

W. H. HARRISON.
Direct-Action Engines.

No. 156,346.

Patented Oct. 27, 1874.

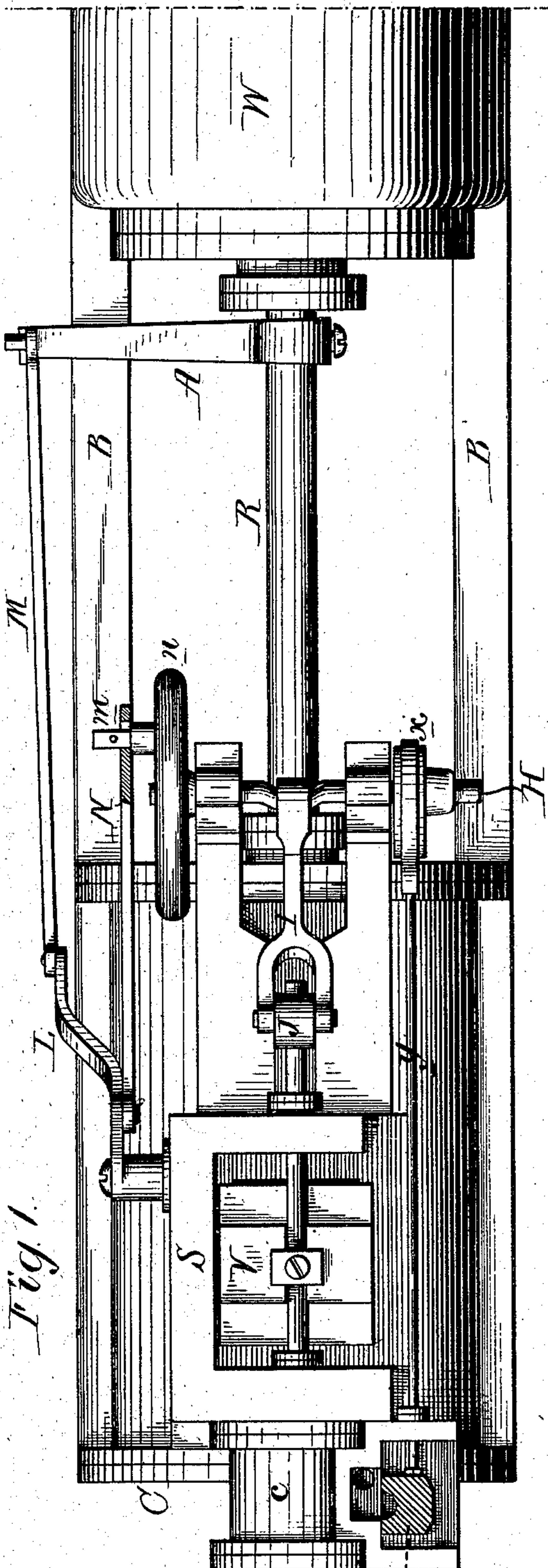


Fig. 1.

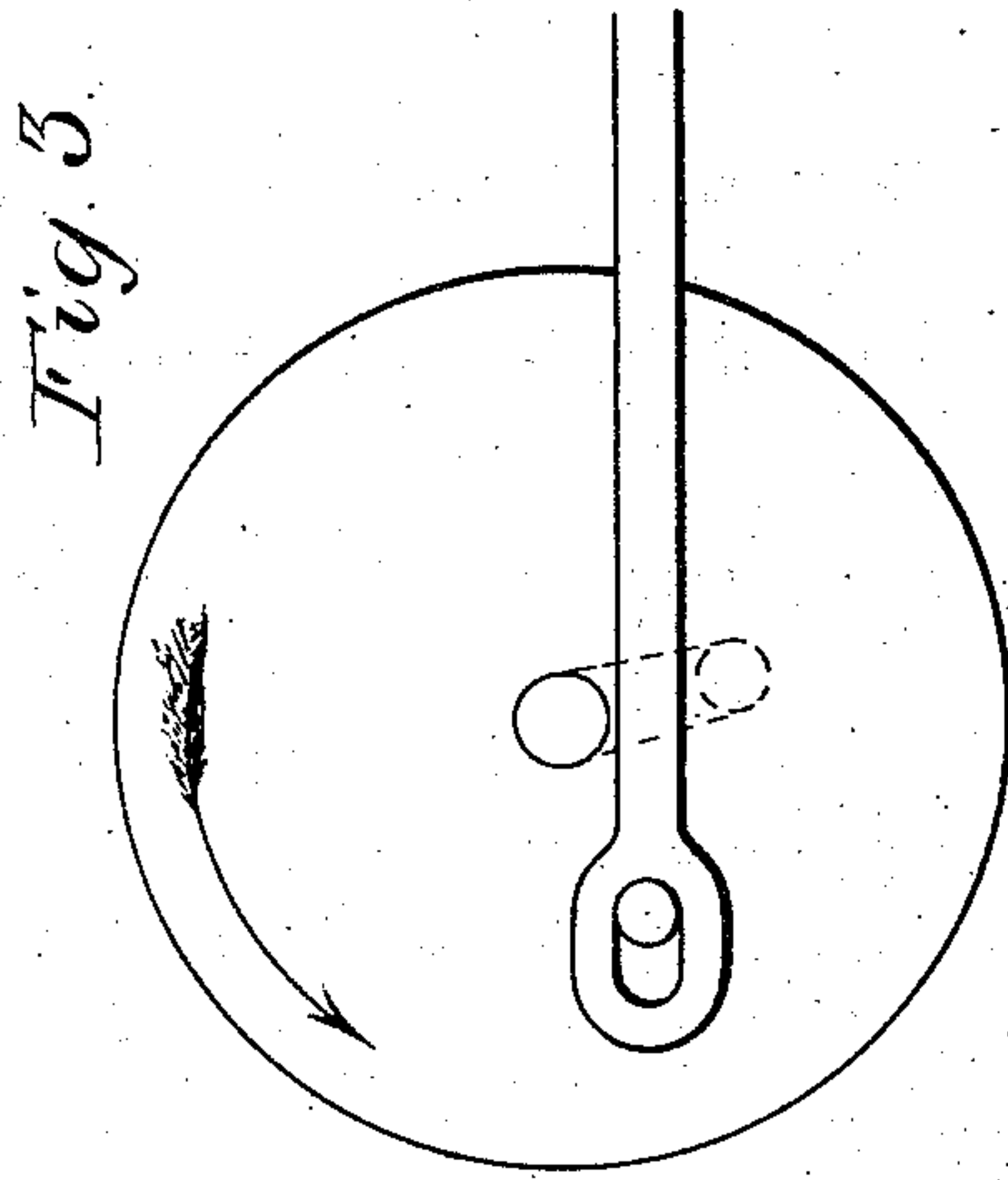


Fig. 3.

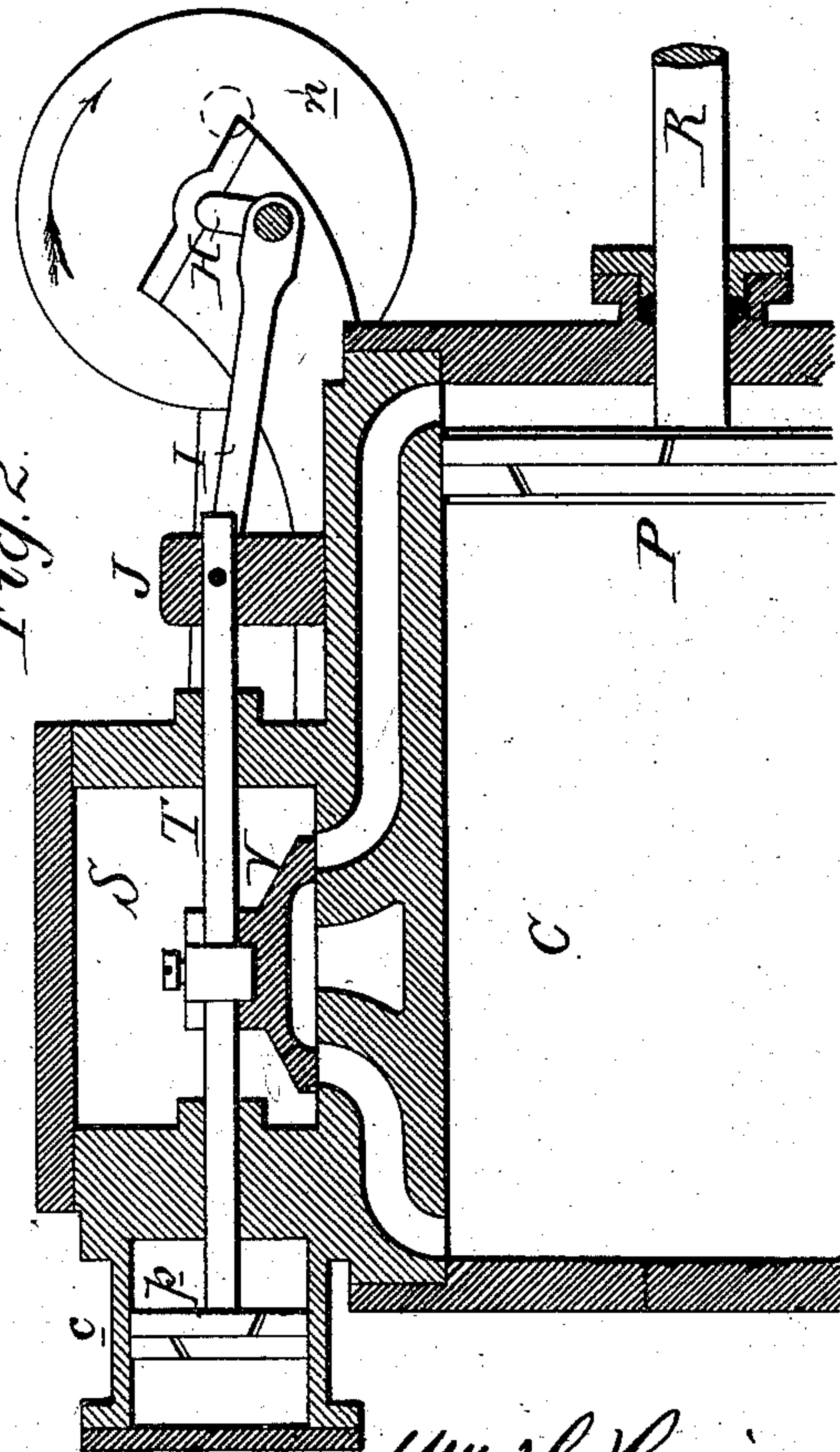


Fig. 2.

Witnesses, Harry Smith
Thomas McIlwain

Wm H. Harrison
by his Atty.
Horton and Son.

UNITED STATES PATENT OFFICE.

WILLIAM H. HARRISON, OF BETHLEHEM, PENNSYLVANIA.

IMPROVEMENT IN DIRECT-ACTION ENGINES.

Specification forming part of Letters Patent No. **156,346**, dated October 27, 1874; application filed May 21, 1874.

To all whom it may concern:

Be it known that I, WILLIAM H. HARRISON, of Bethlehem, Northampton county, Pennsylvania, have invented an Improvement in Direct-Action Engines, of which the following is a specification:

My invention relates to that class of pumping or blowing engines in which the piston of the steam-cylinder is directly connected to the rod of the pump or blowing piston; and the main object of my invention is to obtain such a positive movement of the valve of the steam-cylinder that the latter will control the movement of the piston as effectually as though it were connected directly to a crank furnished with a fly-wheel, and this without resorting to any heavy or costly mechanism. This object I attain by means of a small supplementary steam-engine, controlled by the main engine in the manner which I will now proceed to describe, reference being had to the accompanying drawing, in which—

Figure 1 is a plan view of sufficient of a direct-action pumping or blowing engine to illustrate my invention; Fig. 2 being a vertical section, and Fig. 3 a diagram illustrating one feature of my invention.

C is the main steam-cylinder, and W the pump or blowing cylinder, both being secured to the base-plate B, and the piston of the former being directly connected to the bucket or piston of the latter by the rod R. On the main cylinder is the steam-chest S, containing a slide-valve, V, operating, in connection with the ordinary steam and exhaust ports, in the usual manner. The valve-spindle T is connected to and forms the rod of the piston *p* of the small supplementary steam-cylinder *e*, which has steam and exhaust ports adapted to a slide-valve, *v*, contained in a suitable steam-chest, and operated by an eccentric, X, on a crank-shaft, H, through the medium of an ordinary eccentric rod, *y*. The said shaft H is adapted to suitable bearings on the main cylinder, or any fixed portion of the engine, and the cranked portion of the shaft is connected, by a rod, I, to a guided cross-head, J, secured to the main valve-spindle T. An arm, A, on the piston-rod R, is connected, by a rod, M, to an arm, L, hung, in the present instance, to the side of the main steam-chest S; and the said

arm L is connected to a crank on the shaft H, the said crank consisting, as here shown, of a pin, *m*, and small fly-wheel *n*, secured to the said shaft.

It will be observed that the small cylinder *e*, its piston *p*, rod T, connecting-rod I, crank-shaft H, eccentric X, rod *y*, and valve V, constitute a complete supplementary steam-engine, requiring no aid except, perhaps, a small fly-wheel, to rotate the shaft H, the movement of which is maintained in unison with that of the main engine by connecting the rod R to a crank on the shaft H, in the manner described, or in any other manner substantially the same. In other words, while the crank H makes one complete revolution, the piston of the main cylinder makes a double stroke. The main crank on the shaft, and the crank connected, by the rod N, to the vibrating lever L, are arranged at right angles, or thereabout, to each other, so that the crank of the supplementary engine is aided, on passing the dead-centers, by the movement of the main engine.

The object of thus using a small supplementary engine will be understood when it is borne in mind that without it the crank *m* would be liable to stop on its dead-center, and, if sufficient lead were given the main valve to start the piston P on its return stroke, the breakage of the vibrating arm or its connections would be the result; or else the parts would require to be made sufficiently strong to control the main piston, and this would be a return to the old crank-and-fly wheel engine, with the vibrating lever added.

In direct-action pumps or blowing-engines the stroke is occasionally apt to vary slightly in length; hence I make an elongated opening in the rod N, (see Fig. 3,) to admit the crank-pin *m*, this elongated opening permitting the main piston to exceed its normal stroke without imparting any injurious strain to the pin or its connections. The elongated opening, moreover, permits the required lead to be given to the valve V, while the main piston remains for a short time stationary at the end of the stroke, and also allows the engine to start at any point where it may have been stopped. In other words, the large engine rigidly controls the small engine, excepting at the points where the lost motion due to the elon-

gated opening in the rod I occurs; and it is this lost motion which permits the small engine to have such a temporary independent action that the results described above are attained.

The operation of the different parts will be readily understood by those familiar with machinery of this class without further description. It will also be understood that it is not necessary to adhere to the precise mechanism described for imparting, from the main reciprocating piston-rod to the shaft H, a rotary motion, as other devices for effecting this purpose will readily suggest themselves.

I claim as my invention—

1. The combination, in a direct-acting pumping or blowing engine, of a supplementary engine, with a rotating crank-shaft as the sole

medium for operating and limiting the movement of the valve of the main engine with connecting devices, whereby the movements of the said crank-shaft, and, consequently, of the main valve, by the supplementary engine, are timed by and in accordance with the requirements of the main engine, all as set forth.

2. The combination, with the crank-shaft H and its pin *m*, of the rod M, having an elongated opening, as and for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WM. H. HARRISON.

Witnesses:

WM. A. STEEL,

HARRY SMITH.