W. Baxter. Jr,

Steam Pump.

No. 113,725. Patented Apr. 18, 1871.

FIG. 1.

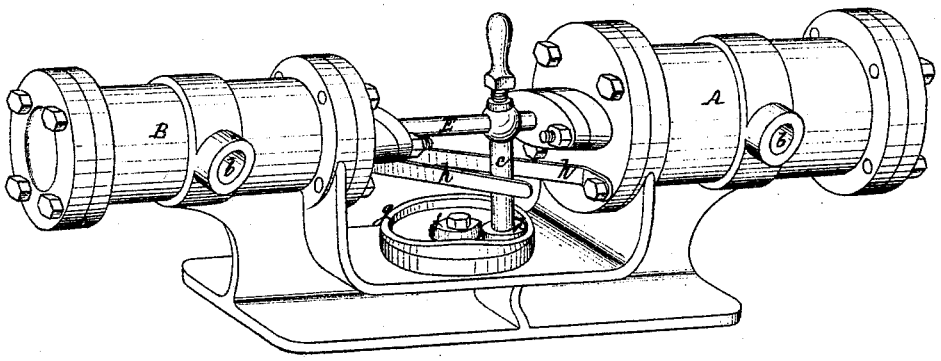



FIG. 2.

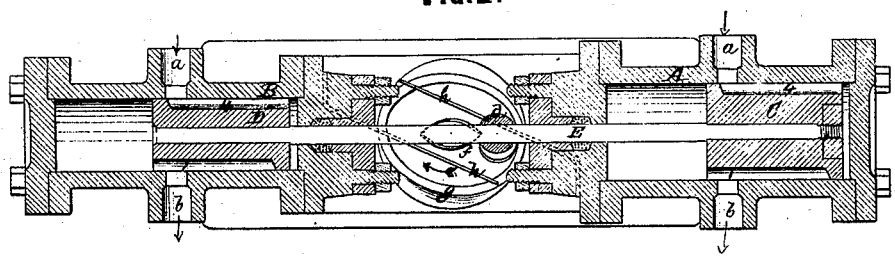



FIG. 3.


FIG. 5.

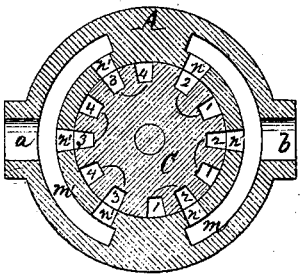
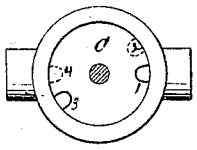



FIG. 4.




William Baxter jr.
by attorney A. Pollok.

WITNESSES. W. Bailey.
C. B. Nottingham

# UNITED STATES PATENT OFFICE.

WILLIAM BAXTER, JR., OF NEWARK, NEW JERSEY.

## IMPROVEMENT IN STEAM-PUMPS.

Specification forming part of Letters Patent No. **113,725**, dated April 18, 1871.

*To all whom it may concern:*

Be it known that I, WILLIAM BAXTER, Jr., of Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Steam-Pumps, of which the following is a specification:

My invention relates to steam-pumps, or pumping-engines composed of two cylinders, the one for steam, the other for water, whose pistons are connected and united by one piston-rod, and are so constructed and operated as to serve as valves for the admission and exit of the water and steam into and from the said cylinders, thus dispensing with all independent valve devices for the purpose. To this end each piston is usually formed with channels communicating with the ends of its cylinder, and with the inlet and outlet ports of said cylinder, and so arranged that a slight rotary movement of the piston is sufficient to close one channel and open another, so as to change the direction in which the piston moves.

The objects I have in view in this invention are, first, to give the piston a uniform velocity throughout its entire stroke, so that it will not slow or stop at the end, but will return immediately, in order to cause the water to flow in the pipes constantly and uniformly; second, to construct the ports in such manner as to allow a free passage to both water and steam, and to have as few obstructions as possible in the water-cylinder; third, to use as few parts in the construction of the engine as possible, and to combine with simplicity of construction cheapness and durability; fourth, to make the pump a "live" pump—that is to say, a pump in which the piston will be carried over the dead-center without the use of a crank, eccentric, or fly-wheel.

In pumps that have a crank, and consequently a fly-wheel, the pistons are thereby caused to travel fast at the center of the stroke and slow at the end, a defect common to all crank-pumps, which, besides being dead-pumps, do not work with uniform velocity.

The manner in which these objects are or may be attained can best be explained by reference to the accompanying drawings, in which—

Figure 1 is a perspective view of a steam-pump or pumping-engine made in accordance with my invention. Fig. 2 is a longitudinal horizontal section of the same through the axis of the cylinders. Fig. 3 is a perspective view of the steam and water pistons and their connecting-rod removed from the cylinders. Fig. 4 is an end view of one of the cylinders, with the head removed in order to show the location of the channels in the piston. Fig. 5 is a transverse vertical section of a cylinder and piston, embodying a modified arrangement of the ports and channels.

A is a steam-cylinder, and B the water-cylinder. Within each is a piston, C and D, the two being connected by an intermediate piston-rod, E, which passes through suitable stuffing-boxes in the inner ends of the cylinders.

The construction of the two cylinders and pistons is substantially the same, so that a description of one will suffice for both.

The cylinder A is provided with the usual inlet and outlet ports *a b*, and is otherwise constructed in any suitable manner. Within it is the piston C, which is constructed with channels and passages, which, when the piston is operated, as hereinafter described, will act as valves to regulate and cut off the admission of steam, doing away with the necessity for the ordinary valve mechanism usually employed in steam-pumps or analogous engines. These channels are formed in pairs on each side of the piston, and opposite to or so as to communicate with the inlet and outlet ports of the cylinder. They are represented by the numerals 1 2 3 4.

The channels 1 2 communicate with the outlet; the channels 3 4 with the inlet. They extend longitudinally near the length of the piston, and the channels of each pair communicate with opposite ends of the cylinder, the channels 1 3 opening into the inner end of the cylinder, the channels 2 4 into the outer end. They are also so arranged that when the channel 1 is in communication with the outlet the channel 4 will be in communication with the inlet, and when the channel 2 opens into the outlet the channel 3 will communicate with the inlet, this arrangement being necessary in order to provide for the proper admission and escape of steam into and from the cylinder.

It will be seen that by giving a slight rotary motion to the piston at or near the end

of its stroke, the proper set of channels may be brought opposite the inlet and outlet ports to reverse the movement of the piston, and by thus rotating the piston sooner or later in its stroke, steam may be cut off at any desired moment, and the length of stroke can be regulated at pleasure within the limits allowed by the cam.

The arrangement of channels in the water-cylinder is precisely the same as that just described, except that the channels 1 3 open into the outer end of this cylinder, and the channels 3 4 into the inner end, this change being obviously necessary in order to enable the pumping operation to be performed properly.

The operation of the piston is also the same as that of the steam-piston, the rotary motion of the two taking place simultaneously through the medium of the piston-rod E.

The piston-rod is actuated to produce this movement of the pistons in the following manner: Upon the rod, and about midway between the two cylinders, is fixed an arm, *c*, the end of which, provided preferably with a friction-roller, *d*, works in a cam-groove formed by the two cams or oval-shaped pieces *f g*, the shape of the groove causing the oscillation of the arm and the consequent slight rotary motion of the piston-rod during the reciprocations of the pistons.

The center-piece *f* has its longer axis parallel with the axis of cylinders and piston-rod, but the longer axis of the outer cam *g* is at an angle with said axis in about the direction of the springs *h*, hereinafter described, (see Fig. 2,) the object and result of this arrangement being to conduct and carry the arm *c*, which moves in the direction of the arrow, around the end of the inner cam-piece *f*, past the dead-center, the piston being rotated so that the steam may enter the cylinder at the proper end and cushion, and also return the piston, thus enabling the pump to work without the crank or eccentric and fly-wheel usually employed.

In conjunction with the cam-groove thus formed I employ springs *h*, one on each side of the groove, and so arranged that the pressure of the spring with which the arm may be in contact is increased as the arm in its movement approaches the center of the cam, and power is thus accumulated to pass the piston over the dead-center when steam is cut off, thus preventing all liability of the piston stopping at a point at which steam would be cut off from both ends of the cylinder, and rendering the engine always capable of starting when steam is let on. The pump thus becomes essentially a "live pump," and will start at whatever part of the stroke the piston may happen to be.

The springs or their equivalents take up a portion of the power while the piston is moving forward, and give it back in passing the piston over the center. The motion is also made regular and uniform, and irregularities incident to the use of cranks and fly-wheels are done away with.

In lieu of springs of the peculiar construction represented, rubber or other substance may be employed, or fingers or rods connected with weights may be used; or, indeed, any suitable device, so arranged as to take up and retain force or power enough during each stroke of the piston to pass it over the dead-center, this power being retained and given out at the proper time, whether the engine be running fast or slow.

With the arrangement just described the engine is adapted to act as a water-meter, and I propose constructing meters upon this principle.

In order to get a sufficient opening at the ports without giving too much rotary movement to the pistons, I prefer to core out or otherwise form around the center of each cylinder chambers *m m'*, provided with a series of openings, *n n'*, each communicating with a pair of channels, 1, 2, &c., and also with the main inlet and outlet *a* and *b*, as shown in Fig. 5.

The principle of operation is substantially the same as above described, and will be understood without further explanation.

The advantages of this arrangement, as just stated, is that ample opening at the ports is obtained without giving too much rotation to the piston.

The cams *f g* can be removed and varied as desired, their shape, of course, regulating the point of entrance and cut-off of steam.

The arm *c* may extend above the piston-rod, and may there fit in another groove corresponding to the one in which its lower end works.

The ports in the cylinder-chambers *m m'* should be oblong, or with their longer axis lengthwise of the cylinders.

The operation of the devices described is obvious, and needs no detailed description.

The pistons in Fig. 2 are represented as having completed their stroke in one direction, and as being about to return, the valve channels or passages having just been shifted.

The steam which enters the cylinder A through the port *a* and channel 4 will drive forward the piston C. This movement is communicated, through the medium of the piston-rod E, to the water-piston D, which is driven forward also, forcing out, through the channel 1 and port *d*, the water in the outer end of the cylinder B, and taking a fresh supply into the opposite end of the cylinder through the port *a* and channel 4. By the reciprocations of the steam-pistons a steady flow of water from the water-cylinder is thus maintained.

In lieu of the cam-groove, other suitable stationary guides for the purpose may be used.

Having now described my invention, and and the manner in which the same is or may be carried into effect, what I claim, and desire to secure by Letters Patent, is as follows:

1. In a steam-pump, the combination, with channeled pistons operating in pairs in axially opposite cylinders, of a stationary cam-groove, or equivalent guide, operating on the piston-rod connecting the pair of pistons, substantially as shown and described, to effect the rotation of both the piston-rod and pistons, thereby reversing the action of the fluid in the cylinders.

2. The combination of the connected channeled pistons and cylinders with a cam groove or guide located between the cylinders to receive an arm or equivalent device, mounted on or projecting from the piston rod, so as to produce oscillation of the pistons upon their axes while reciprocating in their cylinders, substantially as and for the purpose set forth.

3. The cam guide or groove, composed of inner and outer cam-pieces, substantially of elliptical shape, the longer axes of the two forming an angle with each other, substantially as and for the purpose described.

4. In combination with the arm mounted on the piston-rod, and the cam guide or groove which controls the movement of the same, the springs or equivalent devices, as described, operating in connection with said parts, substantially as and for the purpose set forth.

5. The construction of the piston and cylinder, substantially as described and shown in Fig. 5 of the accompanying drawing.

In testimony whereof I have signed my name to this specification before two subscribing witnesses.

WILLIAM BAXTER, JR.

Witnesses:

ELVIN CRANE,

G. N. ABEEL.