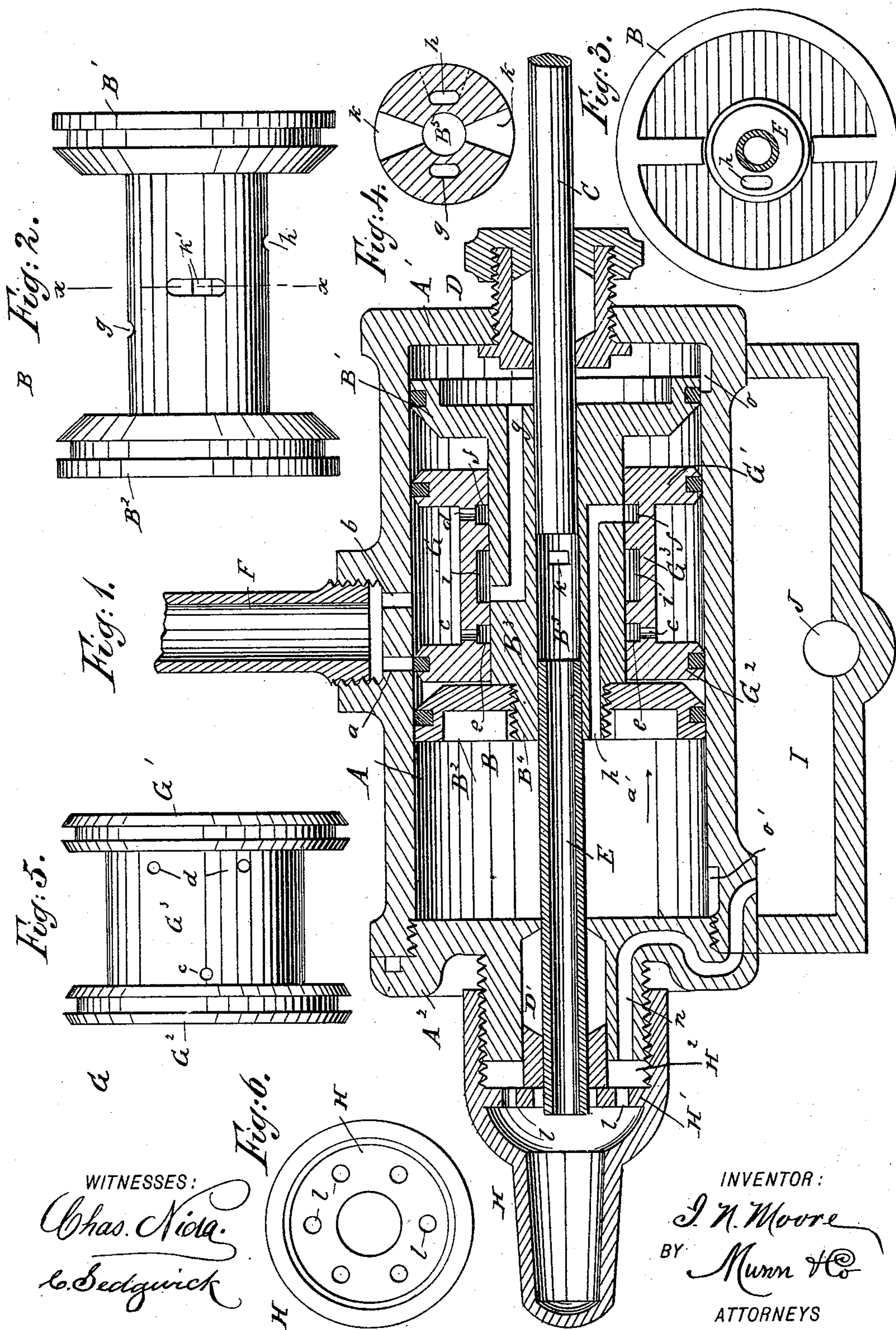


(No Model.)

I. N. MOORE.  
STEAM ACTUATED VALVE.

No. 454,753.

Patented June 23, 1891.



WITNESSES:

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# UNITED STATES PATENT OFFICE.

ILA N. MOORE, OF BATTLE CREEK, MICHIGAN.

## STEAM-ACTUATED VALVE.

SPECIFICATION forming part of Letters Patent No. 454,753, dated June 23, 1891.

Application filed January 27, 1891. Serial No. 379,234. (No model.)

*To all whom it may concern:*

Be it known that I, ILA N. MOORE, of Battle Creek, in the county of Calhoun and State of Michigan, have invented a new and Improved Steam-Actuated Valve, of which the following is a full, clear, and exact description.

The invention relates to steam-engines with steam-actuated valves, and is more specially designed for use as motive power for steam-pumps.

The object of the invention is to provide a new and improved engine or steam-pump power which is simple and durable in construction, very effective in operation, and requiring no steam-chest.

The invention consists of a piston provided with steam-ports leading to the ends of the cylinder, and a valve fitted to slide on the said piston and controlling the said ports and the steam-inlet ports.

The invention also consists of certain parts and details and combinations of the same, as will be hereinafter fully described, and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a sectional side elevation of the improvement. Fig. 2 is a side elevation of the piston. Fig. 3 is an end view of the same. Fig. 4 is a transverse section of the same on the line *x x* of Fig. 2. Fig. 5 is a side elevation of the valve, and Fig. 6 is an end elevation of the same.

The improved engine is provided with a cylinder A, in which is fitted to slide a piston B, secured at one end to a piston-rod C, passing through a suitable stuffing-box D, arranged in one end A' of the cylinder A. The other end of the piston B is connected with a pipe E, extending rearwardly and passing through a stuffing-box D', arranged on the removable head A<sup>2</sup> of the cylinder A.

In the middle of the cylinder A is arranged a steam-inlet pipe F, leading to two inlet-ports *a* and *b*, opening into the interior of the cylinder A to furnish the necessary motive agent to actuate the piston B and the valve G, fitted to slide on the piston B. The latter is provided with heads B' and B<sup>2</sup>, connected with each other by a body part B<sup>3</sup>, in which the

piston-rod C and the pipe E are centrally secured. The head B<sup>2</sup> screws on a threaded end B<sup>4</sup> of the body part B<sup>3</sup>, while the head B' is integral with the body part. The two heads B' and B<sup>2</sup> are formed with suitable packing-rings, pressing on the inner surface of the cylinder A.

On the body part B<sup>3</sup> is fitted to slide a cylindrical valve G, also provided with two heads G' and G<sup>2</sup> and a body part G<sup>3</sup>. The heads and body all are integral, as is plainly shown in Fig. 1. The heads G' and G<sup>2</sup> of the valve G are formed with packing-rings fitted against the inner surface of the cylinder A. The longitudinal sliding motion of the valve G on the piston B is limited between the heads B' and B<sup>2</sup>.

In the body part G<sup>3</sup> of the valve G, and near the heads G' and G<sup>2</sup>, are arranged sets of openings *c* and *d*, leading to annular grooves *e* and *f*, respectively, formed on the inside of the body part G. The annular grooves *e* and *f* are adapted to register alternately with longitudinally-extending channels *g* and *h*, respectively formed in the body part B<sup>3</sup> of the piston B, the channel *g* opening into the front end of the cylinder A, while the other channel *h* leads to the rear end of the said cylinder, as is plainly illustrated in Fig. 1.

Between the annular grooves *e* and *f* is arranged a wider annular groove *i*, registering at all times with exhaust-ports *k k'*, formed in the body B<sup>3</sup> of the piston B and leading to the central hollow space B<sup>5</sup> in the said body part and connecting with the pipe E. The annular groove *i* is adapted to register alternately with the channels *g* and *h*, so that the exhaust-steam can pass from the ends of the cylinders through the respective channel *g* or *h* into the annular groove *i*, and from the latter through the exhaust-ports *k k'* into the opening B<sup>5</sup>, and from the latter into the pipe E.

The rear end of the pipe E passes into a cap H, screwing on the stuffing-box D' and provided with a transverse partition H', adapted to press onto the gland of the stuffing-box to tightly press the packing onto the pipe E. The transverse partition H' is provided with a series of openings *l*, leading to a space H<sup>2</sup>, formed between the partition H' and the outer end of the stuffing-box D'. Into



this space  $H^2$  opens one end of a channel  $n$ , formed in the head  $A^2$  and part of the cylinder  $A$ , the said channel leading to an exhaust-chamber  $I$ , connected with the exhaust-pipe  $J$ . On the inner surface of the cylinder  $A$ , near the heads  $A'$  and  $A^2$ , are formed longitudinally-extending relief-grooves  $o$  and  $o'$ , respectively.

The operation is as follows: When the several parts are in the position as shown in Fig. 1, live steam is passing through the inlet-pipe  $F$  to the ports  $a$  and  $b$ , of which the port  $a$  is cut off by the head  $G^2$  of the valve  $G$ . The live steam passing through the port  $b$  passes into the annular space between the two heads  $G'$  and  $G^2$  of the valve  $G$ , and from this space through the opening  $d$  into the annular groove  $f$ , which at this time registers with the channel  $h$ , so that the live steam passes to the rear end of the cylinder  $A$ , presses against the piston-head  $B^2$  to force the piston in the direction of the arrow  $a'$ . The exhaust-steam in the other end of the cylinder passes through the channel  $g$  into the annular groove  $i$  and from the latter through the exhaust-ports  $k$  and  $k'$  to the pipe  $E$ , from the latter into the cap  $H$ , through the openings  $l$ , into the space  $H^2$ , and through the channel  $n$  into the exhaust-chamber  $I$  to the exhaust-pipe  $J$ . On the further forward movement in the direction of the arrow  $a'$  the valve  $G$  is carried along by the piston  $B$ , so that the valve-head  $G^2$  finally passes the inlet-port  $a$ , so that live steam can pass between the heads  $G^2$  and  $B^2$ . At this time the head  $B'$  of the piston  $B$  has passed onto the relief-groove  $o$ , so that a communication is established between the front end of the cylinder  $A$  and the space between the heads  $G'$  and  $B'$ . The live steam, now entering the port  $a$  between the heads  $G^2$  and  $B^2$ , presses on the valve  $G$  and forces the latter forward in the direction of the arrow  $a'$  until the head  $G'$  strikes the head  $B'$ . By this movement of the valve  $G$  the channel  $h$  is disconnected from the annular groove  $f$  and the annular groove  $e$  is connected with the channel  $g$ . Live steam now entering the port  $b$  passes through the opening  $c$  into the annular groove  $e$ , and from the latter the live steam passes into the channel  $g$  and to the front end of the cylinder  $A$  to press against the head  $B'$ , whereby the piston  $B$  is moved in the inverse direction of the arrow  $a'$ . The exhaust-steam from the rear end of the cylinder  $A$  can pass through the channel  $h$  into the annular groove  $i$  and from the latter through the ports  $k$   $k'$  into the pipe  $E$  to finally pass into the exhaust-chamber  $I$  and exhaust-pipe  $J$ , as previously described. When the piston  $B$  arrives near the outer end of its rearward stroke and the head  $G'$  of the valve  $G$  finally passes over the port  $b$ , so that the live steam passes into the annular space between the heads  $G'$  and  $G^2$  by the port  $a$  only, on the further rearward motion of the piston  $B$  the head  $G'$  passes the port  $b$ , so that live steam finally enters between the heads

$G'$  and  $B'$  at the time when the head  $B^2$  is passed onto the relief-groove  $o'$  to connect the extreme rear end of the cylinder  $A$  with the space between the heads  $B^2$  and  $G^2$ . The live steam which has entered between the heads  $G'$  and  $B'$  forces the valve  $G$  in the inverse direction of the arrow  $a'$ , so that the relative position of the ports on the piston and valve  $G$  is again changed and steam is again admitted to the rear end of the cylinder to force the piston back on its forward stroke in the direction of the arrow  $a'$ . The above-described operation is then repeated. In order to freely admit steam between the respective heads  $B'$  and  $G'$  and  $B^2$  and  $G^2$ , they are slightly chamfered, as is plainly indicated in Figs. 1, 2, and 5.

It will be seen that the engine is very simple and durable in construction, and no steam-chest whatever is necessary for the successful operation of the device. It will further be seen that a steam-cushion is formed on the ends of the cylinder at the time when the respective heads of the piston are nearing the said ends and by the steam passing through the relief-grooves  $o$  and  $o'$ , respectively, to the ends of the said cylinder.

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

1. In a steam-actuated valve, the piston  $B$  in the form of a spool and having longitudinal channels  $g$   $h$  leading through it from its ends to opposite sides of its center and thence laterally outward, a central exhaust-passage within the body of the cylinder, and lateral ports  $k$   $k'$ , leading from the said chamber through the body of the piston between the inner ends of passages  $g$   $h$ , substantially as set forth.

2. In a steam-actuated valve, the combination, with the spool-shaped piston having the oppositely-extending passages  $g$   $h$ , of the spool-shaped valve upon the piston between its heads, annular internal channels  $e$   $f$  to register alternately with the inner ends of passages  $g$   $h$ , respectively, the ports  $c$   $d$ , leading outward from the channels  $e$   $f$  through the contracted body of the valve, and the internal annular exhaust-passage  $i$ , registering alternately with passages  $g$   $h$  and communicating with an exhaust-outlet, substantially as set forth.

3. The combination, with a cylinder provided near its middle with two inlet-ports, of a piston fitted to slide in the said cylinder and provided with two heads of greater diameter than its body and between which open the said ports, the said piston being provided with longitudinal channels extending from opposite sides of the center in opposite directions and leading to the ends of the cylinder, a spool-shaped valve fitted to slide on the said piston between the piston-heads and provided with a cylindrical body and two heads, of which the latter alternately control the inlet-ports and the former is provided with inter-



nal annular steam-inlet grooves and openings leading to the said grooves, which latter are adapted to connect alternately with the said channels in the piston, substantially as shown and described.

4. The combination, with a cylinder provided near its middle with inlet-ports, of a piston fitted to slide in said cylinder and provided with two heads between which open the said ports, the said piston being provided with longitudinal channels extending in opposite directions and leading to the ends of the cylinder, a valve fitted to slide on the said piston between the piston-heads and provided with a cylindrical body and two heads, of which the latter control the inlet-ports and the former is provided with annular steam-inlet grooves, openings leading to the said grooves, which latter are adapted to connect alternately with the said channels in the piston, the said valve-body being provided with an annular exhaust-groove arranged between the inlet-grooves and connecting at all times with an exhaust-space in the piston, substantially as shown and described.

5. The combination, with a cylinder provided near its middle with inlet-ports, of a piston fitted to slide in the said cylinder and provided with two heads between which open the said ports, the said piston being provided with longitudinal channels extending in opposite directions and leading to the ends of the cylinder, a valve fitted to slide on the said piston between the piston-heads and provided with a cylindrical body and two heads, of which the latter control the inlet-ports and the former is provided with annular steam-inlet grooves, openings leading to the said grooves, which latter are adapted to connect alternately with the said channels in the piston, the said valve-body being provided with an annular exhaust-groove arranged between the inlet-grooves and connecting at all times with an exhaust-space in the piston, and a pipe leading from the said piston for carrying off the exhaust, substantially as shown and described.

6. The combination, with a cylinder provided near its middle with inlet-ports, of a

piston fitted to slide in the said cylinder and provided with two heads between which open the said ports, the said piston being provided with longitudinal channels extending in opposite directions and leading to the ends of the cylinder, a valve fitted to slide on the said piston between the piston-heads and provided with a cylindrical body and two heads, of which the latter control the inlet-ports and the former is provided with annular steam-inlet grooves, openings leading to the said grooves, which latter are adapted to connect alternately with the said channels in the piston, the said valve-body being provided with an annular exhaust-groove arranged between the inlet-grooves and connecting at all times with an exhaust-space in the piston, a pipe leading from the said piston for carrying off the exhaust, and a cap secured to the rear end of said cylinder and connected with the exhaust, the said pipe discharging into the said cap, substantially as shown and described.

7. The combination, with a cylinder provided near its middle with inlet-ports and near its ends with relief-grooves, of a piston fitted to slide in the said cylinder and provided with a body and two heads held on the said body, the said inlet-ports opening into the cylinder between the said heads, the latter being also adapted to travel over the said relief-grooves, a valve provided with a valve-body fitted to slide on the said piston-body, two heads held on the said valve-body and controlling the said inlet-ports, the said valve-body being provided with annular grooves, and openings leading to the said annular grooves, which latter are adapted to register alternately with longitudinal channels formed in the piston-body and extending in opposite directions to open into the ends of the cylinder, the said valve-body being also provided with an exhaust annular groove adapted to alternately connect the said piston-channels with an exhaust leading from the piston, substantially as shown and described.

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Witnesses:

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