

M. B. HARVEY.  
Compound Engine.

No. 206,235.

Patented July 23, 1878.

Fig. 1.

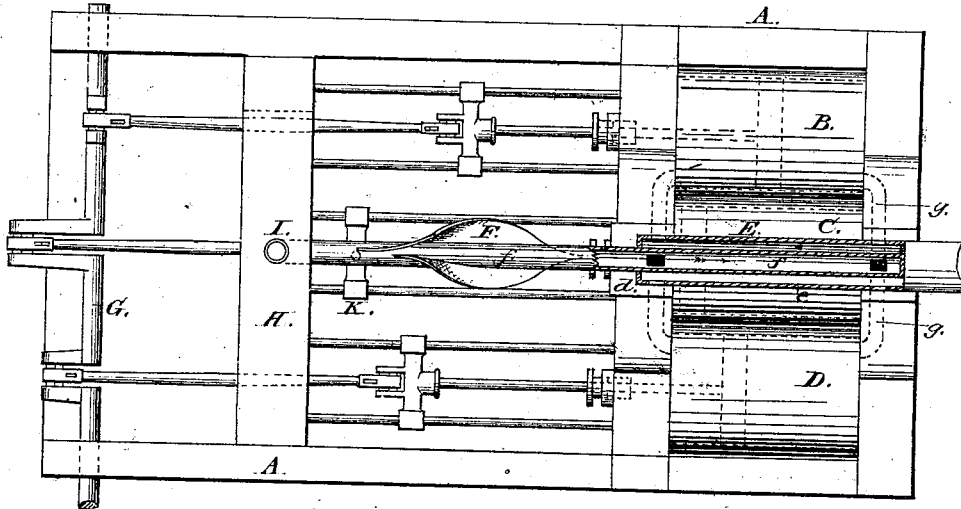


Fig. 2.

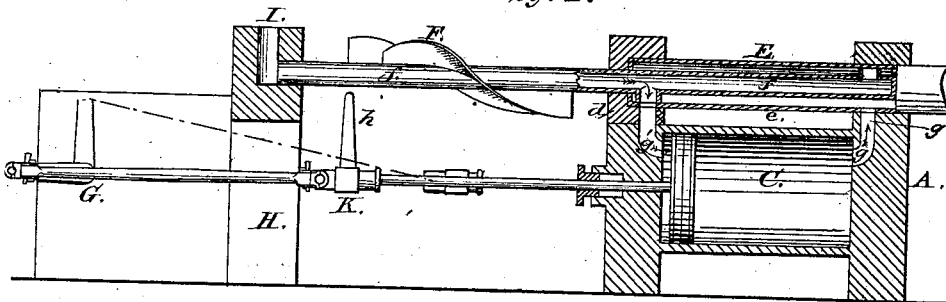
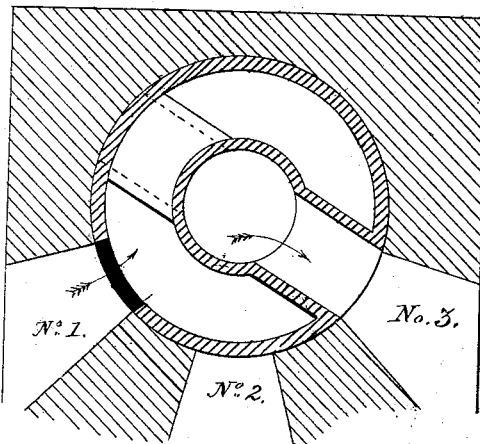


Fig. 3.



Witnesses:  
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# UNITED STATES PATENT OFFICE.

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## IMPROVEMENT IN COMPOUND ENGINES.

Specification forming part of Letters Patent No. **206,235**, dated July 23, 1878; application filed  
June 20, 1878.

*To all whom it may concern:*

Be it known that I, MOSES B. HARVEY, of Leavenworth, in the county of Leavenworth and State of Kansas, have invented a new and valuable Improvement in Compound Engines; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawings, making a part of this specification, and to the letters and figures of reference marked thereon.

Figure 1 of the drawing is a representation of a plan or top view of the engine, partly in section. Fig. 2 is a longitudinal vertical section of the same, and Fig. 3 is an enlarged cross-section of the valve and ports leading to the cylinder.

The object of the present invention is to provide the construction and operation of that class of engines known as "compound engines," in which the steam is used first at high pressure and then at low pressure, by using the exhaust-steam before it finally escapes into the atmosphere or condenser.

The invention therefore consists of a rotary or oscillating valve, operated by a spiral or cam-blades, with which a pin or stud on the cross-heads engages and gives it the proper motion to admit and exhaust the steam at the opposite ends of the cylinders. If desired, two, three, or more cylinders may be employed, according to the power required.

The invention further consists in the construction and arrangement of the different parts, as will be hereinafter described.

In the accompanying drawings, A represents a frame of any suitable construction, in which the cylinders B C D are firmly secured, and they are provided with the usual stuffing-boxes. In the heads of the cylinders are arranged the ports for admitting and exhausting the steam.

Over the central cylinder C is arranged the valve E, which consists of the outer cylindrical shell *e* and the inner tube *f*, which is provided at its inner end with the spiral or curved cam plates or flanges F, by which the valve is rotated. The valve is provided with suitable openings or ports *a b c*, and is journaled in the boxes *d*, having corresponding openings that communicate with the ports *g* in the cylinder-heads. It is extended to the bearing-piece H

and connects with the steam-inlet pipe I, thus forming the connection between it and the cylinders.

The guides and cross-heads are of the ordinary construction, excepting the center one, K, which is provided with a pin or stud, *h*, which engages with the spirally-curved cam-plates F, and as the cross-head moves backward and forward it rotates the valve. If desired, the valve may be operated by bevel-wheels from the crank-shaft. The crank-shaft G is of the ordinary construction, excepting that the cranks are placed at an angle of about one hundred and twenty degrees, more or less. By this arrangement each cylinder receives a fractional feed of boiler-pressure, and the pistons are forced two-thirds of the stroke by the expansive force of the steam without breaking off.

The valve may be round or square, rectangular or semicircular, as desired, the exhaust-ports extending double that of the induction-ports; but in every case the space between the ports in the boxing must be exactly the same width as the ports, thus acting so that, as it cuts off one, it immediately begins to feed the next, and as it feeds a cylinder at one end the exhaust is open at the other, and as the last or third cylinder finishes its feed the first is being exhausted and fed at the opposite end, so that the boiler-pressure is continuous throughout the complete revolution of the crank-shaft.

When the engine stops, it at all times presents one full head to the induction-steam, thus having no dead-center, and, of course, the engines will run more uniform.

The exhaust opens prior to the induction, and remains open longer, it being longer endwise as well as sidewise, and even if two cylinders are being exhausted at once it does not matter, only it should close in time to produce a small amount of cushioning at the dead-centers.

The operation is as follows: The air, steam, or other motive power enters at I. Passing through E it enters the cylinder at *g'*, the exhaust passing out at *g*, and through *e* into the next cylinder, and, after having performed its duty therein, it finally escapes at the end of *e* into the atmosphere or to the condenser.

The piston having passed the length of the

cylinder causes the valve to revolve half a revolution, thereby causing the steam to enter at the other end of the cylinder, and exhausting from the opposite end.

Having now fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a compound engine, the rotary valve E, consisting of the inner tube *f* and an outer tube, *e*, provided with suitable ports, constructed and arranged substantially as shown, and for the purpose described.

2. The valve E, herein described, consisting of the outer tube *e* and the inner tube *f*, provided with the spiral flanges F, arranged substantially as shown, and for the purpose specified.

3. The combination, with a valve, E, consisting of outer tube *e* and inner tube *f*, provided with spiral flanges F, of cross-head K, having stud *h*, arranged substantially as and for the purpose set forth.

4. The combination of the cylinders B C D with valve E, consisting of outer tube *e* and inner tube *f*, provided with spiral flanges F and cross-head K, all constructed and arranged substantially as shown and herein described.

In testimony that I claim the above I have hereunto subscribed my name in the presence of two witnesses.

MOSES B. HARVEY.

Witnesses:

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ALICE M. HOLMAN.