

UNITED STATES PATENT OFFICE.

GEORGE SMITH, OF NEW YORK, N. Y.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 360,057, dated March 29, 1887.

Application filed July 13, 1886. Serial No. 207,879. (No model.)

To all whom it may concern:

Be it known that I, GEORGE SMITH, of New York city, county of New York, and State of New York, have invented certain new and useful Improvements in Steam-Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

My invention relates, chiefly, to steam-engines, but includes all power engines, whether driven by steam, air, gas, or liquids.

The object of my invention is to produce an engine of few and simple parts, occupying but little space compared with engines of ordinary types, of light weight, not liable to get out of order, capable of running in any position and at a high rate of speed, economical in the use of the motive fluid or liquid at any pressure, transmitting the pressure to the crank-shaft equally at all positions thereof, entirely obviating the "dead-center," and embodying other advantageous features, as will appear from a consideration of its construction and mode of operation.

To accomplish all of this my improvements involve certain new and useful peculiarities of construction, relative arrangements or combinations of parts, and principles of operation, as will be herein first fully described, and then pointed out in the claims.

In the accompanying drawings, forming part of this specification, Figure 1 is a sectional elevation upon a plane at right angles to the axis of the crank-shaft, the axis being for purposes of illustration located in a horizontal position. Fig. 2 is a view in cross-section through line *xx* of Fig. 1. Fig. 3 is a view similar to Fig. 1, showing the position of the parts after the crank has made a quarter-turn from the point assumed for it in Fig. 1.

In all these figures like letters of reference, wherever they occur, indicate corresponding parts.

According to the form shown in the drawings, A is a square box, within which is the channel *a*, through which the exhaust-steam is conducted to an exhaust-pipe, B, and within the interior of this box all the working parts are located. The sides or ends of the box are closed by plates or heads, as C C, secured in

any suitable manner. These contain the bearings for the crank-shaft, which bearings may be of any approved form. D is the crank-shaft serving to transmit power, and D' is the crank-pin.

E is the piston, preferably made in one piece. It is boxed upon the crank-pin, as by the brass box *b b*, in two parts, with a suitable screw, as *c*, by which compensation for any wearing may be made. The single piston has four projecting parts, as E' E² E³ E⁴, each of which is fitted to enter its corresponding cylinder, (represented at F' F² F³ F⁴.) The piston thus constructed might be described as being composed of four different pistons, though the four are not independent one of the other. The cylinders bear upon the interior faces of the square box and travel thereon, operating both as valves and cylinders, and obviating the employment of any separate valves, such as ordinarily required. Steam or the motive fluid or liquid under pressure is admitted to the interior of the square box at any convenient point, as at the port G, and the pressure thereof upon the exposed surfaces of the several cylinders holds them to their seats. When the engine is to be run in the position shown in the drawings, any simple means may be employed for preventing the upper cylinder from dropping away from its seat when the pressure is removed. In the position shown in Fig. 1 full steam is supposed to be entering at the port *f*¹, the pressure of which counterbalances an equal amount upon the piston outside of cylinder F¹, (and acting in the opposite direction,) and permits an equal amount or degree of pressure to be transmitted in a line directly at right angles to the plane through the axis of the crank-shaft and that of the crank-pin, and thus in the most advantageous direction possible. The movement of the piston (and of the cylinders with it) opens the port *f*¹, admitting steam to the outer face of E', the effects upon E' and E² being transmitted to the crank-pin in such manner that the resultant pressure is always at right angles to the line above mentioned. As the piston continues its movement the pressure is admitted to the outer faces of the portions E² E³ E⁴ in succession and the exhaust-ports are opened in proper consecutive order, as will be readily understood. The exhaust-ports are

represented at $g' g^2 g^3 g^4$ and the steam-ports at $f' f^2 f^3 f^4$. The cylinders are shown as provided with auxiliary passages or channels, as $h h$, to facilitate exhaustion; but these are not
 5 necessary and need not be used. The movements of the piston are peculiar. Each section thereof travels back and forth within its cylinder a distance equal to twice the radius of the crank, and it travels a like distance in the
 10 direction of the corresponding face of the box, carrying its cylinder with it. Any point of the piston will therefore travel in a complete circle, and only those points within the limits of the radius of the crank will travel around
 15 a corresponding or common center. Under the arrangement shown in the drawings, when the engine is running, the pressure within two cylinders will act simultaneously, and this kind of an engine may be properly called a
 20 "twin-cylinder engine." Following the same general principles of arrangement, instead of making the box square or four-sided, it might be made with only two sides finished to form seats for cylinder-valves, or with three such
 25 sides, or any greater number of such sides. When provided with only two cylinder-valves, the engine might stop upon a dead-center; but with any greater number that would be impossible. The engine may be started from any
 30 position and with full power.

The construction indicated is extremely simple, the cylinders are similar one to the other, and the whole device is easily made and mounted, or easily dismantled and readily accessible for any required packing or repairs.
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The shaft may be run in any position, and the improved engine has been found in prac-

tice to admirably answer the purpose or object of the invention, as previously stated.

Having now fully described my invention, 40 what I claim as new herein, and desire to secure by Letters Patent, is—

1. In an engine, the piston having two or more connected parts movable back and forth within their respective cylinders, said cylinders being made movable upon their seats and 45 operating as valves, and the crank-pin located at the central part of the piston, the parts being combined and arranged to operate substantially in the manner shown and described. 50

2. In an engine, the piston composed of three or more parts, the corresponding independent cylinders, movable upon their seats, the box containing the channel for the exhaust, the seats for the cylinder-valves, and the crank- 55 shaft and crank-pin, combined and arranged substantially as shown and described.

3. The herein-described engine, comprising the crank-shaft and crank-pin, a piston mounted upon said pin, and having a number of parts 60 surrounding the same and fitted to enter their respective cylinders, the movable cylinders operating as valves, the box containing the steam channels and ports, and the sides or heads, all arranged for operation substantially in the 65 manner and for the purposes set forth.

In testimony that I claim the foregoing I have hereunto set my hand in the presence of two witnesses.

GEORGE SMITH.

Witnesses:

SIMON SCHWARZMANN,
FRANK MARSHALL.