

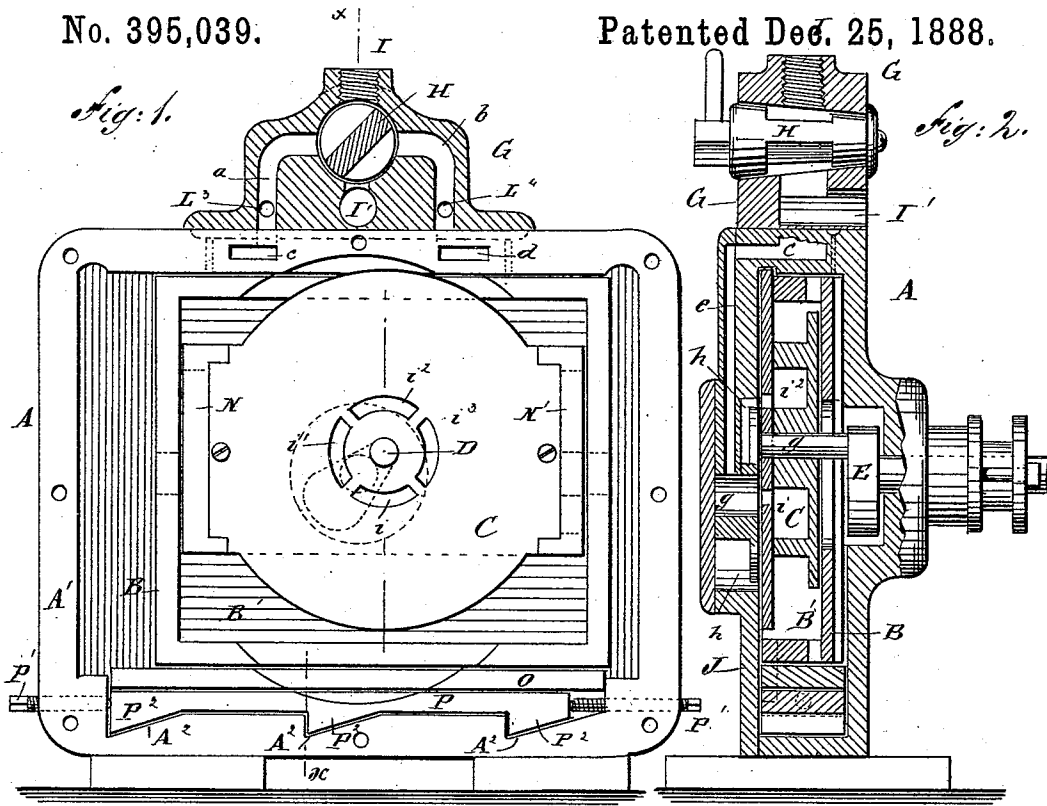
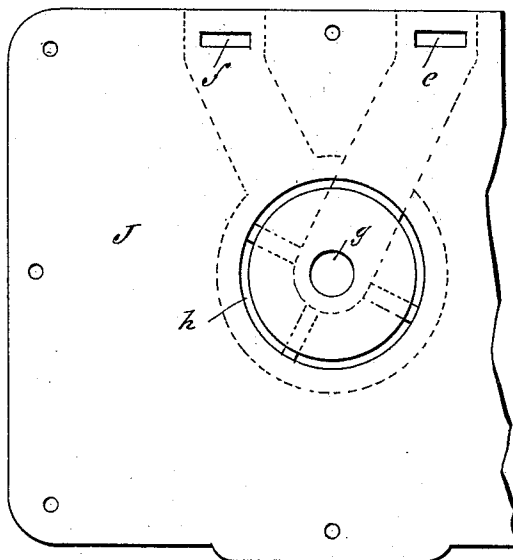
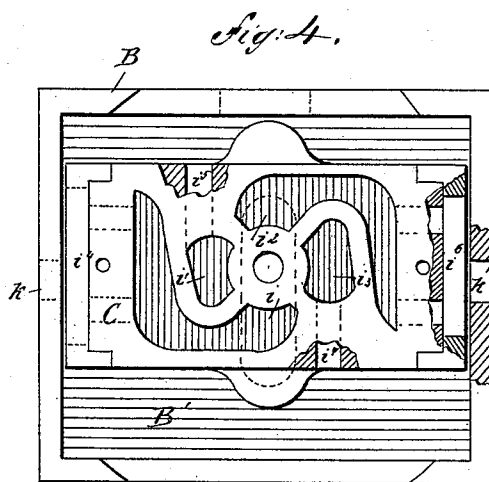
(No Model.)

2 Sheets—Sheet 1.

W. F. DAKE.
ENGINE.

No. 395,039.

Patented Dec. 25, 1888.



WITNESSES:

Chas. Vida.
L. Sedgwick.

INVENTOR:

W. F. Dake

BY

Munn & Co

ATTORNEYS.

(No Model.)

2 Sheets—Sheet 2.

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Fig. 5.

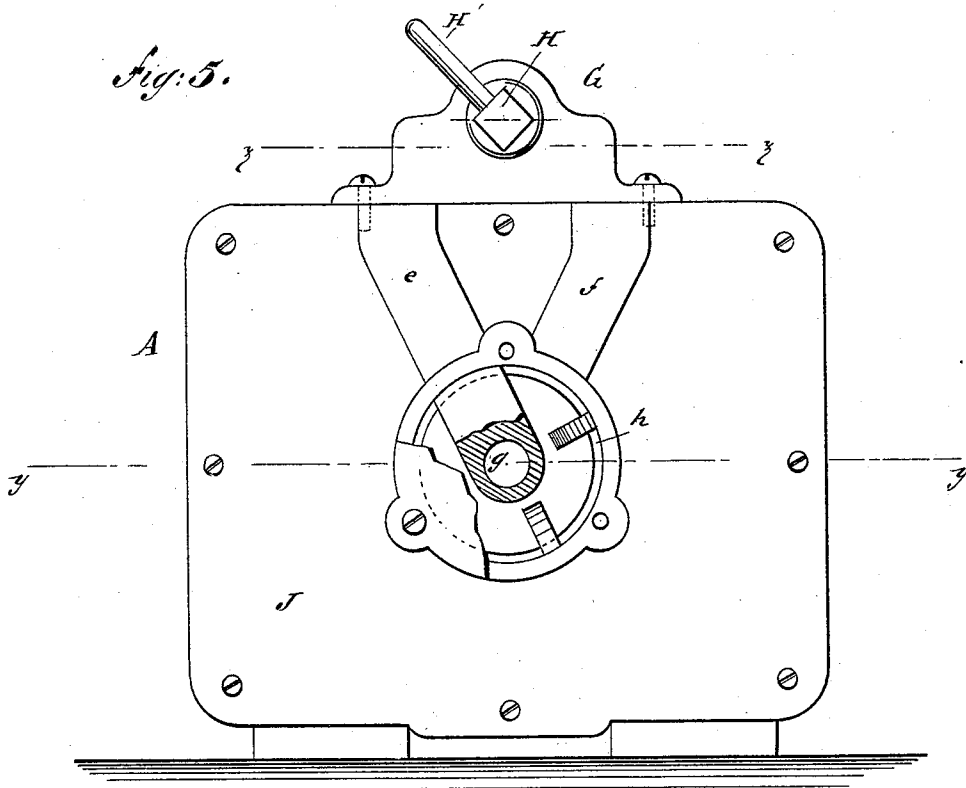


Fig. 6.

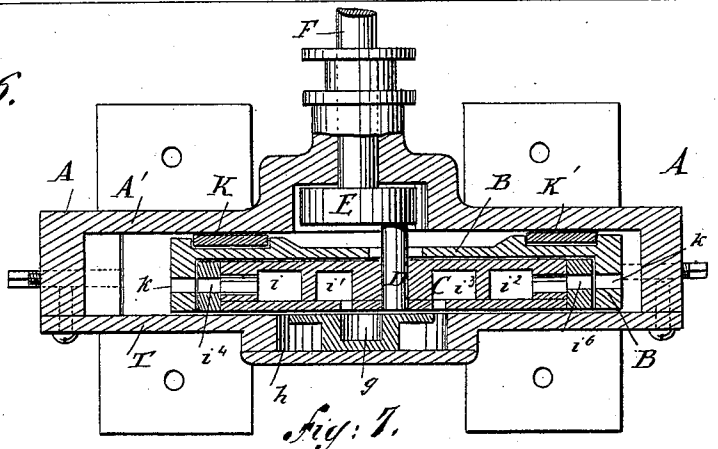


Fig. 7.

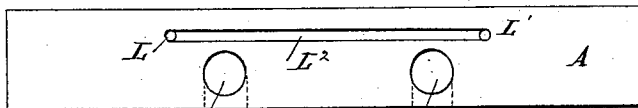


Fig. 8.



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UNITED STATES PATENT OFFICE.

WILLIAM F. DAKE, OF GRAND HAVEN, MICHIGAN, ASSIGNOR TO THE DAKE
ENGINE MANUFACTURING COMPANY, OF SAME PLACE.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 395,039, dated December 25, 1888.

Application filed July 3, 1888. Serial No. 278,939. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM F. DAKE, of Grand Haven, in the county of Ottawa and State of Michigan, have invented a new and Improved Engine, of which the following is a full, clear and exact description.

The invention relates to the class of double reciprocating square piston-engines such as shown and described in Letters Patent No. 10 363,368, granted to me May 24, 1887.

The object of the present invention is to provide a new and improved engine which is simple and durable in construction and very effective in operation.

15 The invention 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 20 drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a front view of the improvement with the cover removed and the steam-chest 25 in section. Fig. 2 is a sectional view of the same on the line *xx* of Fig. 1; Fig. 3 is an inner face view of part of the cover. Fig. 4 is a face view of the piston with the cover removed and parts in section. Fig. 5 is a face 30 view of the improvement with parts broken out. Fig. 6 is a sectional plan view of the same on the line *yy* of Fig. 5. Fig. 7 is a plan view of the casing, the steam-chest being removed; and Fig. 8 is a sectional plan view 35 of the steam-chest on the line *zz* of Fig. 5.

The improved engine is provided with a casing, A, of suitable shape and material and having a chamber, A', in which is held to move backward and forward horizontally a 40 rectangular piston, B, having a chamber, B', in which is mounted to slide vertically the inner piston, C, mounted in its middle on a wrist-pin, D, projecting through a slot in the back plate of the piston B and secured to a 45 crank-disk, E, fastened on the inner end of the main driving-shaft F. On top of the casing A is secured the steam-chest G, provided with a four-way valve, H, having a handle, H', on its inner end for turning said valve H 50 in any desired position. Othersuitable means

may be employed for turning the valve, if desired.

Into the valve H leads the steam-inlet pipe I, and the said valve also connects with the exhaust-pipe I', leading from the valve-chest 55 G. The valve H is adapted to connect the steam-inlet pipe I either with the port *a* or the port *b*, and also to connect the exhaust-pipe I' with the said port *a* or *b*. The ports *a* and *b* are formed in the steam-chest G and 60 lead to the ports *c* and *d*, formed in the casing A, and the ports *c* and *d* connect with the channels *e* and *f*, respectively, formed in the outside of the cover J of the casing A. The channel *e* leads to a central aperture, *g*, formed 65 in the middle of the cover J and opening at the inside against the face of the inner piston, C. The channel *f* leads to an annular opening, *h*, also formed on the inside of the cover J and opening on the face of the inner 70 piston, C.

The central opening, *g*, and the annular opening *h* are adapted to connect alternately with the ports *i*, *i'*, *i²*, and *i³*, formed in a circle 75 in the inner piston, C, and of which the port *i* leads through a channel, *i¹*, to an opening *k*, formed in the left side of the said piston B and leading to the chamber A' of the casing A. The port *i'* leads to the channel *i²*, opening into the chamber B' of the piston B 80 at the top of the inner piston, C. The port *i²* is similar to the port *i* and leads to a channel, *i³*, which connects with an opening, *k'*, formed in the right end of the piston B and leading to the chamber A' of the casing at the right 85 of the piston B. The port *i³* is similar to the port *i'* and leads to the channel *i²*, opening into the chamber B' of the piston B at the bottom of the inner piston, C.

In the back of the piston B are formed vertical recesses, into which fit the packing- 90 plates K and K', pressed against the rear wall of the casing A by live steam entering between the said plates K and K' and the piston B through openings L and L', connected 95 with each other by a groove, L², in the top of the casing A, as is plainly shown in Fig. 7. The groove L² connects with the openings L³ and L⁴, formed in the steam-chest G and leading into the ports *a* and *b*, so as to admit 100

live steam into the groove L^2 , from which the live steam passes through the openings L and L' between the packing-plates K and K' and the piston B , so as to form a steam-tight packing.

The inner piston, C , is provided at its ends with the packing-plates N and N' , of any approved construction and pressed against the end walls of the piston B by any suitable means, so as to form a steam-tight packing between the said inner piston, C , and the piston B .

The wear of the latter is taken up by a plate, O , supporting the bottom of the said piston B and resting against the plate P , held to slide longitudinally by screws P' in the casing A bearing against the ends of the said plate P . On the under side of the latter are formed the inclines P^2 , sliding on corresponding inclines, A^2 , formed in the bottom of the casing A . Thus, when the screws P' are adjusted the plate P presses this plate O upward in firm contact with the bottom of the piston B .

The operation is as follows: When the engine is in the position shown in Fig. 1, steam passes from the inlet-pipe I through the valve H into the port a , and from the latter the steam passes through the port c into the channel e and into the central opening, g , formed in the cover J . The steam now passes from the central opening, g , into the port i of the inner piston, C , and through the channel i' and the opening k into the left end of the chamber a' , thus acting against the piston B from the left to the right, so that the said piston B is caused to slide from the left to the right. Rotary motion is thus imparted to the main shaft F by the inner piston, C , the crank-pin D , and the crank-disk E , secured to the said main shaft F . The inner piston, C , in moving causes the port i to register with the central opening, g , so that live steam now passes into the port i' from the latter through the channel i'' into the chamber B' of the piston B on top of the piston C . The latter is thus pressed downward by the steam, whereby a new impulse is given to the main driving-shaft F by the action of the crank-pin D and the crank-disk E . On the further movement of the pistons B and C , as above described, the central opening, g , registers with the port i^2 , so that the live steam passes through the channel i'' and the opening k' into the chamber A' at the right end of the piston B , so that the latter is now forced to its return-stroke—that is, to the left of the casing A . The further movement of the pistons B and C now brings the central opening, g , to register with the port i^3 , so that the live steam passes through the channel i'' into the chamber B' at the bottom of inner piston, C . The live steam thus presses the inner piston, C , upward, at the same time assisting the piston B in its movement to the left. The exhaust-steam from the left of the chamber A' passes through

the opening k , the channel i' , and the port i into the annular opening h , formed in the cover J and leading to the channel f , connected by the port d with the port b in the steam-chest G . Steam then passes from the port d through the valve H into the exhaust-pipe I' and to the outside. The exhaust at the upper end of the chamber B' passes through the channel i^3 into the port i' , and from the latter to the annular opening h , through which it passes to the exhaust-pipe I' , as above described in reference to the port i . The exhaust in the right of the compartment A' takes place through the opening k' , the channel i'' , and the port i^2 into the annular opening h , and the exhaust in the bottom of the chamber B' takes place through the channel i'' and the port i^3 into the annular opening h , from which the steam passes to the exhaust-pipe I' , as above described.

It is understood that the movement of the inner piston, C , brings the ports i , i' , i^2 , and i^3 alternately to register with the central opening, g , and at the same time the exhaust-ports exhaust through the annular opening h .

When the valve H is turned, the live steam passes from the inlet-pipe I to the port b , and the port a is then connected with the exhaust-pipe I' . The above-described operation is repeated, except that it is in the reverse direction.

It will be observed that by the construction of this engine there are no valves whatever except on the face of the inner piston, C , against the cover-plate J , and no eccentric or other devices are needed to operate the valve, the action being directly upon the piston C and cover J to cut off and let in steam at the proper time to give continuous motion to the engine.

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

1. In an engine, the combination, with a casing and a piston reciprocating therein, of a second piston arranged within and having a reciprocating motion at right angles to the line of movement of the first-named piston, the outer face of the said second valve forming a valve for operating both pistons, substantially as described.

2. In an engine, the combination of a casing having a central opening in the inner surface of its front plate, a piston reciprocating therein, a second valve arranged within and having a reciprocating motion at right angles to line of movement of the first-named piston and provided with ports on its outer face, said ports being arranged in a circle and operating over the said central opening of the casing, substantially as herein shown and described.

3. In a steam-engine of the class described, the combination, with an inner piston having steam-ports arranged in a circle, of a cover having a central opening and an annular opening adapted to register with the said ports, substantially as shown and described.

4. In a steam-engine of the class described, the combination, with an inner piston provided with the ports i, i', i^2 , and i^3 , of an outer piston having the openings k and k' , connecting with the said ports i and i^2 , and a casing surrounding the said outer piston, substantially as shown and described.
5. In an engine of the class described, the combination, with a casing and a steam-chest held on the said casing, of a piston mounted to slide horizontally in the said casing, and packing-plates held at the back of the said piston and pressed against the back of the said casing by live steam passing from the said steam-chest through suitable openings in the casing between the said packing-plates and the said piston, substantially as shown and described.

WILLIAM F. DAKE.

Witnesses:

CHAS. T. PAGELSON,
J. P. ARMSTEAD.

Corrections in Letters Patent No. 395,039.

It is hereby certified that in Letters Patent No. 395,039, granted December 25, 1888, upon the application of William F. Dake, of Grand Haven, Michigan, for an improvement in "Engines," errors appear in the printed specification requiring correction as follows: In lines 116 and 122 page 2, the word "valve" should read *piston* and in line 124 same page the word *the* should be inserted before the word "line"; and that the said Letters Patent should be read with these corrections therein to conform to the papers pertaining to the case in the Patent Office.

Signed, countersigned, and sealed this 1st day of January, A. D. 1889.

[SEAL.]

D. L. HAWKINS,
Assistant Secretary of the Interior.

Countersigned:

BENTON J. HALL
Commissioner of Patents.