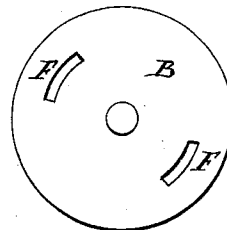
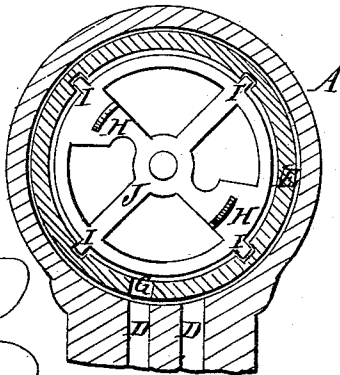
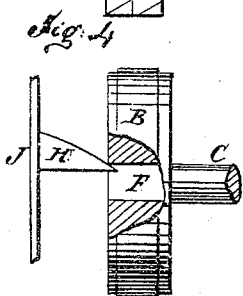
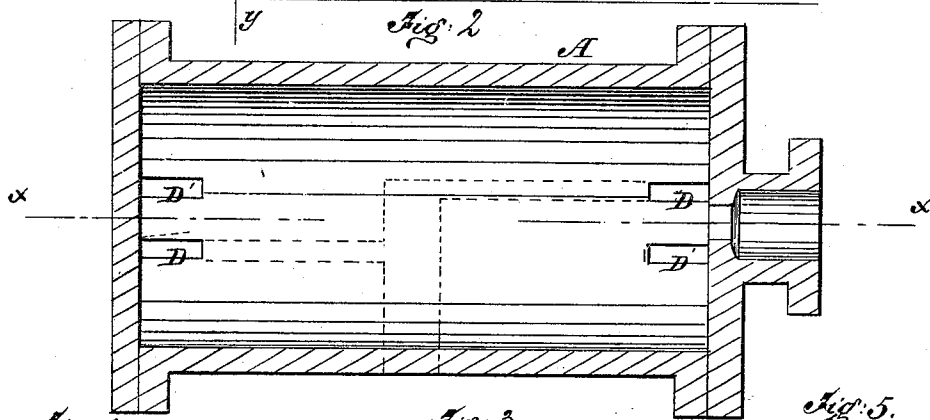
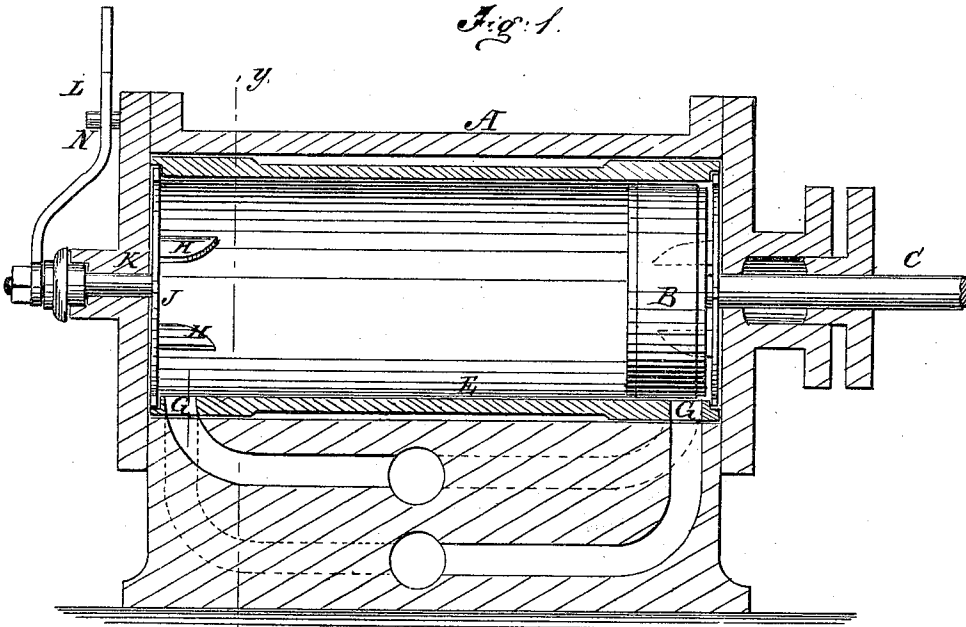


A. E. WHITE.
Steam-Engines.

No. 148,393.

Patented March 10, 1874.



WITNESSES:

Chas. Nida
Belgium

INVENTOR:

BY

ATTORNEYS.

UNITED STATES PATENT OFFICE.

ALBERT E. WHITE, OF ST. PAUL, MINNESOTA.

IMPROVEMENT IN STEAM-ENGINES.

Specification forming part of Letters Patent No. **148,393**, dated March 10, 1874; application filed January 24, 1874.

To all whom it may concern:

Be it known that I, ALBERT E. WHITE, of St. Paul, in the county of Ramsey and State of Minnesota, have invented a new and useful Improvement in Steam-Engines, of which the following is a specification:

This invention relates to the construction of steam-engines; and consists in the mode of introducing and exhausting the steam into and from the cylinder, whereby all valves are dispensed with, and the engine is rendered simple and efficient.

In the accompanying drawing, Figure 1 represents a longitudinal vertical section taken on the line *xx* of Fig. 2. Fig. 2 is a central horizontal section of the cylinder, showing the steam and exhaust ports. Fig. 3 is a vertical cross-section of Fig. 1, taken on the line *yy*. Fig. 4 is a detail, showing the action of the piston on the cams and sleeve. Fig. 5 is a detail, showing the end of the piston.

Similar letters of reference indicate corresponding parts.

A is the cylinder. B is the piston. C is the piston-rod. D D' are the induction and eduction ports of the cylinder. E is a sleeve or interior cylinder, fitted into the outer cylinder A, which sleeve receives a slight rotating motion by means of cams at each end of the cylinder, actuated by the piston. F F are mortises in each end of the piston, which receive the cams and turn the sleeve sufficiently to change the ports at the end of each stroke. G is a port in each end of the sleeve. (See Fig. 3.) H H are the cams attached to the cam-plates, which plates are connected with the ends of the sleeve by means of lugs on the rims of the plates, and small recesses in the ends of the sleeve, as seen at I, so that the sleeve is turned or receives a rotating motion as the cams enter the mortises in the ends of the piston. The action of the piston on the cam is seen in Fig. 4. The position of the cams on the ends of the sleeve is reversed, as indicated in Fig. 1, so that one pair of cams turn the sleeve in one direction to change the ports, and the other pair turns it in the other direction, or back again. The inclined edge

of the cam is struck by the end of the mortise in the piston, and the piston having only a longitudinal motion the cam-plate J and sleeve receive the rotating movement as the piston moves up to the cam-plate. The cam-plate at the inner end of the cylinder works on the piston-rod. At the outer end the cam-plate is attached to a stem, K, which passes through the cylinder-head, to the outer end of which the lever L is attached, by means of which the sleeve may be given its rotating movement for starting the engine by hand. This lever works between stop-pins N, which limit the movement of the lever to the required distance to change the ports.

In Fig. 1, the induction and exhaust passages are each seen partly in dotted lines to indicate the induction and eduction or exhaust of steam. The dotted lines in Fig. 2 indicate the manner of taking steam.

By this manner of construction an engine is produced without valves. The sleeve, being perfectly balanced, is turned without undue friction, and the steam is introduced and exhausted as regularly, and used as efficiently, as in the best balanced-valve engines.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In combination with the cylinder A and piston B, the internal supplementary cylinder or sleeve E, receiving an axial movement, to alternately open and close the induction and eduction ports at the opposite ends of the cylinder by the motion of the piston, substantially as herein described.

2. In combination with the cylinder A and movable internal cylinder E, the piston B, provided with openings F, operating in connection with cam-shaped projections H H at the ends of the cylinder E, to impart an axial movement to the same in opposite directions, substantially as herein described.

ALBERT E. WHITE.

Witnesses:

THOMAS MCGOVERN,
FRANCIS KELLY.