

M. B. HARVEY.  
Compound Steam-Engine.

No. 218,528.

Patented Aug. 12, 1879.

FIG. I.

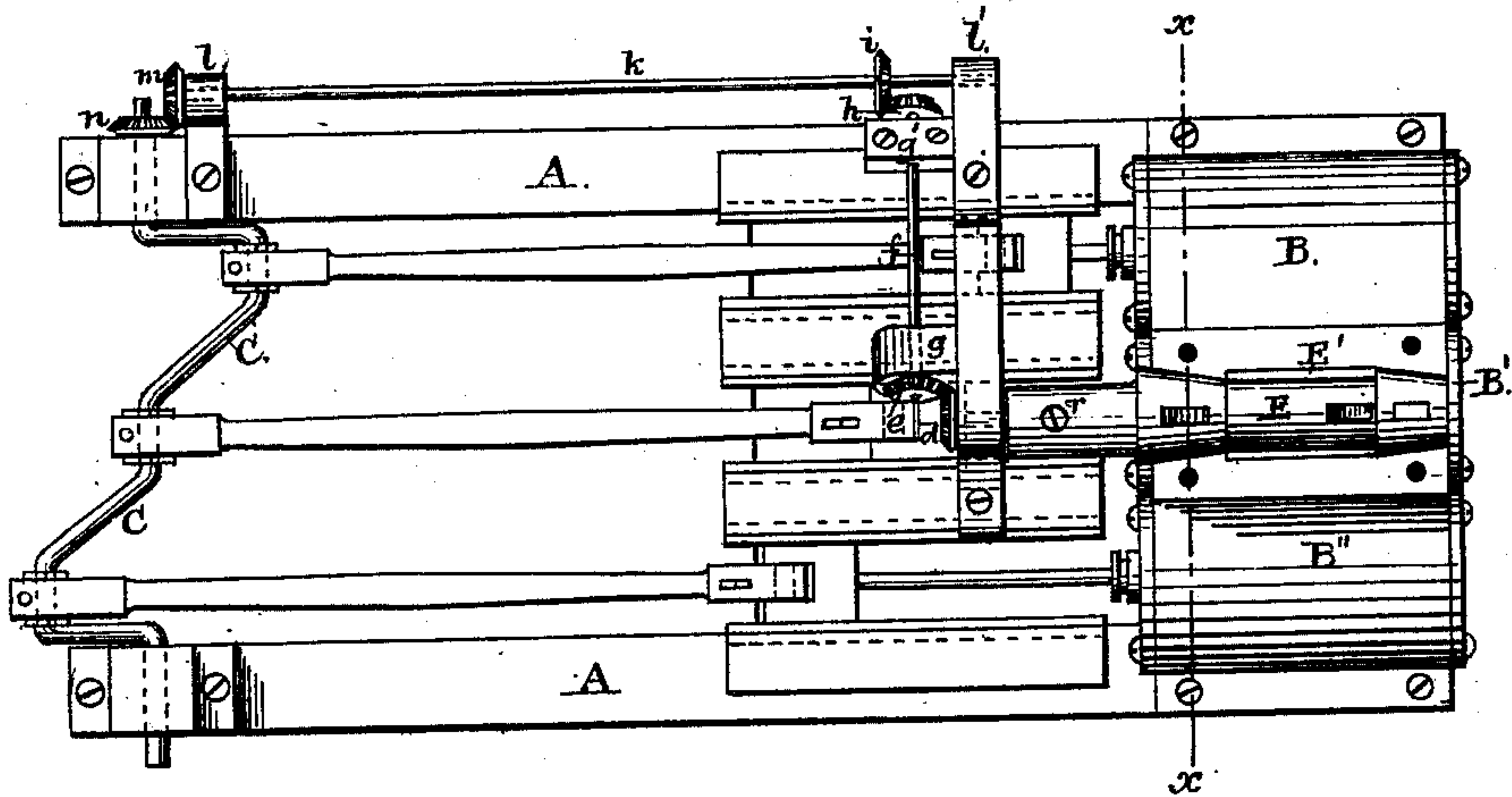


FIG. II.

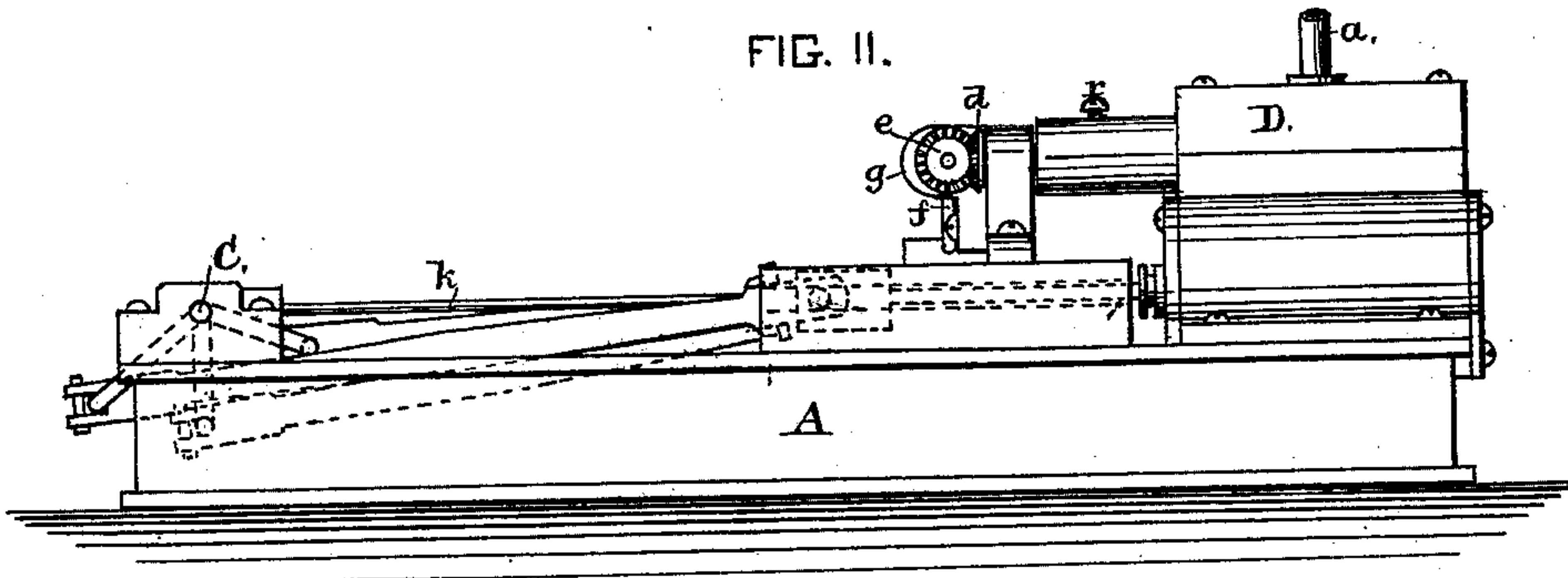


FIG. III.

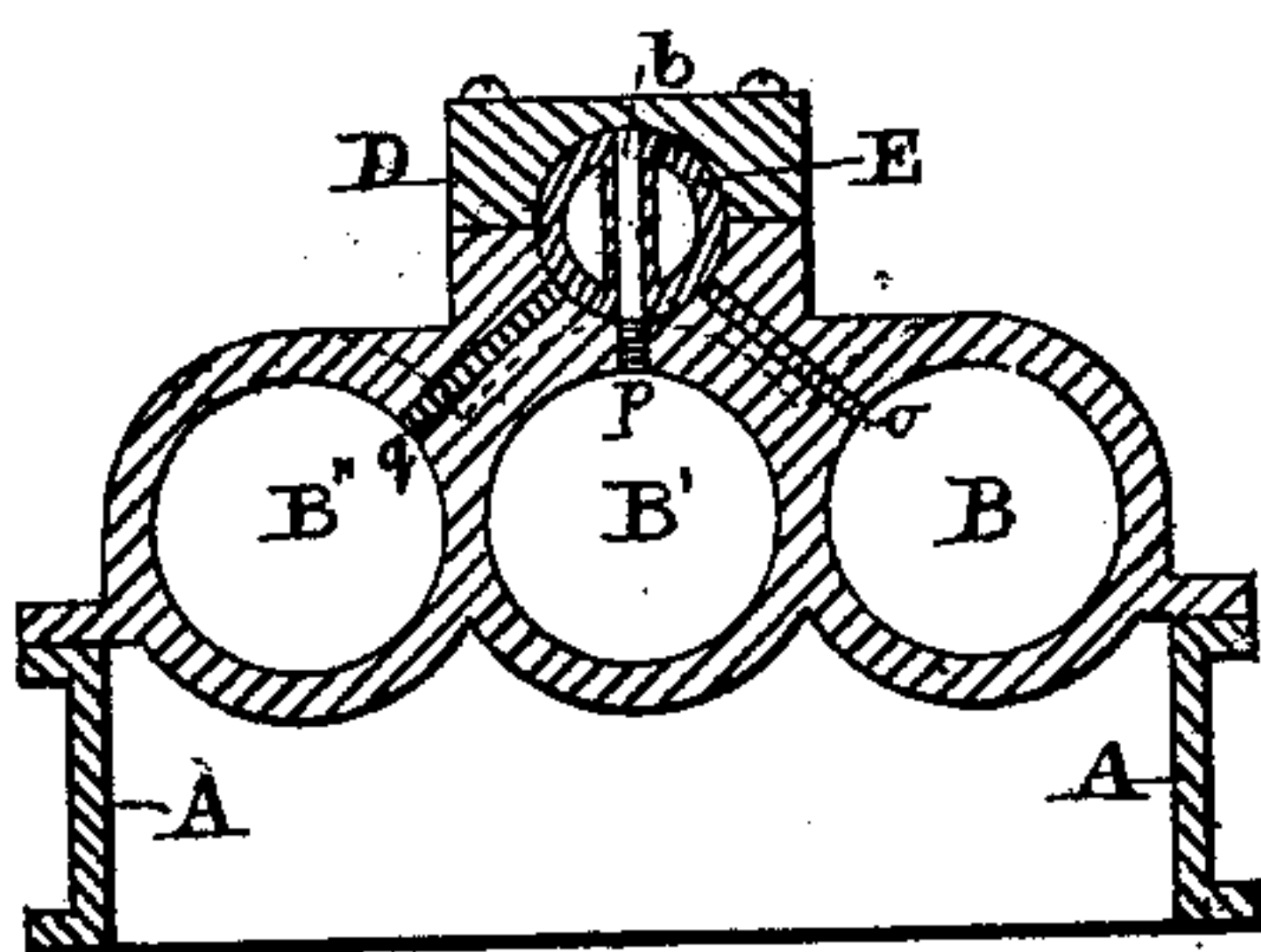
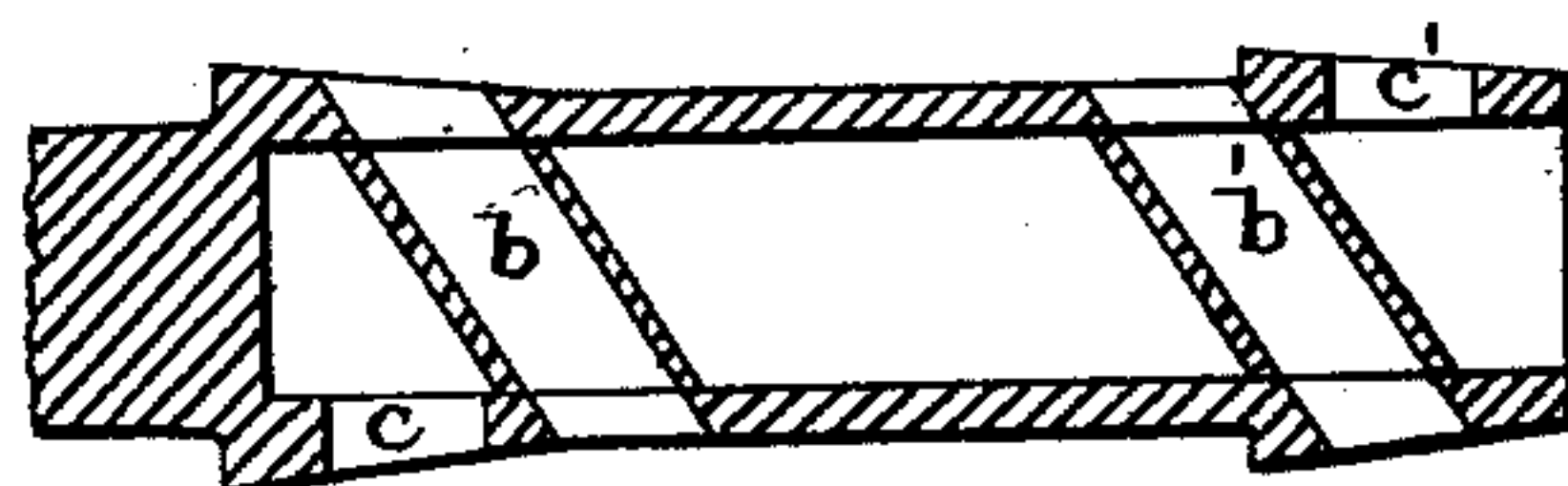


FIG. IV.



WITNESSES:

Nat. E. Oliphant  
Geo. R. Porter

INVENTOR.

Moses B. Harvey.  
per Charles H. Fowler  
Attorney.



# UNITED STATES PATENT OFFICE.

MOSES B. HARVEY, OF LEAVENWORTH, KANSAS.

## IMPROVEMENT IN COMPOUND STEAM-ENGINES.

Specification forming part of Letters Patent No. **218,528**, dated August 12, 1879; application filed July 16, 1879.

*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 Steam-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 drawings is a representation of a top-plan view of my improved engine with the valve chest cover removed. Fig. 2 is a side elevation of the same. Fig. 3 is a cross-section on line *xx* of Fig. 1. Fig. 4 is a longitudinal section of the valve.

The object of the present invention is to improve the construction and operation of that class of engines in which the steam is first used as high pressure and then as low pressure, before it escapes from the cylinder.

The invention consists of a rotary or oscillating valve provided with suitable openings or ports, by which the steam is properly divided and distributed at each stroke made by the engine as the same is required. It is caused to rotate by suitable gearing from the main shaft, or by spiral or cam blades worked by connections with any portion of the moving parts. Said valve is incased in ground seats at each of its ends, so as to supply and cut off through the seats any number of cylinders desired, and also so constructed as to vary the amount of supply to any fraction or part of boiler-pressure desired, in order to utilize the expansive power of the same before it is set free, and also so as to keep constantly one or more pistons acting with boiler-pressure to rotate the main or crank shaft. By such arrangement the boiler-pressure is continuous upon said crank in its entire revolution, and also the expansive power of each additional feed, thereby giving the engine a motion perfectly uniform throughout, or destroying both dead-centers common to all single engines, as while one cylinder is being fed the others are at work on the strong leverage of the crank. It is also so constructed that the boiler-pressure may at the same time press on more than

one piston, and still not interfere with the amount of steam to be consumed or used, thus giving the same amount of steam double power from boiler-pressure in addition to the expansive force which follows after each has been cut off and allowed to finish its stroke.

It also consists in arranging the ports so that the supply can be governed at will by enlarging them, or that they can be opened before or after or at the time of supply, and that more than one cylinder may be exhausting at the same time, thus securing the free and unencumbered travel of the piston.

The valve is tapering, and is made adjustable by means of springs or set-screws, so as to prevent leakage occasioned from wearing.

The valve may also be provided with an increased number of ports, so as to allow the engine to make more than one revolution to one of its own, thereby relieving it from rapid motion in cases of high-speeded engines, said motion being regulated by the proper number of teeth or cogs in gearing.

The valve may be set or placed in position, or at any time examined, by means of lines or dots on its outer surface, corresponding with or indicating the exact position of ports in chest or boxing and valve, so that the engine may at any time be reversed by backing or turning the valve by hand to the reverse feed and exhaust, (which varies as the number of cylinders is increased,) making said ports more or less numerous in the seats or ground journals.

One end of the valve may be at all times visible, so that any correction or alteration may be made without loosening the joints, which corrections are held by set screws in valve-stem or parts used to rotate the same.

The crank-shaft may be of ordinary construction, excepting that the angles at which the cranks are set are so placed as to accommodate or work in unison with the proper feed or supply at the dead-centers of each cylinder, thus securing the uniform and continuous boiler-pressure, not only from cylinder to cylinder, but also at the time of passing from one side or end of the cylinder to the opposite end, and thus securing the boiler-pressure continuously throughout the entire revolution of



the cranks, the number of degrees between them being varied according to the number of cylinders employed.

The guides, cross-heads, stuffing-boxes, &c., may be of the ordinary style, and a fly-wheel or faced pulley may be used on the main shaft to operate the machinery.

The steam-chest, with the valve, may be arranged under the cylinders, if desired, so as to allow the condense-water to drain off instead of entering the cylinder, all of which will be hereinafter more fully described.

In the accompanying drawings, A represents a suitable frame, to which the cylinders B B' B'' are secured at one end, while pillow-blocks, with the crank-shaft C, are arranged at the opposite end. The guides, cross-heads, stuffing-boxes, and connecting-rods are of the ordinary construction.

The steam-chest D and valve E are arranged over the central cylinder, B'. The valve is made conical or tapering at both ends, and cylindrical in its central part. Around the central part of the valve is arranged an enlarged part, E', for the steam, which is admitted through the steam-pipe *a*. In the valve are arranged the steam and exhaust ports *b b' c c'*, and their number may be varied to suit the number of cylinders. On the inner end of the valve is secured a bevel-wheel, *d*, which meshes into the teeth of a similar wheel, *e*, on the shaft *f*, journaled in brackets *g g'*. On the opposite end of shaft *f* is secured a bevel-wheel, *h*, meshing into the teeth on wheel *i*, secured to a shaft, *k*, said shaft being journaled in the brackets *l l'*. On the shaft is secured the bevel-wheel *m*, which meshes into wheel *n*, on the main shaft, from which, through this gearing, the valve receives its motion.

The cylinder-ports are shown at *o p q* in Fig. 3 of the drawings, the valve-ports admitting steam through port *p* to cylinder B'. A set-screw, *r*, holds the valve in position when properly adjusted as desired.

The operation of the engine is as follows: Steam or other motive power enters the steam-chest at *a* into the space E', and passes through port *b'* into cylinder B at one end, while the

exhaust passes out through port *c'* at the other end; and as the inlet-port advances to leave the first port, the space between the ports being the same width as the ports, it will be seen that as it cuts off the first the second is immediately fed, so that, as all are fed at one end, the valve has so changed its position as to begin to feed at the other end. When the feed is completed at one end the exhaust-ports have shifted accordingly. The boiler-pressure is never off the pistons, and with three or more cylinders it is confined to the leverage most profitable to the working of the engine.

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

1. In a compound engine, the combination of the cylinders B B' B'', with a rotary valve provided with incline inlet and straight outlet ports, constructed and arranged substantially as shown and herein specified.

2. In combination with a compound engine, the rotary valve E, provided with ports *b b'* and *c c'*, arranged substantially as shown and described.

3. In a compound engine, the rotary valve E, having conical or tapered ends and cylindrical central part, and provided with ports *b b' c c'*, and arranged in the steam-chest D substantially as shown and herein set forth.

4. In a compound engine having cylinders B B' B'', the rotary valve E, constructed as described, and operated by gearing from the main shaft, arranged substantially as specified.

5. The compound engine herein described, consisting of the frame A, cylinders B B' B'', steam-chest D, rotary valve E, crank-shaft C, connecting-rods, guide and cross heads, and suitable valve-driving mechanism, substantially as set forth.

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

MOSES B. HARVEY.

Witnesses:

A. E. CHANDLER,

GEO. S. WOODWARD.