pressure cylinder, and the exhaust-valve opening being larger than either of the others, to allow of the ready escape of steam from the respective cylinders, by means of which the engine is rendered much more effective in operation.

The operation is as follows: The steam enters the inlet-pipe E, and, supposing the piston to be at the lower end of the cylinder A, it is admitted to the cylinder by valve *a* and

port *g* until it reaches the part of the stroke at which it is desired to cut off the steam, when the valve *a* is closed, and steam admitted at the opposite end of the cylinder by valve *a*. The exhaust steam from this cylinder is then admitted by valve *b* and passages or ports *f* to the expansion or low-pressure cylinder B, and after having accomplished its duty therein it is exhausted by the valves *c*, and passes out by the exhaust-pipe F to the condenser or to the atmosphere. When the pistons arrive at the opposite ends of the stroke, of course the valves *a'*, *b'*, and *c'* admit and exhaust the steam in a similar manner, the steam passing through the side pipes to and from the upper steam-chest—viz., the high-pressure steam through side pipe D, and the low-pressure or exhaust steam through side pipe D'.

What I claim, and desire to secure by Letters Patent, is—

The combination, in a compound engine, of the three double-beat valves, of increasing size, at each end of the high-pressure cylinder, arranged to operate substantially as described.

In testimony that I claim the foregoing I have hereunto set my hand and seal in the presence of the subscribing witnesses.

HENRY DAVEY. [L. S.]

Witnesses:

WM. WARD,

CHAS. GILLIARD.