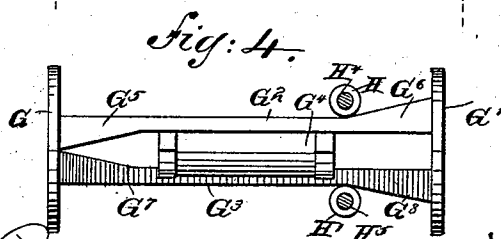
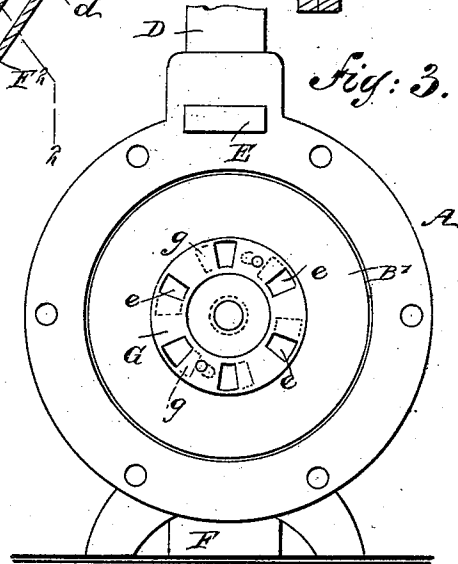
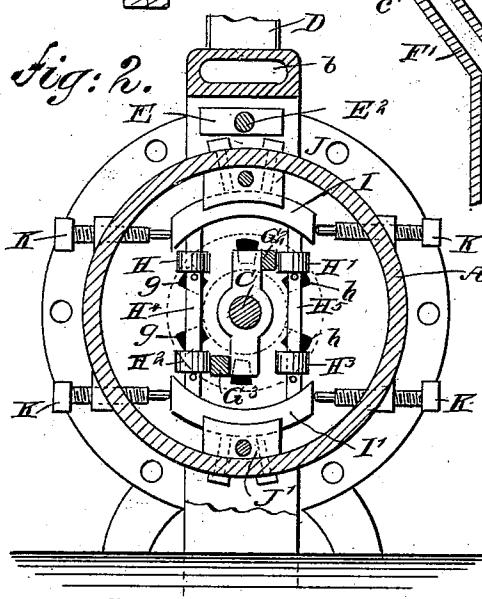
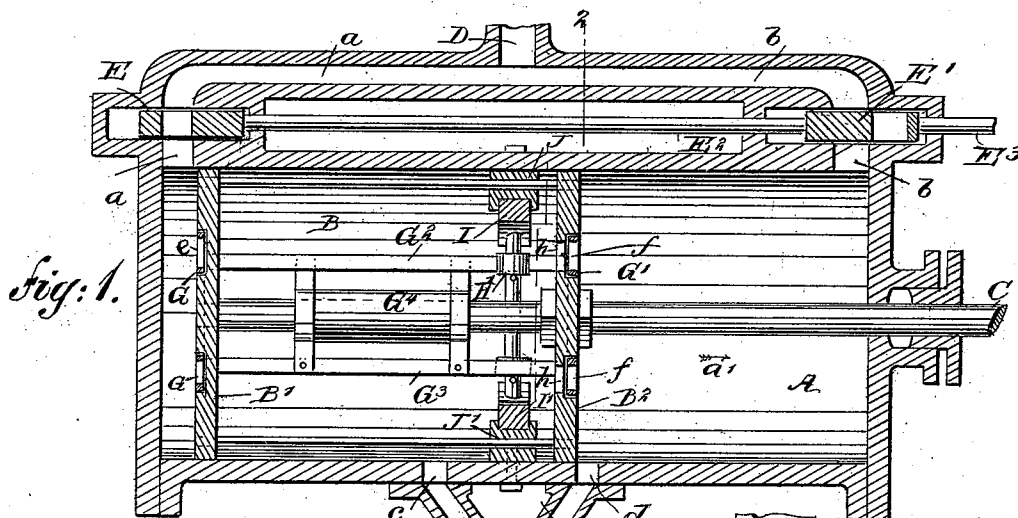


(No Model.)

W. F. & E. W. CLEVELAND.
STEAM ENGINE.

No. 553,747.

Patented Jan. 28, 1896.



WITNESSES:

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UNITED STATES PATENT OFFICE.

WILLIAM F. CLEVELAND AND EUGENE W. CLEVELAND, OF ROUNTHWAITE,
CANADA.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 553,747, dated January 28, 1896.

Application filed November 17, 1893. Renewed July 2, 1895. Serial No. 554,767. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM FITCH CLEVELAND and EUGENE WYMAN CLEVELAND, subjects of the Queen of Great Britain, residing at Rounthwaite, in the Province of Manitoba, Dominion of Canada, have invented a new and Improved Steam-Engine, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved steam-engine which is simple and durable in construction, very effective in operation, and arranged to utilize the motive agent to the fullest advantage by providing a full and complete exhaust to prevent back-pressure.

The invention consists principally of a hollow piston connected at all times with the exhaust, and valves on the heads or faces of the said piston to alternately connect the interior of the piston with the ends of the cylinder.

The invention also consists of certain parts and details, and combinations of the same, as will be fully described hereinafter and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the views.

Figure 1 is a sectional side elevation of the improvement. Fig. 2 is a transverse section of the same on the line 2 2 in Fig. 1. Fig. 3 is an end view of the improvement with one of the cylinder-heads removed, and Fig. 4 is a plan view of the piston-valves.

The improved steam-engine is provided with a cylinder A, in which reciprocates the hollow piston B, secured on a piston-rod C, connected in the usual manner with the main driving-shaft of the engine. The cylinder A is provided at or near its ends with the inlet-ports *a* and *b*, connected with a common steam-inlet pipe D, connected with the boiler, so that the motive agent can pass through the said pipe D into the ports *a* and *b*, and alternately into the ends of the cylinder A, to exert its force against the heads or ends of the piston B.

In the ports *a* and *b* are arranged the valves E and E', respectively, connected with each

other by a stem E² and arranged in such a manner that when one valve opens its port the other closes the other port, and vice versa. The valve E' is connected by a valve-stem E³ with suitable mechanism driven from the main driving-shaft to impart motion to the said valves to alternately connect the respective ports with the ends of the cylinder A. The cylinder A is also provided near its middle with exhaust-ports *c* and *d* leading to branch pipes F' and F² of the exhaust-pipe F.

The piston B is made hollow and preferably in the shape shown in Fig. 1, by providing the said piston with two heads B' and B² secured on the piston-rod C and connected with each other by suitable stay-rods, as is plainly shown in Figs. 1 and 2. In the outer faces of the heads B' and B² are formed circular seats for ring-shaped valves G and G', respectively, connected with each other by longitudinally-extending bars G² and G³, united at or near their middle by a suitable cross-head G⁴, as is plainly shown in Figs. 2 and 4.

On the end of the bar G², near the valve G and at the inner edge thereof, is formed an incline G⁵, and a similar incline G⁶ is formed on the said bar near the valve G' and on the outer edge thereof, as is plainly shown in Fig. 4. Similar inclines G⁷ and G⁸ are formed on the other bar G³, and the said inclines G⁶ and G⁷ are adapted to be alternately engaged by friction-rollers H and H², and the other inclines G⁵ and G⁸ are adapted to be alternately engaged by friction-rollers H' and H³. The friction-rollers H and H² are supported on a vertically-extending rod H⁴, and the other friction-rollers H' and H³ are held on a rod H⁵, both rods H⁴ and H⁵ being secured in segmental arms I and I', set in blocks J and J', respectively, fastened to the inside of the wall of the cylinder A, as is plainly shown in Fig. 2. The segmental arms I and I' are engaged at their ends by set-screws K, screwing in the cylinder A, to securely hold the said segmental arms in position to prevent lateral motion of the same.

In the valves G and G' are arranged ports *e* and *f*, adapted to alternately connect the similar ports *g* and *h*, respectively, formed in the heads B' and B² of the piston B. The relation of the valves G and G' to the valves

E and E' is such that when the valve E opens its port *a*, as shown in Fig. 1, the ports *e* in the valve G do not register with their ports *g*, while at the same time the valve E' closes the port *b* and the valve G' has its port *f* registering with the port *h*. Now, the steam in front of the piston-head B² can pass through the registering ports *f* and *h*, between the piston-heads B' and B², and through the port *c* into the branch pipe F' to the exhaust-pipe F.

Now, when the several parts are in the position shown in Fig. 1, the live steam entering the port *a* passes through the valve E into the left or outer end of the cylinder A to press against the piston-head B' to force the piston to the right in the direction of the arrow *a'*. Steam in front of the head B² now exhausts through the registering ports *f* and *h* and port *c*, as above described, and when the piston D nears the end of its inward stroke the friction-rollers H' and H² act on the inclines G⁵ and G⁷, so as to cause the valves G and G' to turn, whereby the ports *h* are closed, and the ports *g* are opened by the ports *e* registering with the said ports *g*. At the time this takes place the valves E and E' shift, so that the port *a* is closed, and the port *b* opens and live motive agent now passes into the right-hand end of the cylinder A to press on the piston-head B² to force the piston in the inverse direction of the arrow *a'*. When the piston travels in this direction, the steam in front of the head B' passes through the registering ports *g* and *e* between the heads B' and B² to exhaust through the ports *c* *d* to the branch pipe F' of the exhaust-pipe F leading to the outside. When the piston travels in this direction and nears the end of its stroke, the friction-rollers H and H³ come in contact with the inclines G⁶ and G⁸, so as to turn the valves G and G' to close the ports *g* in the head B' and to open the ports *h* in the head B². The above-described operation is then repeated—that is to say, the valves E and E' again shift to the position shown in Fig. 1 and steam now passes to the outer end of the cylinder A to force the piston B in the direction of the arrow *a'*. It will be seen by this arrangement a complete and free exhaust is obtained as soon as the piston nears the end of the cylinder, so that no back-pressure then will be exerted on the piston and the motive agent forcing the piston forward is utilized to the fullest advantage.

Having thus fully described our invention, we claim as new and desire to secure by Letters Patent—

1. A steam-engine, comprising a hollow piston connected at all times with the exhaust, and valves mounted to turn on the heads or faces of the said piston, to alternately connect the interior of the piston with the ends of the cylinder, substantially as shown and described.

2. A steam-engine, comprising a cylinder having inlet-ports at the ends of the cylinder and exhaust-ports near the middle thereof, a hollow piston reciprocating in the said cylinder and connected at all times with the said exhaust-ports, and valves mounted to turn on the heads or faces of the said piston, to alternately connect the interior of the piston with the ends of the cylinder, substantially as shown and described.

3. A steam-engine, comprising a cylinder having inlet-ports at the ends of the cylinder and exhaust-ports near the middle thereof, a hollow piston reciprocating in the said cylinder and connected at all times with the said exhaust-ports, valves mounted to turn on the heads or faces of the said piston, to alternately connect the interior of the piston with the ends of the cylinder, and means, substantially as described, for automatically turning the said valves on the forward and backward motion of the said piston as set forth.

4. A steam-engine, comprising a cylinder having inlet-ports at the ends of the cylinder and exhaust-ports near the middle thereof, a hollow piston reciprocating in the said cylinder and connected at all times with the said exhaust-ports, valves mounted to turn on the heads or faces of the said piston, to alternately connect the interior of the piston with the ends of the cylinder, and valves arranged in the said inlet-ports and adapted to alternately open and close the same, substantially as shown and described.

5. A steam-engine, comprising a cylinder, a piston reciprocating in the said cylinder and having two connected piston-heads having ports, valves mounted to turn over the said piston-head ports, bars connecting the valves with each other and provided with inclines, and friction-rollers held in the said cylinder and adapted to engage the inclines of the said bars to turn the said valves, substantially as shown and described.

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EUGENE W. CLEVELAND.

Witnesses:

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WILLIAM COWAN.