

G. J. WARDWELL.  
Oscillating Steam-Engines.

No. 156,685.

Patented Nov. 10, 1874.

Fig. 1

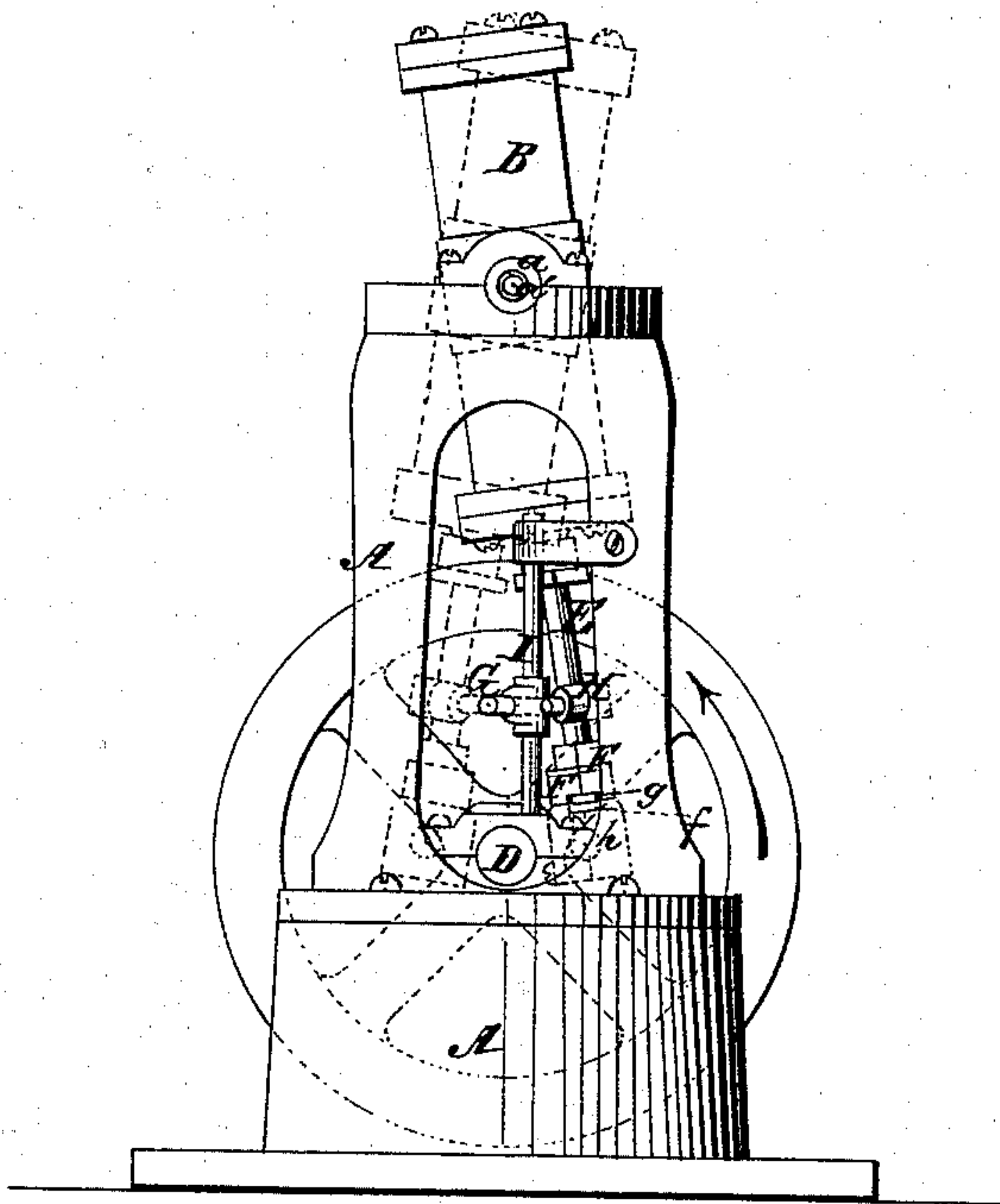


Fig. 2

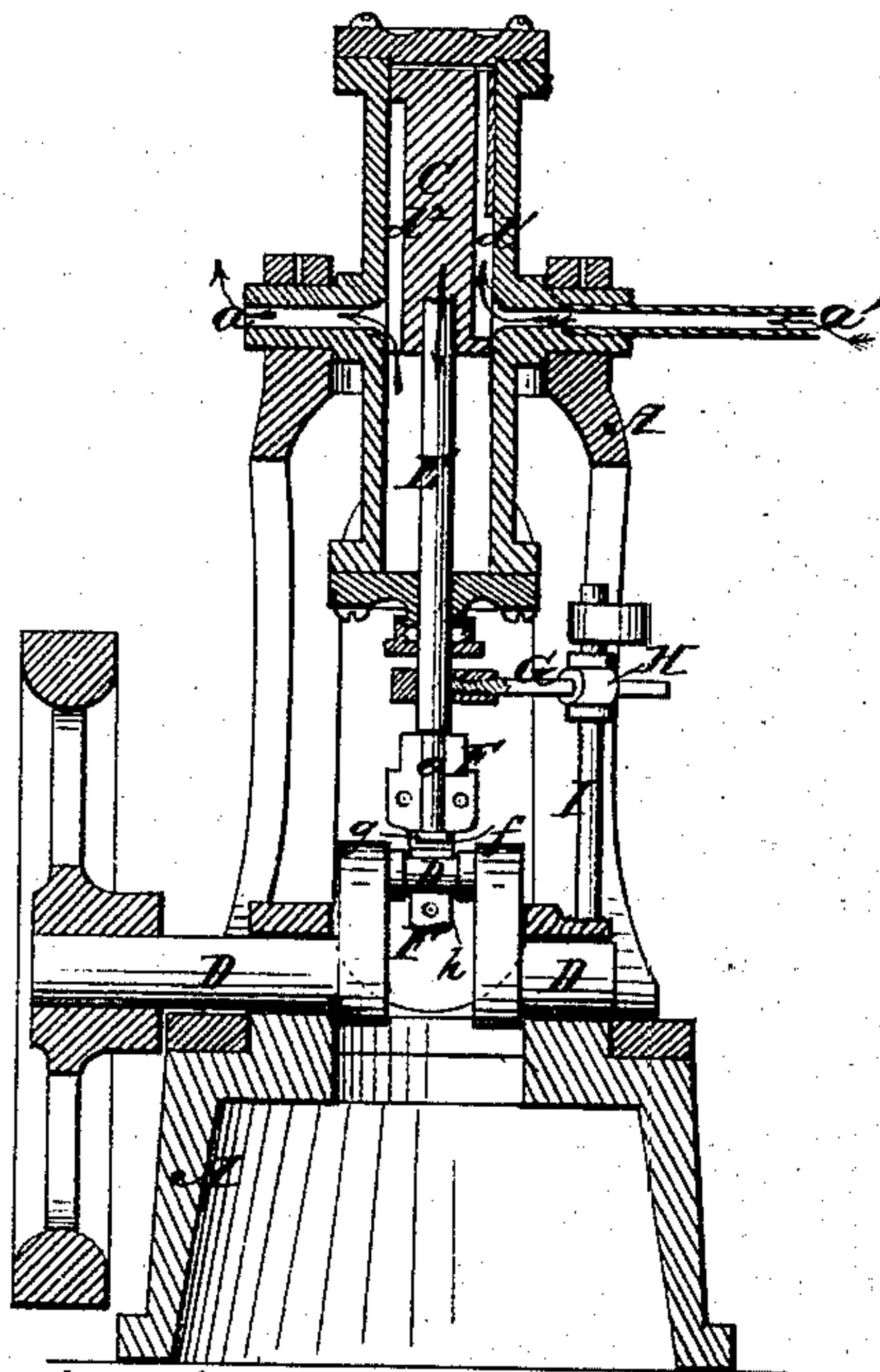


Fig. 3

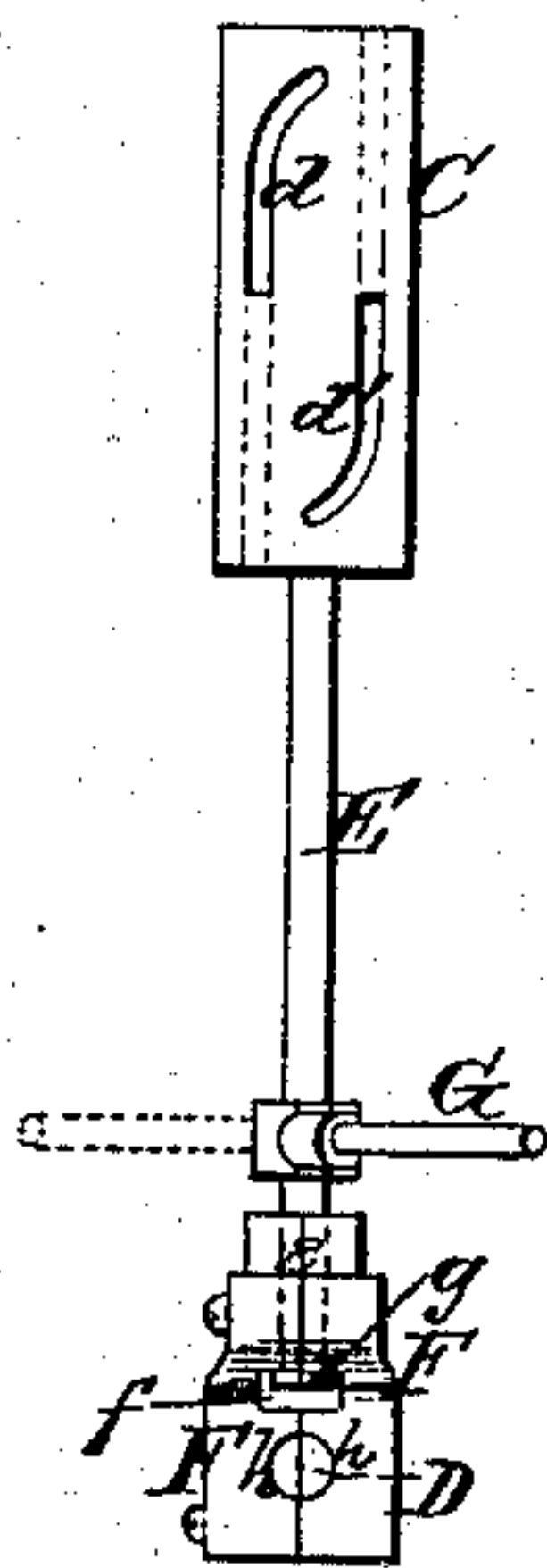


Fig. 4

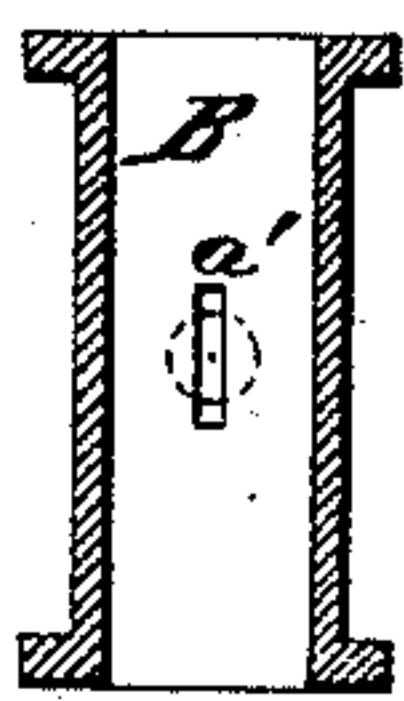
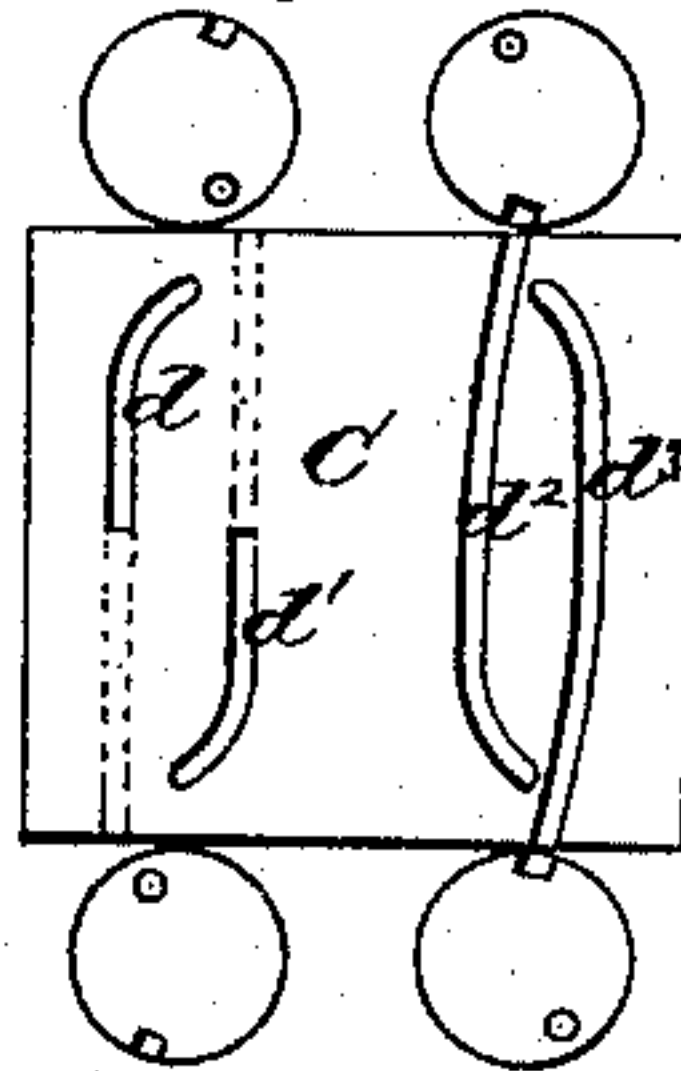


Fig. 5



Witnesses.  
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# UNITED STATES PATENT OFFICE.

GEORGE J. WARDWELL, OF RUTLAND, VERMONT.

## IMPROVEMENT IN OSCILLATING STEAM-ENGINES.

Specification forming part of Letters Patent No. 156,685, dated November 10, 1874; application filed October 1, 1874.

*To all whom it may concern:*

Be it known that I, GEORGE J. WARDWELL, of the town and county of Rutland, State of Vermont, have invented a new and useful Improvement in Oscillating Steam-Engines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings making part of this specification, in which—

Figure 1 is a side elevation of an oscillating engine constructed in accordance with my invention. Fig. 2 is a vertical central section of the same. Fig. 3 is a side elevation of the piston and its rod, and strap or box by which the crank-shaft is connected to the piston-rod. Fig. 4 is a longitudinal section of the cylinder. Fig. 5 is a diagram on a plane of the circumference of the piston.

First, the nature of my invention consists in the combination, with the piston-rod of an oscillating engine and a guide-rod, of means for turning the piston while it is reciprocating; second, in the crank-shaft strap or box, made in two halves, and constructed to receive and confine the lower end of the piston-rod of an oscillating engine while it clasps around the crank-shaft.

The first part of my invention is designed for so operating the piston of an oscillating engine that its curved receiving and exhausting passages shall be brought and kept in range with the inlet and exhaust ports of the cylinder during the inward and outward strokes of the piston. The construction and operation of my invention are such that the use of valves in or on the cylinder are rendered unnecessary, and yet the steam may be cut off at any point desired, and worked on the expansion, while the piston is balanced at proper times in range with the inlet and exhaust passages of the cylinder during the inward and outward strokes of the piston; and the second part of my invention is to simplify, render more convenient and durable, as well as cheapen the connecting means between the crank and piston-rod of oscillating engines.

A represents the frame of the engine, cast in two upright circular parts, with openings through it for making it light and giving access to its interior, wherein the working parts of the engine are arranged. The lower part

has a broad base-flange, and the upper part has a flange at its base, by which it is bolted to the lower part.

Any other style of frame may be adopted; but the one shown is light, strong, and cheap.

B is the oscillating cylinder, hung by its hollow journals *a a* in boxes upon the top of the frame, so that about one-half of its length extends down into the frame. This cylinder is perfectly plain in its bore, having no other chamber or passages besides the receiving-passage *a<sup>1</sup>* and the exhaust-passage *a<sup>2</sup>* through its journals *a a*, which passages are enlarged and narrowed as they approach the interior circumference of the cylinder, in order that the discharging end thereof shall be equal in its capacity to the receiving end. C is the piston, having in it reverse-operating receiving-passages *d d<sup>1</sup>*, of about the curvilinear shape represented. These passages commence near opposite ends of the cylinder in open grooves, and then for about one-half, more or less, of their length take the form of inclosed channels or tubes, and extend to the ends of the piston, so as to open into the cylinder at opposite ends of the piston. On the opposite side of the piston reverse-operating exhaust-ports *d<sup>2</sup> d<sup>3</sup>* are formed in the piston, these taking the form of open grooves from their beginning to their ending. The receiving and exhausting ports are of about the same shape, and they, respectively, work together in pairs, one of the exhaust-ports and one of the receiving-ports operating on the in stroke and the others operating on the out stroke of the piston. These ports are so arranged that the steam acts on both sides of the piston simultaneously, for the purpose of balancing the piston, while only one of the ports thus acting is in communication directly with the steam-inlet passage; and while this is the case the tubular portions of the receiving-channels cause the steam to be cut off and worked on the expansion near the completion of the in and out strokes of the piston. To work this piston, it is connected to a crank-shaft, D, by its rod E; and to make this connection, I have devised a strap or box, F F, made of two halves, and in the upper part of these halves semicircular bearing or box seats *e e* for the lower end of the piston-rod are formed, and below these seats a transverse



passage, *f*, is made through each of the pieces, in order to accommodate an enlargement, *g*, of the end of the rod, and below this passage semicircular bearing or box seats *h h* for the crank of the shaft are made transversely through the pieces *F F*, as shown. The pieces *F F* are placed laterally against the crank-wrist between the crank-arms, and against the piston-rod above its enlarged end, and clamped loosely upon the same by bolts or screws. The connection thus made produces an oscillation and reciprocation of the piston; and now, to turn the piston during these movements, a coupling-pin, *G*, standing at right angles to the piston-rod, is firmly fastened by an eye-piece to the rod, and this pin is passed loosely through an eye of a vertically-sliding piece, *H*, which is fitted loosely by an eye over a vertical rod, *I*, which is rigidly connected to the frame *A*, as shown. By this coupling contrivance, which may be varied in its construction and arrangement without departing from my invention, the piston-rod and piston are vibrated circularly during the oscillating move-

ments of the piston and cylinder, and thus the ports of the piston are brought properly in range with the inlet and exhaust passages, both on the in and out strokes of the piston.

It may be found desirable to use other power than steam for working this engine, and therefore I reserve to myself the privilege of using either steam, air, gas, or any other suitable agent as the power for operating the piston.

What I claim as my invention is—

1. The combination, with the oscillating piston-rod *E* and the guide-rod *I*, of a sliding connecting device, *G H*, for turning the piston while the piston is oscillating with the cylinder, and sliding back and forth therein, substantially as and for the purpose set forth.

2. The combination of the connecting strap or box, made of two halves, as described, with the crank-shaft and piston-rod of the engine, substantially as and for the purpose set forth.

GEORGE JEFFARDS WARDWELL.

Witnesses:

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C. CLARK.