

(No Model.)

3 Sheets—Sheet 1.

J. W. WALTERS.

PENDULUM OR VIBRATING PISTON ENGINE.

No. 367,872.

Patented Aug. 9, 1887.

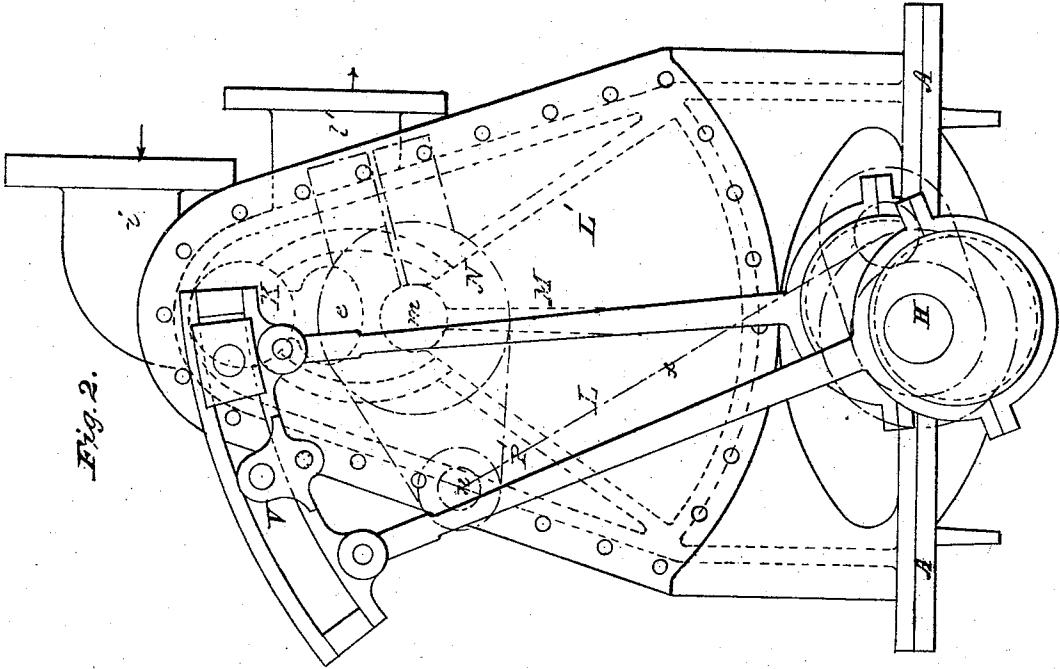


Fig. 2.

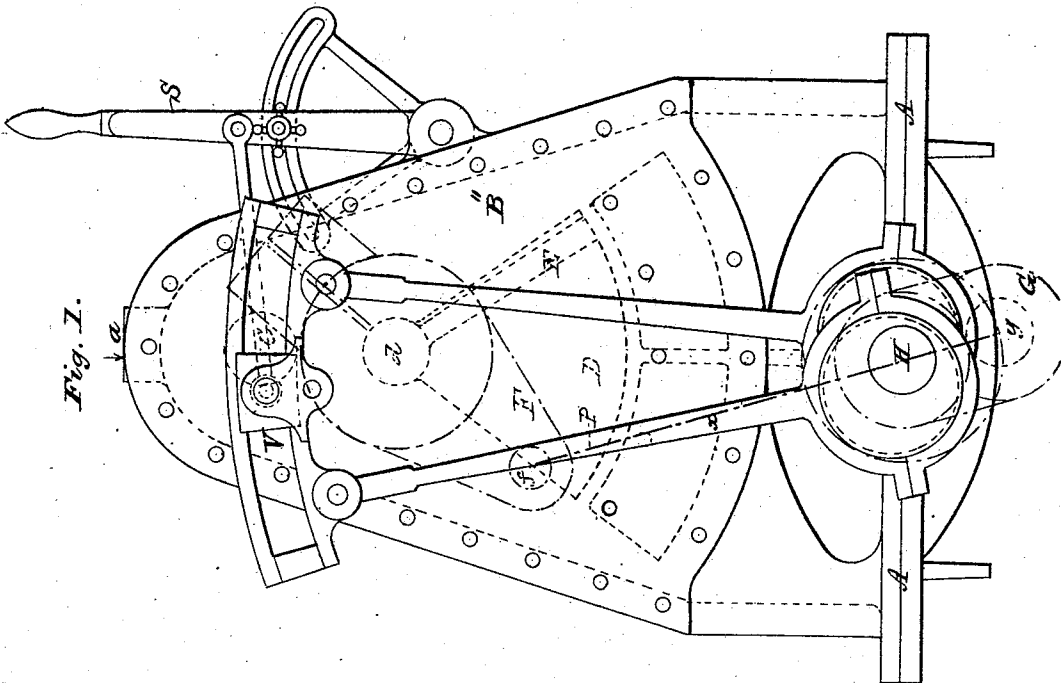


Fig. 1.

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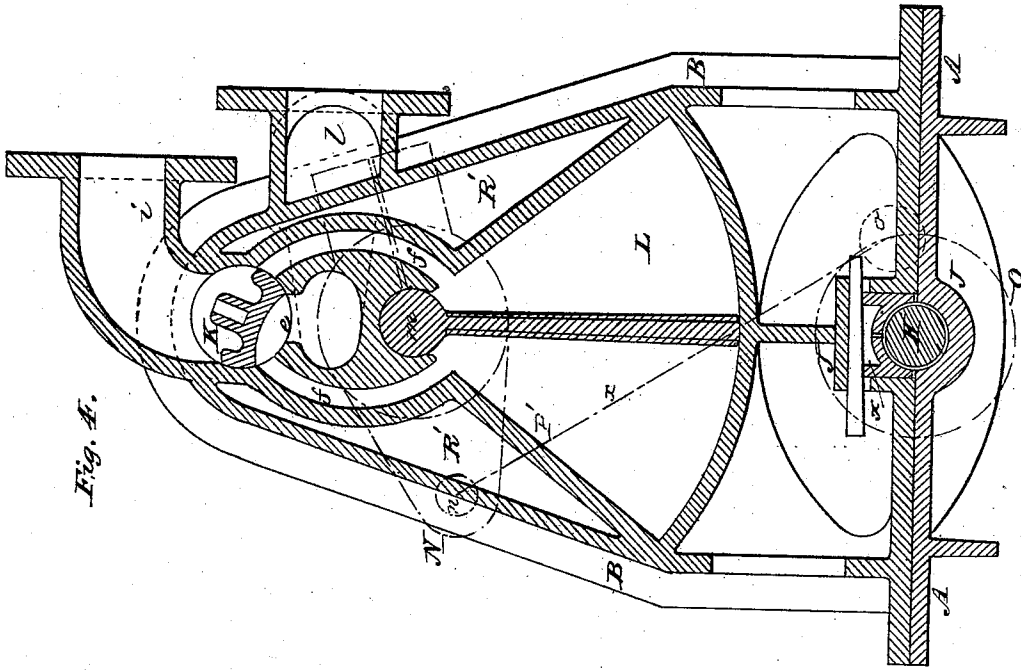


Fig. 4.

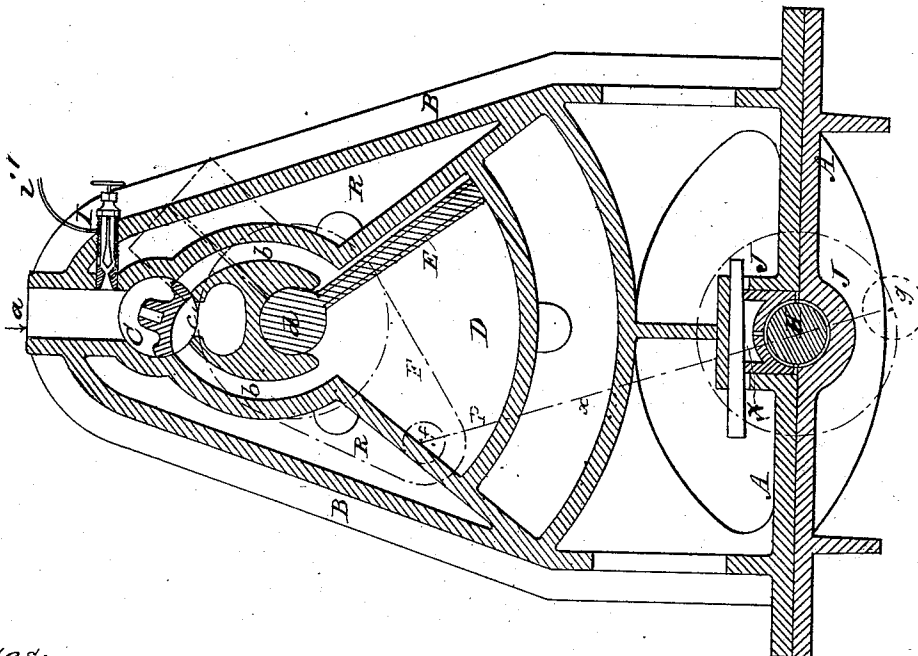


Fig. 5.

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UNITED STATES PATENT OFFICE.

JULIUS WM. WALTERS, OF NEW YORK, N. Y.

PENDULUM OR VIBRATING-PISTON ENGINE.

SPECIFICATION forming part of Letters Patent No. 367,872, dated August 9, 1887.

Application filed September 15, 1886. Serial No. 213,608. (No model.)

To all whom it may concern:

Be it known that I, JULIUS WM. WALTERS, a citizen of the United States, residing at New York, in the State of New York, have
5 invented certain new and useful Improvements in Pendulum or Vibrating-Piston Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in
10 the art to which it appertains to make and use the same.

My invention relates to improvements in that class of engines usually called "pendulum" or vibrating engines—*i. e.*, in which a
15 vibrating piston is secured upon an oscillating shaft and operates in a sector-shaped chamber, whose diverging walls radiate from the shaft of the piston.

The object of my invention is to improve
20 this style of engine, and to produce a very simple, economical, effective, and compact engine, which can be used either as a simple or a compound engine—that is, the steam is first utilized in a high-pressure cylinder or chamber
25 of smaller size, and then in a low-pressure or expansion cylinder of larger size; also, to exhaust the steam from the high-pressure cylinder into a receiver, (inclosing said cylinder and forming a jacket,) and thence passing it to
30 the low-pressure cylinder; or the steam from the receiver can be utilized by mixing it with the live steam from the boiler by means of an injector placed in the side of the inlet-pipe leading into the high-pressure cylinder. Fur-
35 thermore, to produce an engine that is readily accessible to all its parts, and can be run at high velocities, and, finally, large power can be obtained in proportion to the quantity of fuel consumed.

My invention consists in arranging the high
40 and low pressure cylinders of a compound engine side by side, and connecting the pistons of each engine by suitable connecting-rods to a common crank-shaft having its cranks placed
45 at an angle of ninety degrees, or at right angles to each other; also, in combining with each engine a vibrating piston with or without a balanced valve and suitable inlet and exhaust ports; also, in placing the valve-gear between
50 the engines and the starting-gear on the outside thereof; also, in placing a receiver on

each engine for the exhaust-steam, acting as steam-jackets, and these cast with the frame, so as to inclose the cylinders, valve, and ports; also, in attaching an injector in the side of the receiver, so that part or all of the steam contained in said receiver may be utilized by mixing it with the steam from the boiler in said cylinder by means of said injector forcing it into the cylinder from the receiver, and, finally, in the construction and arrangement of details, more fully described hereinafter, and specifically pointed out in the claims, reference being had to the accompanying drawings and the letters of reference thereon.

Like letters indicate similar parts in the different figures of the drawings, in which—

Figure 1 represents a side elevation of the high-pressure cylinder and valve-gear. Fig. 2 is a similar view of the low-pressure cylinder and its valve-gear. Fig. 3 is a vertical transverse section of the high-pressure cylinder. Fig. 4 is a similar view of the low-pressure cylinder. Fig. 5 represents a longitudinal vertical section of the high and low pressure cylinders connected to the crank-shaft.

In said drawings, A is a suitable bed-plate, upon which the frame or casing B is mounted and secured, which frame contains the cylinder, valve-chamber, valve, ports, receiver, and pillow-blocks for the crank-shaft. Said casing is provided with the removable heads or bonnets B' B''. In the upper part of the casing is formed the steam-chest, in which an oscillating or rocking valve, C, operates, and admits and exhausts the steam to and from the cylinder D through the inlet and outlet ports *b c*. The cylinder is of sector shape, and its ends or diverging walls radiate from the shaft *d*, to which the piston E is secured or cast, and it vibrates in said cylinder. The piston should be provided with packing in its sides and periphery, set out by springs or steam admitted through small holes *e'* (see Fig. 5) in the body of the piston, as desired. The shaft *d* is journaled in the sides of the casing in proper bearings, and extends through packing *p* on one side, and it has an arm, F, secured to it, which has a pin, *f*, to which the connecting-rod P (represented in full in Fig. 5 and by a broken line, *x*, in Fig. 1) is attached with one end, while the opposite end

is connected to the crank-pin *g* of the crank G on the crank-shaft II. The packing *p*, of segmental or other kind, serves to prevent leakage around the shaft *d*, and when it commences to wear or needs adjusting or setting up it is forced inward by a suitable spring, *q*, placed behind the gland *p'*. The hub of the arm N is bored out to receive the packing, and is secured to the shaft *m* by one or more set-screws. It is also fitted over the nipple or reduced end *q* of the bearing at that end for said shaft. The packing is thus self adjusting.

The cylinder, steam-chest, valve, and ports are inclosed in a receiver, R, into which the exhaust-steam from the cylinder D is exhausted, and thence it passes through a pipe, *i*, into the low-pressure cylinder L, where it exerts its force by expansion on the piston contained therein. Any number of expansion-cylinders may be employed to expand the steam as often as it is desired. A stop-valve, *z*, may be placed in the pipe *i* when the high-pressure cylinder only is to be used or the engine is to act as an ordinary direct-acting engine, and the exhaust-steam may then be led to a condenser or to the atmosphere.

In the side of the casing and communicating with the steam-inlet pipe *a* is arranged an injecting-valve, I, communicating by a pipe *z'* with the live steam in the boiler, by which means the steam in said receiver can be utilized and mixed with the live steam before entering the cylinder D. The crank-shaft II is journaled in bearings J, formed partly in the bed-plate and partly in the bottom of the casing B, and the cap is provided with an oil-cup for lubricating the shaft *x*. The journal-boxes may be lined and adjusted by keys, bolts, or otherwise.

The steam having exerted its power on the piston of the high-pressure cylinder, is exhausted into the receiver R and passes through the pipe *i* into the valve-chamber of the valve K of the low-pressure cylinder, and thence through suitable inlet and exhaust ports *e f* into the cylinder L of larger size, containing the piston M, secured to the shaft *m*, and journaled in similar manner to the shaft *d*. The cylinder L is provided with heads L' L'', and is inclosed in a receiver, R'. An arm, N, with pin *n*, is secured on the end of the shaft *m*, and to said pin the connecting-rod P' is attached with one end, while the other end is connected to the crank-pin *o* of the crank O.

The valve-gear V, (shown in Figs. 1, 2, and 5,) preferably of the link kind, is placed between the two engines and by suitable valve-rods and arms operates the valves. The starting-gear S is placed on the outside of the high-pressure cylinder so as to be more accessible. Wherever it is required or deemed necessary at any of the joints, and there is liability of leakage, suitable packing must be provided. The exhaust from the expansion or low-pressure cylinder passes into the receiver R', and thence through the nozzle *l'* into the condenser or the atmosphere.

The engines can be made of any suitable size required, and the different parts may be made of any suitable material, and various changes in the details of construction may be made without departing from the scope of my invention. The engine may be also employed as an air-compressor, in which case it is only necessary to reverse the action of the valves, so as to receive through the exhaust-pipe and exhaust through the inlet-pipe, the air being taken into the low-pressure cylinder and forced into the high-pressure cylinder, in which the air is further compressed.

This engine is especially adapted for launches, steam-yachts, and for other purposes requiring engines running at high speed or velocity. The cylinder, steam-chest, receiver, pillow-blocks, and frame or casing may be cast in one piece, if desired, and the piston-shaft may be extended through both cylinders and the pistons secured thereon, although I prefer to make them independently and cast the pistons on them.

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

1. A pendulum engine having a vibrating piston in a sector-shaped cylinder, with or without a balanced rocking valve and inlet and outlet ports arranged above it, and inclosed in a receiver for the exhaust-steam, as set forth.

2. A pendulum engine having a vibrating piston in a sector-shaped cylinder, with or without a balanced rocking valve and inlet and outlet ports above it, in combination with a receiver and a frame or casing, all arranged substantially as herein specified.

3. A pendulum engine having a vibrating piston, with or without a balanced rocking valve and ports arranged above it, and a receiver for the exhaust-steam, in combination with an injector, as and for the purpose described.

4. A compound pendulum engine consisting of a high and low pressure cylinder, arranged side by side, provided with rocking valves and ports, and connected by an exhaust-pipe, all as shown, and for the purpose specified.

5. A compound pendulum engine consisting of a high and low pressure cylinder, arranged side by side, provided with rocking valves and ports, in combination with a receiver, into which the exhaust-steam escapes, and thence passes to the low-pressure cylinder, substantially as specified.

6. In a pendulum engine, the combination of two cylinders, arranged side by side, having steam-chest, valves, and ports arranged as shown, and inclosed in receivers for the exhaust-steam, with a common crank-shaft, all substantially as and for the purpose set forth.

7. In a pendulum engine, the combination of two cylinders, arranged side by side, having steam-chests, valves, and ports placed above said cylinders, and inclosed in receivers for the exhaust-steam, with a common crank-shaft

having its cranks at right angles, all as shown and specified.

8. In a pendulum compound engine, consisting of the high and low pressure cylinders, arranged side by side, and connected by an exhaust-pipe, *i*, in combination with rocking valves and ports, as shown, and receivers, all substantially as set forth.

9. The combination of the high and low pressure cylinders of a compound engine, connected by an exhaust-pipe provided with a stop-valve, and having rocking valves and ports, as shown, with receivers for the exhaust-steam, and a common crank shaft, as and for the purpose described.

10. The combination of a bed-plate and frame containing the high and low pressure cylinders of a compound pendulum engine and receivers, with a crank-shaft having cranks at right angles to each other, as and for the purpose set forth.

11. The combination of a high and low pressure cylinder of a pendulum engine, connected by an exhaust-pipe attached to a receiver, into which the exhaust-steam from the high-pressure cylinder escapes and passes into the low-pressure cylinder; and thence into a receiver and the condenser or atmosphere, as specified.

12. The combination of a bed-plate and a frame or casing containing the bearings for a common crank-shaft, with the high and low

pressure cylinders of a compound pendulum engine having rocking valves and ports, arranged as shown, and provided with receivers, as shown and set forth.

13. The combination of a high and low pressure cylinder of a pendulum-engine having rocking valves and ports, as shown, and operated by valve-gear placed between the engines, with a common crank-shaft having cranks placed at right angles, substantially as specified.

14. The combination of a sector-shaped cylinder containing a vibrating piston, and provided with a rocking valve and ports inclosed in a receiver formed in the frame or casing, with the bed-plate containing the pillow-blocks for the crank-shaft, and all arranged as set forth.

15. A compound pendulum engine, provided with rocking valves, operated by valve-gear arranged between the steam-chambers, and its pistons connected by crank-arms and connecting-rods to the crank-shaft, all substantially as shown and specified.

In testimony whereof I hereby affix my signature in presence of two witnesses.

JULIUS WM. WALTERS.

Witnesses:

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