2 Sheets--Sheet 1.

R. EICKEMEYER.
Steam-Pumps.

No. 138,622. Patented May 6, 1873.

Fig. 1.

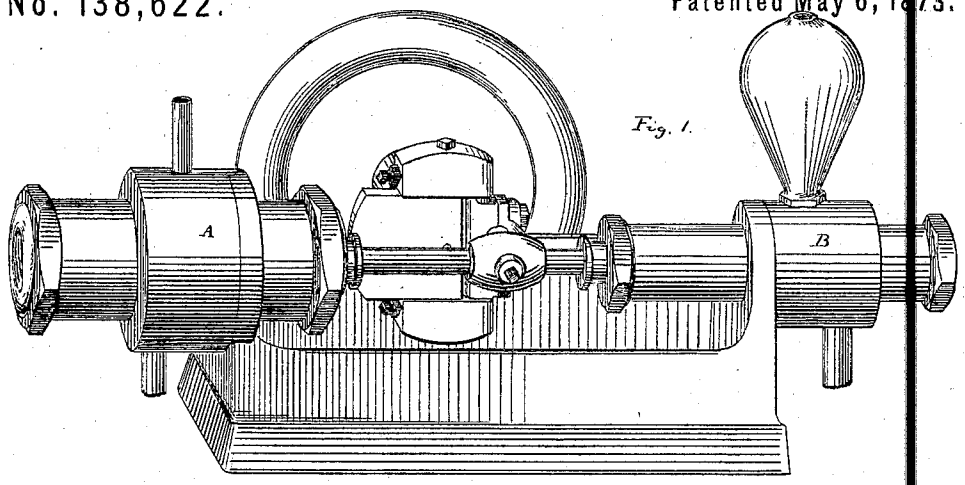


Fig. 3.

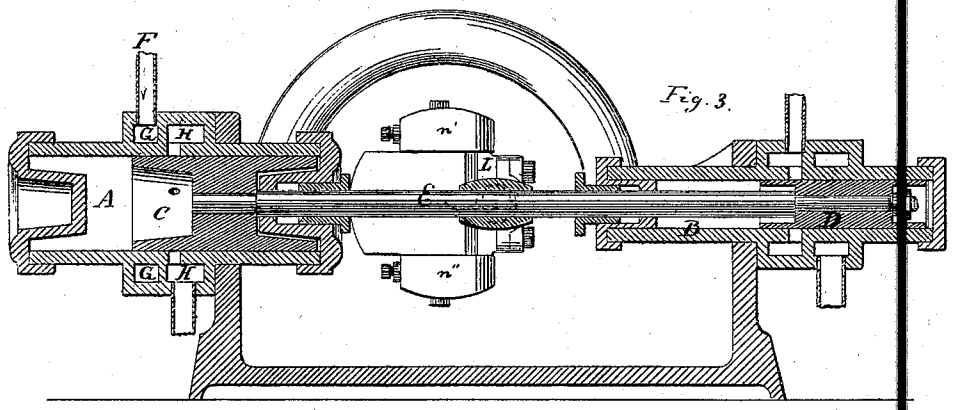
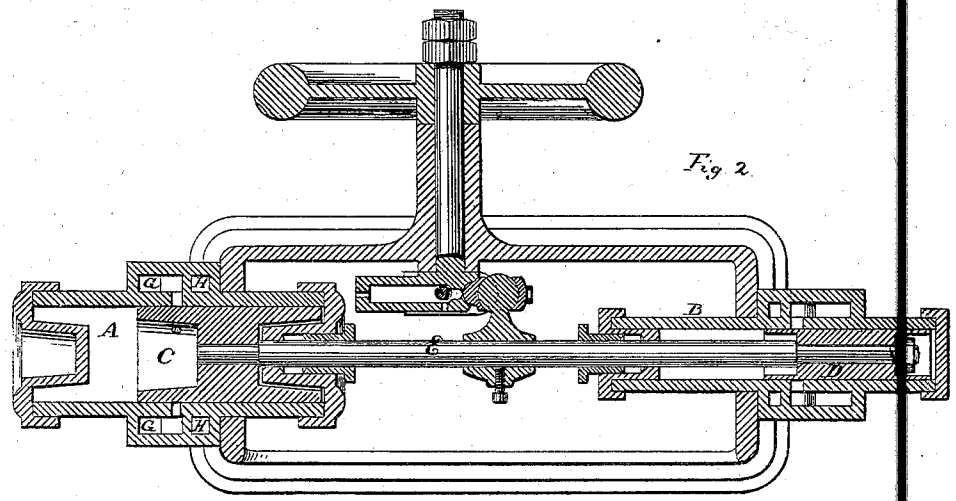


Fig. 2.



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2 Sheets--Sheet 2.

R. EICKEMEYER.

Steam-Pumps.

No. 138,622. Patented May 6, 1873.

Fig 4.

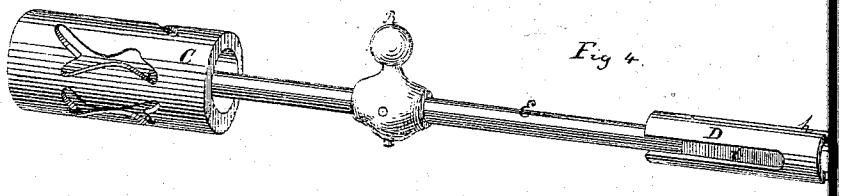


Fig 10.

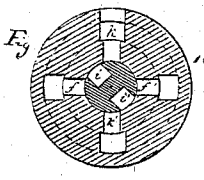


Fig 5.

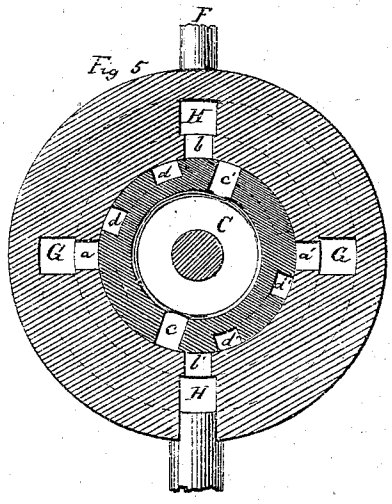


Fig 6.

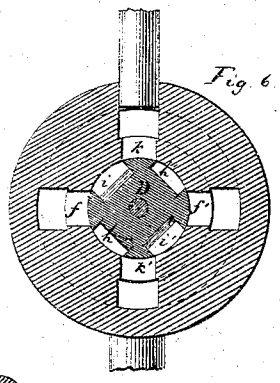


Fig 8.

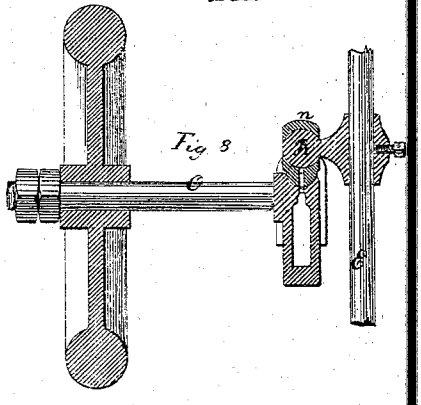


Fig 7.

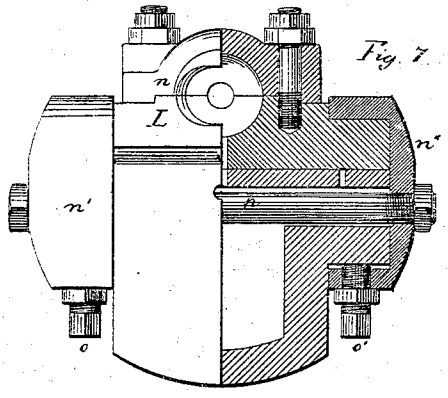
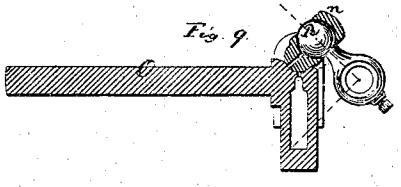


Fig 9.



Witnesses:

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Inventor: R. Eickemeyer

UNITED STATES PATENT OFFICE.

RUDOLF EICKEMEYER, OF YONKERS, NEW YORK.

IMPROVEMENT IN STEAM-PUMPS.

Specification forming part of Letters Patent No. **138,622**, dated May 6, 1873; application filed January 15, 1873.

To all whom it may concern:

Be it known that I, RUDOLF EICKEMEYER, of Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Steam-Pumps and Pumping-Engines; and that I do hereby declare that the following is a full and correct description thereof, reference being had to the accompanying drawing and the letters of reference thereon.

My invention relates to steam-pumps and pumping-engines, composed of two cylinders, the one for steam, the other for water, whose pistons are connected by one piston-rod, and are so constructed and operated as to serve as valves for the admission and exhaust of the steam, and the admission and discharge of water, thus dispensing with all independent valve devices for that purpose, or of one steam-cylinder and one plunger-pump, when the engine is to be used as a motor, and the pump as a feed-pump for the boiler only. When two cylinders are used the pistons are formed with channels communicating with the ends of the cylinders and with the inlet and outlet ports, and when one cylinder is used the piston is formed in the same manner. The plunger has channels communicating with one end of the plunger-barrel, and alternately with the inlet and outlet ports of the said barrel. These ports in the cylinders, or in the barrel of the pump-plunger, are so arranged relative to the channels in the pistons or the pump-plunger that the rotary motion produced on the piston by the movement of the crank will close one port and open another. The first part of my invention relates to mechanism for giving the pistons of both steam and water cylinders a partly rotating motion around their axis by means of a hinged crank which is attached to the fly-wheel shaft, and, by a ball-shaped wrist-pin, to the piston-rod, the arrangement being such that the pistons are turned about one-quarter of a revolution, and back again to the position from which they started during each revolution of said hinged crank, or during each double stroke. My invention further relates to the construction of the inlet and outlet ports of the cylinders and the long channels in the pistons, and consists in constructing and placing them in such a manner that the pressure of the steam and the pressure of the water is balanced, so that no pressure is exerted upon the pistons which would force them against the sides of the cylinders; also, in so constructing the exhaust-ports of the steam-cylinder and the discharge-port of the water-cylinder that the condensed water from the first and the air from the latter have a free passage, thereby dispensing with all water and air cocks, and obtaining a free and smooth-running machine; also, in so constructing the ports in the water-cylinder and the long channels in the piston that, at each end of the stroke, the two ends of said cylinder are in communication with the delivery or outlet pipe, while the suction-ports are closed, for the purpose of giving the pump-piston an equal pressure on both ends to ease the turning around of the pistons in the cylinders as much as possible.

To more particularly explain my invention I refer to the accompanying drawing, in which—

Figure 1 is a perspective view of a steam 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 and crank-shaft. Fig. 3 is a longitudinal vertical section through the axis of the cylinders. Fig. 4 is a perspective view of the steam and water pistons, their connecting piston-rod and wrist-pin removed from the cylinders. Fig. 5 is a transverse vertical section of cylinder and piston of steam-cylinder. Fig. 6 is a transverse vertical section of cylinder and piston of pumps. Fig. 7 is a front view of the jointed crank. Fig. 8 is a horizontal section of the crank-shaft fly-wheel, wrist-pin, and part of the piston-rod, showing the piston-rod at the end of its stroke. Fig. 9 is a vertical section of the crank-shaft, wrist-pin, and piston-rod through the axis of the crank-shaft showing the piston-rod and crank in the middle of the stroke of the piston. Fig. 10 is a transverse vertical section of a pump-barrel and plunger, showing the inlet and outlet ports in the barrel and the ports in the plunger.

Letter A is the steam-cylinder. Letter B is the water-cylinder. Within each is a piston, C and D, being connected by a piston-rod, E, which passes through suitable stuffing-boxes in the inner cylinder-heads. The construction

of the two pistons is substantially the same. Annular chambers for the inlet and outlet openings are cast around each cylinder, and two ports are put in each. The cylinder A is provided with two inlet-ports, *a a'*, and two outlet-ports, *b b'*, and the piston C is constructed with four channels, *c c' d d'*, which will act as valves when the piston is operated, and will regulate the admission and exhaust of the steam, as may be desired. The inlet-ports *a* and *a'* are connected with each other and the inlet-pipe F by an annular opening, G, shown in sections Figs. 2 and 3, while the exhaust-ports *b* and *b'* are connected with each other and with the exhaust-pipe by an annular opening, H. Both the inlet and exhaust ports are placed exactly opposite each other for the purpose of bringing the pressure of the steam on both sides of the piston, and the exhaust-port *b'* is placed in the lowest part of the cylinder to give a free discharge to the condense-water. The channels *c* and *c'* are connected by holes with one end of the piston, while the channels *d* and *d'* communicate with the other end. That part of the cylinder which is in connection with the ports *c* and *c'*, as shown in Fig. 5, would receive steam through the ports *a* and *a'*, while that port connected with the channels *d d'* would exhaust its steam and condense-water through the exhaust-ports *b b'*.

It will be seen that by giving the piston a rotary motion of one-fourth of a turn the position of the channels will be such that the part of the cylinder which, before the turning was done, received steam through the inlet-ports will now exhaust its steam, and that part of cylinder which then exhausted is now in communication with inlet-ports, and will receive steam through the pipe F.

The channels in the steam-piston are made in a curved form to correspond with the movement of the piston, and the length and position of these channels regulate the admission and escape of the steam. In order to cut off the steam at three-quarters of the stroke of the piston, it is only necessary to reduce those parts of the channels which act as inlet-valves to the necessary length, and the same may be done with those parts of the channels used as exhaust-valves, when it is deemed desirable to cushion the steam at the end of the stroke when high speed is wanted. The arrangement of the ports in the water-cylinder B is the same as in the steam-cylinder. The inlet-ports *f f'* are placed horizontal and the outlet-ports *k k'* vertical, for the purpose of passing the air out at the highest point of the cylinder.

To obtain the largest possible openings I have made the ports nearly one-eighth of the circumference of the water-cylinder, and have constructed the channels *h h' i i* also almost the width of one-eighth of the circumference of the piston.

In Fig. 6 the water-cylinder is shown with the piston inside at the end of its stroke. It will be seen that the inlet-ports *f f'* are closed, while the outlet-port *k* is in communication with both channels, *i* and *h'*, and *k'* is in communication with *i* and *h*. Turning the piston to the right the connection between *k k'* and *h h'* is closed first, and then *h* and *h'* will pass over the inlet-ports *f* and *f'*, and thus fill that end of the cylinder with which they communicate, while the other end will discharge its contents through the channels *i i'* and the ports *k* and *k'*. Constructing the ports and channels in this manner no compression of the water at the end of the stroke can take place, and an easy reversal of the machine is insured.

To compel the pistons to make the desired motion, and to enable me to transfer a part or all the power developed by the steam-cylinder either upon the pump-piston or the band-wheel, and also to enable me by the use of a fly-wheel to cut off the steam at a part of the stroke, and use the expansion through the remaining portions of the stroke, I have constructed a jointed crank, shown in Fig. 2, but more distinctly seen in Figs. 7, 8, and 9. The crank is composed of a bearing formed at right-angles with the axis of the shaft, and the center of this bearing is one-fourth of the stroke from said axis. In this bearing the piece L is hinged in such a manner that it can swing from a position at right-angles to the axis of the crank-shaft toward the piston-rod from thirty to forty-five degrees, as occasion may require. The piece L and caps *n* form the socket or bearing for the ball-shaped end of the wrist-pin R. The distance from the center of this ball to the joint is also one-fourth of the whole stroke. *n'* and *n''* are straps which form one-half of the bearings of the cylindrical ends of piece L, and small set-screws *o o'* are used to tighten the straps on the cylindrical part of L, and the bolt *p* prevents any movement of L lengthwise in its bearings. The distance from the center of the ball-shaped end of the wrist-pin to the center of the piston-rod, as shown in the drawing, gives the pistons in the two cylinders one-fourth of a turn. When a longer wrist-pin is used the turning of the pistons would be less, while a shorter wrist-pin would make it more.

When a greater part of the power is to be used from the crank-shaft it may be advantageous to use a short wrist-pin, so as to bring the strain as near in line with the piston-rod as possible.

Referring to Figs. 8 and 9 it will be seen that the joint in the crank will allow the bearing to follow the wrist-pin through its stroke. In Fig. 8 the crank, wrist-pin, piston-rod, and fly-wheel are shown in section at the end of the stroke, and in Fig. 9 the crank, wrist-pin, and piston-rod are shown in a vertical section through the axis of the fly-wheel shaft at the middle of the stroke. The dotted lines show the angle of oscillation of the wrist-pin during one double stroke, which is ninety degrees.

From the action of the jointed piece L it is obvious that the crank-shaft O would have a

tendency to follow the wrist-pin, and make a motion lengthwise to the center of its axis. To prevent this and to produce a means to take up any wear that may be caused by this tendency between the fly-wheel and the bearing, I have formed a screw-thread upon the end of the shaft, and fitted two jam-nuts on this thread, by means of which the fly-wheel, which serves as a collar, and is fitted upon a stationary key, may be set up close to the bearing when required. To take up the wear on the wrist-pin it is only necessary to tighten the screws which hold the cap.

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

In Figs. 2 and 3 the pistons are represented as having completed their stroke in one direction. The momentum of the fly-wheel would now continue to turn the pistons, and thereby bring two of the channels in the steam-piston in communication with the inlet-ports, and the two others with the exhaust, thus causing a return motion of the steam-piston. The motion of the steam-piston being transmitted by the piston-rod to the water-piston, the ports and channels being in the proper position, the one end of the water-cylinder will discharge its contents through the outlet-port, while the other end is filled through the inlet port. By the reciprocations of the steam-piston a steady flow of water is thus maintained.

When most of the power developed by the engine is to be used from the band-wheel, and only a small part for pumping, I construct the piston-rod on its outer end with channels operating in a pump-barrel.

Fig. 10 is a vertical section through the barrel and plunger, and explains itself.

Instead of four channels in the pistons, when the pump is double-acting, I use here two only, the inlet and outlet ports remaining as before.

The construction of the ports in pairs, opposite each other, has enabled me to prevent all friction and wear on the pistons, and the jointed crank furnishes a solid and durable connection between the moving parts. The construction of the crank and wrist-pin may, of course, be varied.

Instead of the ball-shaped wrist-pin a ball-shaped crank-pin may be put on the hinged piece, and an adjustable socket on the piston-rod.

When a greater part of the power is to be used on the band-wheel it may also be desirable to place the hinge of the hinged piece in the center of the crank-shaft, or even on the opposite side of the crank-center; but these modifications are only such as would be adapted for certain purposes, and would not alter the character of my improvements.

Having thus described my invention, and being aware that long channeled pistons having a partly-rotary motion to enable them to act as valves are not new, I do not broadly claim these pistons, but without confining myself to the combination of two cylinders, or one cylinder and one plunger, what I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination of the steam-cylinder, channeled piston, piston-rod, and wrist-pin with a hinged crank, substantially as and for the purpose described.

2. The channeled pistons in combination with the opposite cylinders, a hinged crank operating a wrist-pin attached to the piston-rod, and the two channeled pistons, substantially as and for the purpose described.

3. The two inlet-ports opposite each other, and the two outlet-ports opposite each other, in combination with the channeled piston, as and for the purpose specified.

4. The channeled pistons when so arranged relatively to the inlet and outlet ports in the cylinder that the same channels will act alternately as outlet and inlet passages, as and for the purpose specified.

5. The hinged crank in combination with the adjustable fly-wheel, piston-rod and its wrist-pin, as and for the purpose described.

RUDOLF EICKEMEYER.

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