J. G. BAKER.

Steam Engine and Pump.

No. 207,936. Patented Sept. 10, 1878.

FIG. 2.

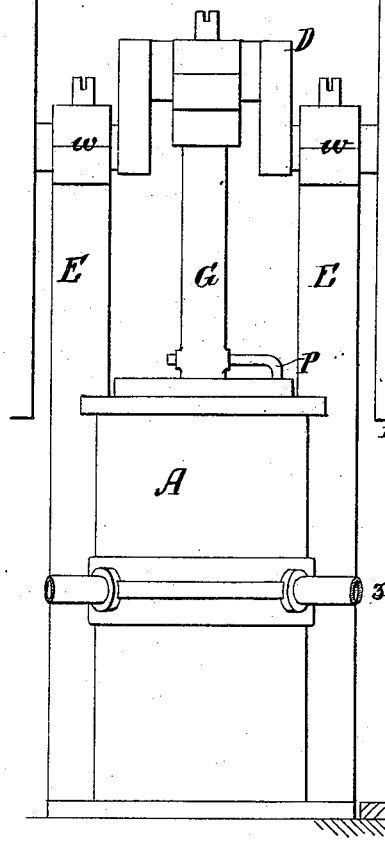


FIG. 1.

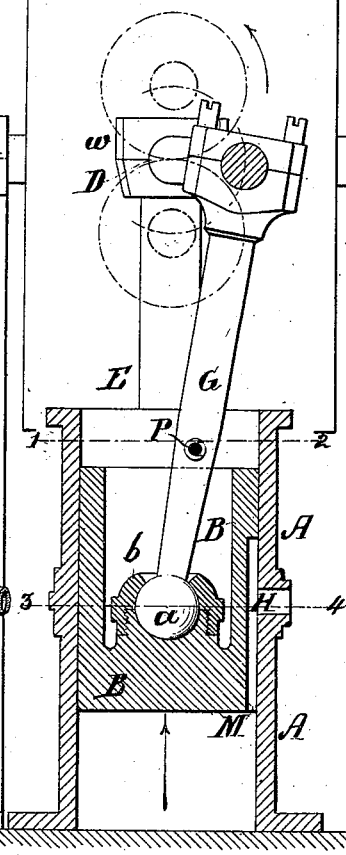


FIG. 3.

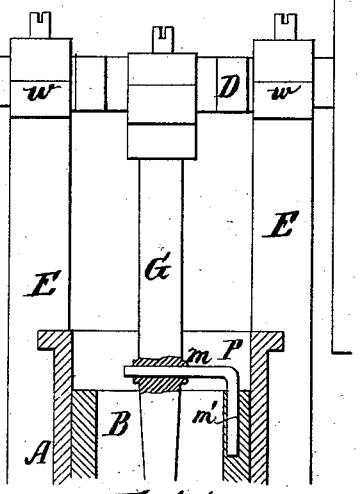


FIG. 4.

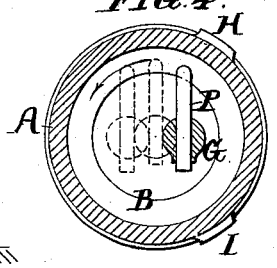


FIG. 5.

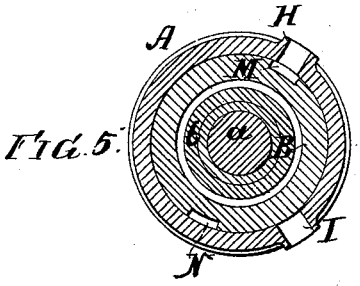
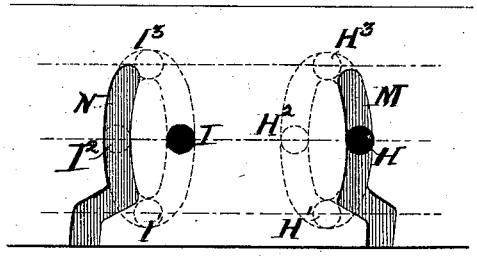


FIG. 6.



Witnesses,
Henry Howson Jr.
Harry Smith

Inventor,
John G. Baker
by his Attorneys
Howson and Sons

UNITED STATES PATENT OFFICE.

JOHN G. BAKER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE ENTERPRISE MANUFACTURING COMPANY, OF SAME PLACE.

IMPROVEMENT IN STEAM ENGINES AND PUMPS.

Specification forming part of Letters Patent No. **207,936,** dated September 10, 1878; application filed August 13, 1878.

To all whom it may concern:

Be it known that I, JOHN G. BAKER, of Philadelphia, Pennsylvania, have invented a new and useful Improvement in Steam Engines and Pumps, of which the following is a specification:

The main object of my invention is to make a very cheap single-acting steam-engine for domestic use, or for grocers, farmers, and others who may be desirous of procuring an economical motor of comparatively small power. Another object of my invention is to make a single-acting pump without the usual suction and force valves. These objects I attain in the following manner, reference being had to the accompanying drawing, in which—

Figure 1 is a vertical section of my improved steam-engine, and it is also a vertical section of my improved pump; Fig. 2, a front view; Fig. 3, a vertical section, showing the manner of operating the piston-valve from the connecting-rod; Fig. 4, a sectional plan on the line 1 2; Fig. 5, a sectional plan on the line 3 4; and Fig. 6, a diagram, showing the circumference of the piston and the relation of its passages to the steam and exhaust ports.

The following main elements are combined to produce my improved steam-engine: first, a cylinder, A, open at one end and closed at the other; second, a piston, B, adapted to the cylinder; third, a crank-shaft, D; fourth, a frame or frames, E, for the bearings *w w* of the crank-shaft; fifth, a connecting-rod, G, hinged at one end to the piston and connected directly to the crank at the other end; and, sixth, a valve and ports or passages for directing the steam to and exhausting it from the cylinder on one side only of the piston.

By this combination of parts I produce a single-acting steam-engine—that is, a steam-engine in which the pressure of steam is exerted during one-half or nearly one-half only of the stroke of the crank; in other words, one half or nearly one half of the revolution of the crank is due to the pressure of steam on one side of the piston, the other half of the revolution being due to the absence of this pressure and to the momentum acquired by the crank-shaft, which is furnished, as usual, with a fly-wheel or pulley.

I have found, by practical tests, that a small single-acting engine, thus constructed and operating at a high speed, is quite as effective as an ordinary double-acting engine, and can be made at about half the cost, owing to the absence of cylinder-cover, piston-rod, stuffing-box, guides, and cross-head, which constitute expensive elements in common steam-engines.

Different kinds of valves and different kinds of devices for operating the same can be used. The ordinary slide or cylindrical valve, operated by an eccentric, may, for instance, be employed; but I prefer to make the engine still more economically by converting the piston itself into the valve and by operating it through the medium of the simple device which I will now proceed to explain.

A sphere, *a*, is formed on one end of the connecting-rod G, and is confined to a socket, *b*, within the hollow piston B, thus forming a ball-and-socket joint, which permits the free movement of the connecting-rod in obedience to the crank, and at the same time permits the piston itself to be turned laterally in the cylinder.

In the sectional plan, Fig. 5, H is the steam-port, having direct communication with the steam-boiler, and I the exhaust-port, and M and N two passages cut in the piston, the former for the steam and the latter for the exhaust, both passages terminating abruptly at the top, below the upper edges of the piston, and extending downward to the bottom of the same, so that both will always be in communication with the cylinder below the piston.

During the greater portion of the upward movement of the piston in the direction of the arrow, Fig. 1, the passage M must be in communication with the steam-port H while the exhaust-pipe is closed, and during the greater portion of the movement of the piston in the contrary direction the passage N must be in communication with the exhaust-port I while the steam-port is closed, as more fully explained hereinafter. Hence it will be seen that by properly vibrating the piston laterally in the cylinder during its reciprocating movements the necessary admission of the steam to and its exhaustion from the cylinder below the piston at the proper time in relation to the

position of the crank may be effected. There are different devices through the medium of which this desired vibration of the piston may be effected from a moving part of the engine; but I prefer the simple device shown in Figs. 1, 3, and 4.

A rod, P, is so bent or otherwise so constructed as to present two cylindrical arms, *m m'*, arranged at right angles to each other, the arm *m'* fitting snugly, but so as to turn and slide freely in a transverse opening in the connecting-rod G, and the other arm, *m'*, fitting snugly and so as to turn and slide freely in a vertical orifice in the edge of the piston B.

As the engine operates there must necessarily be a vibration of the connecting-rod, and while the piston reciprocates it must necessarily receive a lateral vibrating motion from the said connecting-rod through the medium of the rod P, the arm *m* of which slides and turns in the connecting-rod, the arm *m'* both sliding and turning in the orifice of the piston as the latter reciprocates.

The diagram Fig. 6 will best serve to explain the relation of the ports to the passages in the piston at the different positions of the same.

Supposing the engine to be at half-stroke, as shown in Fig. 1, (the crank turning in the direction of its arrow,) and the piston to be rising under the pressure of steam, the passage M will be in communication with the steam-port H at the point shown by the black circle in the said diagram Fig. 6 while the exhaust-port I is closed, and this will continue until the piston has passed from the position Fig. 1 to the limit, or rather nearly to its highest position, during which movement the piston has been turned laterally in the direction of the arrow, Fig. 5.

When the piston has reached the extreme limit of its upward movement the relation of the passage M with the steam-port H is indicated by the dotted circle H^1, and the relation of the passage N to the exhaust-port by the dotted circle I^1, the steam being cut off from the passage M, and the lower end of the exhaust-passage N just commencing to open to the exhaust-port, when the piston will commence to descend, and during this descent the piston will continue to turn in the direction of its arrow, the exhaust still continuing and the steam being still cut off. When the piston, during its descent, has reached the position of half-stroke, the relation of the passages M and N to the steam and exhaust ports is indicated by the dotted circles H^2 and I^2.

During the farther descent of the piston it will turn in a direction contrary to that pointed out by the arrow, Fig. 5, and when the piston has reached the limit of its downward movement the exhaust-passage will have moved away from the exhaust-port, as indicated by the dotted circle I^3, and the steam-passage M will just be beginning to open to the steam-port H, as indicated by the dotted circle H^3. The shape of the passages will depend upon the relation of the steam and exhaust ports to each other and to the piston and its movements, and this relation may be changed as circumstances may suggest.

It may be remarked that any fixed point in the piston will, as the engine operates, traverse an oval course, to which due regard must be had in determining the shape of the steam and exhaust passages; but the simplest plan of doing this is to put the engine together before the passages are cut, and then to make, through the steam and exhaust ports, and with the latter as guides, marks on the piston as it is being reciprocated and turned by rotating the crank-shaft. These marks being obtained, any skilled engineer will understand how to cut the passages in the piston so as to bring about the desired result.

Although a vertical engine has been shown in the present instance, it may have its cylinder inverted and the crank below the same; or the engine may be horizontal or inclined, and different styles of frame-work may be used in place of the two columns E E, on which, in the present instance, are the bearings *w w*.

In some cases I propose to connect the pistons of two, or even three, cylinders to the same crank-shaft.

Thus far the mechanism has been described as a steam-engine; but the combination of the cylinder, crank-shaft, connecting-rod, the piston automatically vibrated laterally while it is reciprocated, the passages in the piston, and the ports in the cylinder constitute a single-acting force-pump—in other words, the machine as described can be used either as a steam-engine or a pump without any alteration. All that is necessary in applying the engine to pumping purposes is to make the port H communicate with a water-supply, when, by driving the crank-shaft in the direction of its arrow, the water will be intermittently admitted to the space in the cylinder and discharged through the port I.

I claim as my invention—

1. A single-acting steam-engine in which are combined the following elements, namely: a cylinder closed at one end and open at the other, a hollow piston adapted to the cylinder, a crank-shaft and a frame for the same, a connecting-rod hinged to the piston at one end and connected to the crank at the other end, and a valve and ports for directing the steam to and exhausting it from the cylinder on one side only of the piston, all constructed and operating substantially as set forth.

2. The combination, in a single-acting engine or single-acting pump, of a cylinder having inlet and outlet passages, a connecting-rod embracing the crank at one end and at the other end attached to the interior of the hollow piston by a ball-and-socket joint, and devices whereby the said piston may be vibrated during its reciprocating movement, all substantially as described.

3. The combination of the piston and the

connecting-rod attached to the piston by a ball-and-socket joint with the rod P, one arm, *m*, of which is arranged to slide and turn in a transverse opening in the said connecting-rod, the other arm, *m'*, being arranged to slide and turn in an orifice in the piston, all substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN G. BAKER.

Witnesses:
HENRY HOWSON, Jr.,
HARRY SMITH.