A. S. CAMERON.

EXPANSION ENGINE.

No. 184,587. Patented Nov. 21, 1876.

Fig. 1.

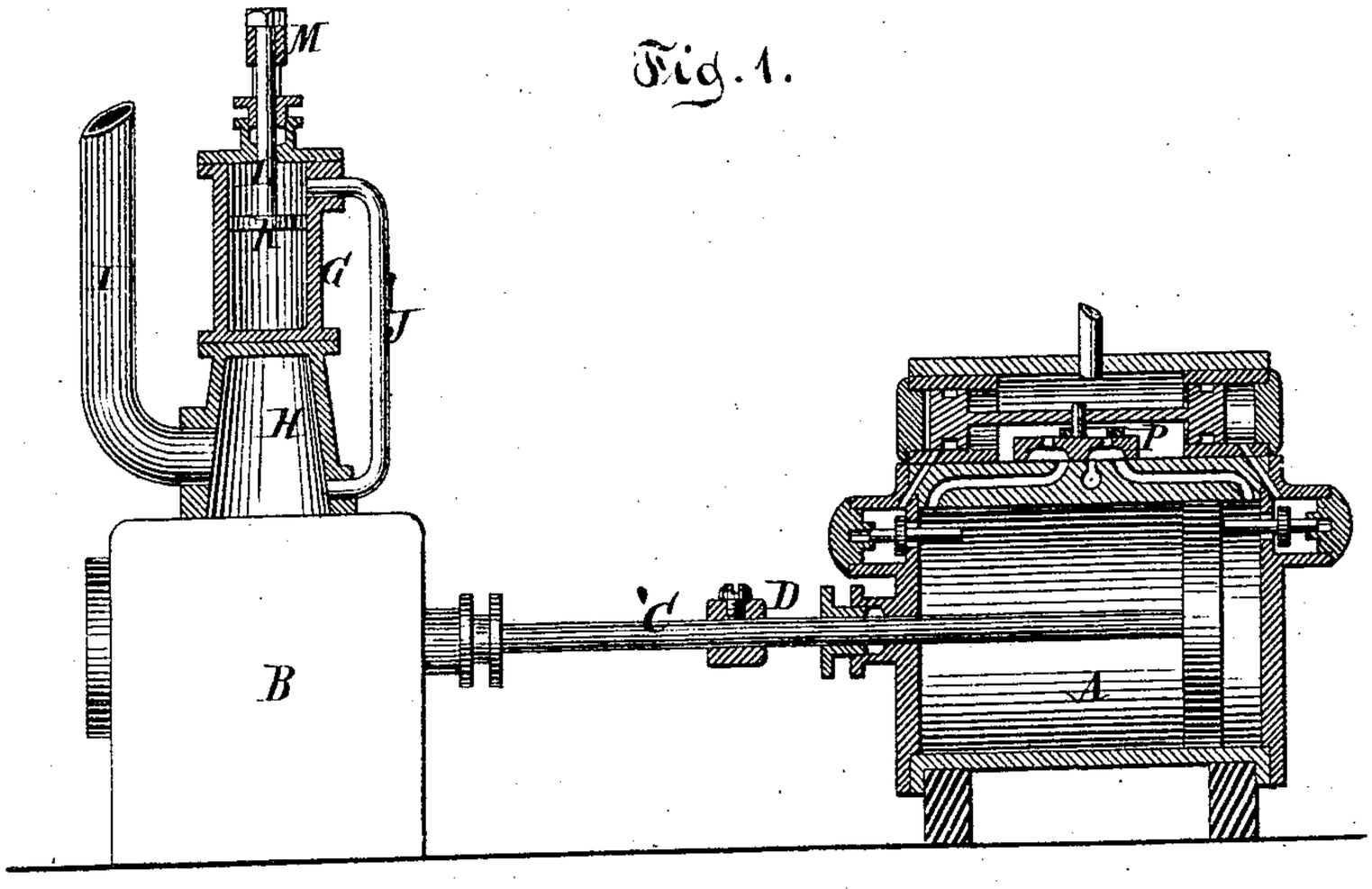
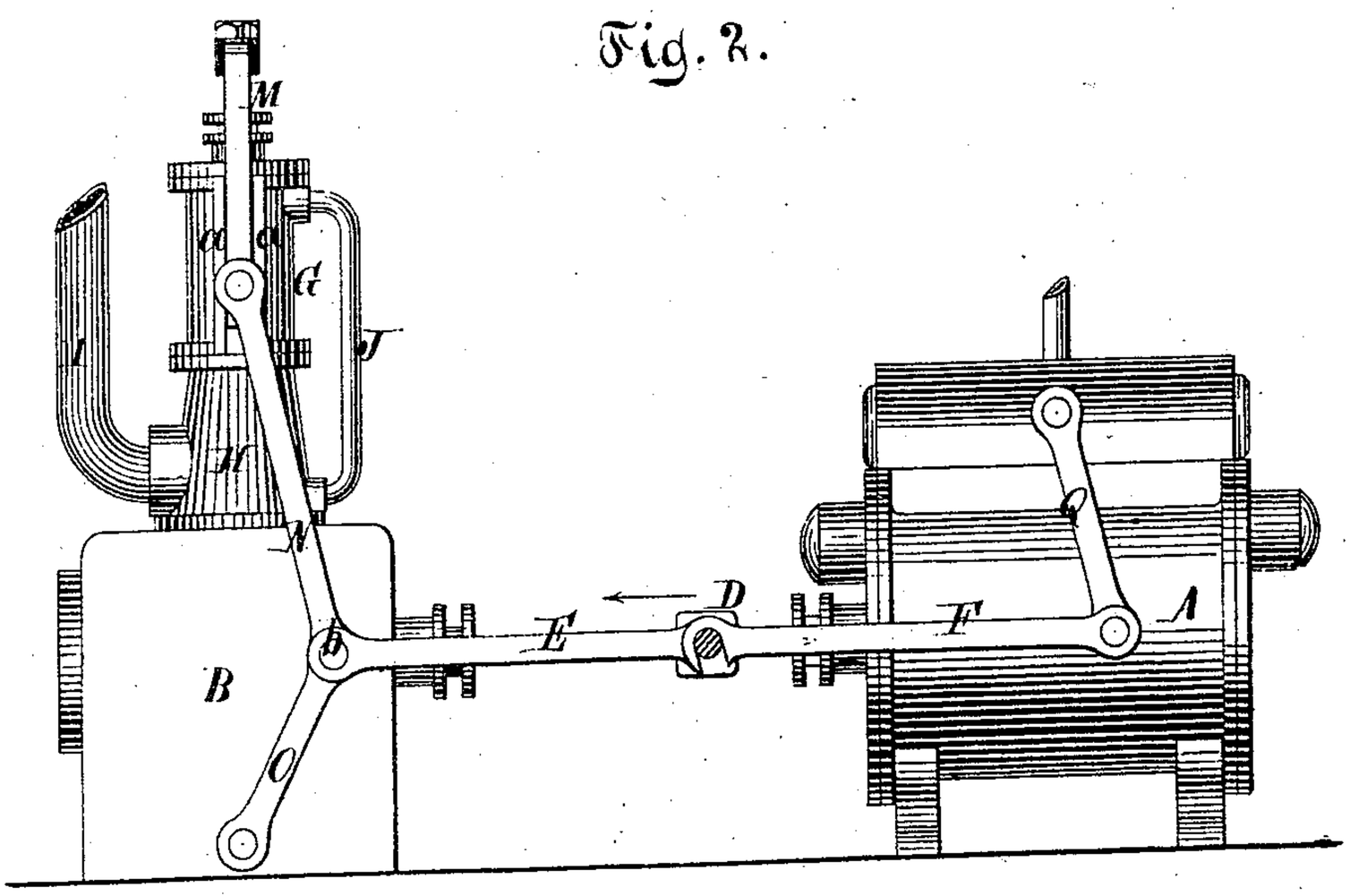


Fig. 2.



Witnesses.
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UNITED STATES PATENT OFFICE.

ADAM S. CAMERON, OF NEW YORK, N. Y.

IMPROVEMENT IN EXPANSION-ENGINES.

Specification forming part of Letters Patent No. **184,587**, dated November 21, 1876; application filed October 11, 1876.

To all whom it may concern:

Be it known that I, ADAM S. CAMERON, of the city, county, and State of New York, have invented a new and useful Improvement in Expansion-Engines, heretofore patented by me in Great Britain, April 9, 1875, No. 429, which improvement is fully set forth in the following specification, reference being had to the accompanying drawing, in which—

Figure 1 represents a longitudinal vertical section. Fig. 2 is a side view.

Similar letters indicate corresponding parts.

This invention relates to means whereby an engine may be constructed to use steam expansively by so arranging the parts that the resistance to be overcome by the pressure applied to the motive-piston will gradually decrease toward the end of its stroke, thus compensating for the gradual reduction of pressure in the steam-cylinder by expansion.

Hitherto it has been necessary in practice to employ a weight or body of matter in engines using steam expansively, which weight, after it has been set in motion by the primary pressure of the steam, continues to move by its own momentum, and so compensates for the reduced pressure of steam in the cylinder. In what are known as "Cornish engines," this weight is generally furnished by pump-rods, or weights are attached to the piston or other moving parts of the engine, and in rotative engines the fly-wheel accomplishes the same purpose. But as this moving matter renders engines in which it is employed costly, not only in themselves, but also in their foundations and other accessories, and, moreover, makes them liable to accidents, and unavailable for high speeds, it is desirable to avoid the necessity for the same.

In the accompanying drawing I have represented a direct-action steam-pump constructed according to my present invention.

In this drawing, the letter A designates the steam-cylinder, and the letter B the pump-cylinder, the pistons of which are connected by a rod, C. On this rod I have secured a cross-head, D, which connects with the compensating-gear by two rods, E, and with the expansion-gear of the steam-cylinder by a rod, F. These rods are provided at their ends with hooks, which catch over pivots formed at the end of the cross-head, so that said rods can be readily disengaged, and the pumping-engine can be worked, in the ordinary manner, without expansion. The compensating-gear which I have represented in the drawing consists of a cylinder, G, which is secured to the top of the air-vessel H of the pump. From one side of this air-vessel extends the ascension-pipe I, and from its opposite side extends a pipe, J, which leads into the top of the cylinder G. In this cylinder works a piston, K, from which extends a rod, L, through a stuffing-box in the cylinder-cover, and on the upper end of this rod is secured a yoke, M, which is guided between flanges *a a*, cast with or otherwise secured to the sides of the cylinder G. With this yoke are combined two pairs of toggle-levers, each pair consisting of two sections, N O, which are connected together by pivots *b*, while the upper sections are attached to the yoke M by pivots *c*, and the lower sections of the sides of the pump-cylinder by pivots *d*. The pivots *b*, which form the connection between the sections N O of the toggle-levers, support the outer ends of the rods E, which connect the compensating-gear with the cross-head D.

The cut-off valve or expansion-slide P is moved by a lever, Q, which connects with the cross-head D by the rod F. The valve-gear which I have represented in the drawing is of that class known as "steam-moved valves;" but my present invention is applicable to steam-engines with any suitable cut-off valve-gear.

When it is desired to work my engine without expansion, the rods F and E are disconnected from the cross-rod; but when the rods F and E are connected to the cross-head, as shown in Fig. 2, the operation is as follows: When the steam-piston moves in the direction of the arrow, Fig. 2, the water ejected by the pump is forced up through the ascension-pipe I; but a portion of such water passes through the pipe J into the upper part of the cylinder G, while at the same time the piston K in the cylinder is moved upward against the pressure of the water acting on it. As soon as the toggle-levers N O pass their center of motion, however, the piston K begins to descend, and as it is continually exposed to the pressure of the water acting on its upper surface, it moves

down with considerable power; and if steam has been cut off at any point of the stroke of the steam-piston, the decreasing power of the expanding steam during the latter part of the stroke of the steam-piston is compensated for by the pressure of the water on the piston K during its descent. It will also be noticed that by the combination of the toggle-levers N O with the piston K and cross-head D, the power exerted by the piston K on said cross-head increases during its descent, while at the same time the pressure of the expanding steam on the steam-piston decreases.

It will be seen from this description that the power exerted by the compensating-piston K during the second half of each stroke of the steam-cylinder changes with the resistance to be overcome—that is to say, if the height to which the water is forced increases, the downward pressure of the water on the compensating-piston, and consequently the power exerted by the compensating-gear, increases in a corresponding ratio, and vice versa; and for this reason, whenever I apply a compensating-gear to a steam-pump, I prefer to use the mechanism shown in the drawing; but, if desired, a simple weight or spring may be substituted for the piston K, said weight being raised during the first part of each stroke of the steam-piston, and being made to descend during the second half; but it is obvious that the compensating power exerted by such weight will be uniform, no matter what may be the resistance to be overcome. The compensating-piston K may also be so arranged that it exerts its compensating power during its upward stroke; but I prefer the arrangement shown in the drawing. It must also be remarked that steam might be made to act on the piston K instead of water, or that the cylinder G can be connected to a condenser or vacuum-pump in one end of said cylinder.

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

1. The combination, with a steam-engine in which the steam is worked expansively, of a secondary piston or plunger, working in a cylinder and exposed to the pressure of water, steam, or air, substantially as described, whereby power is absorbed at the commencement and given off toward the end of the stroke of the piston, as set forth.

2. The combination, with a steam-engine in which steam is worked expansively, of a piston or weight, connected by toggle-levers with the piston-rod or cross-head of the steam-engine, substantially in the manner and for the purpose herein shown and described.

3. The combination, with the compensating-piston K and its toggle levers N O, and with the cut-off lever Q, of hooks E F, substantially as described, whereby the engine can be worked without expansion, as set forth.

In testimony that I claim the foregoing I have hereunto set my hand and seal this 9th day of October, A. D. 1876.

A. S. CAMERON. [L. S.]

Witnesses:

W. HAUFF,

E. F. KASTENHUBER.