

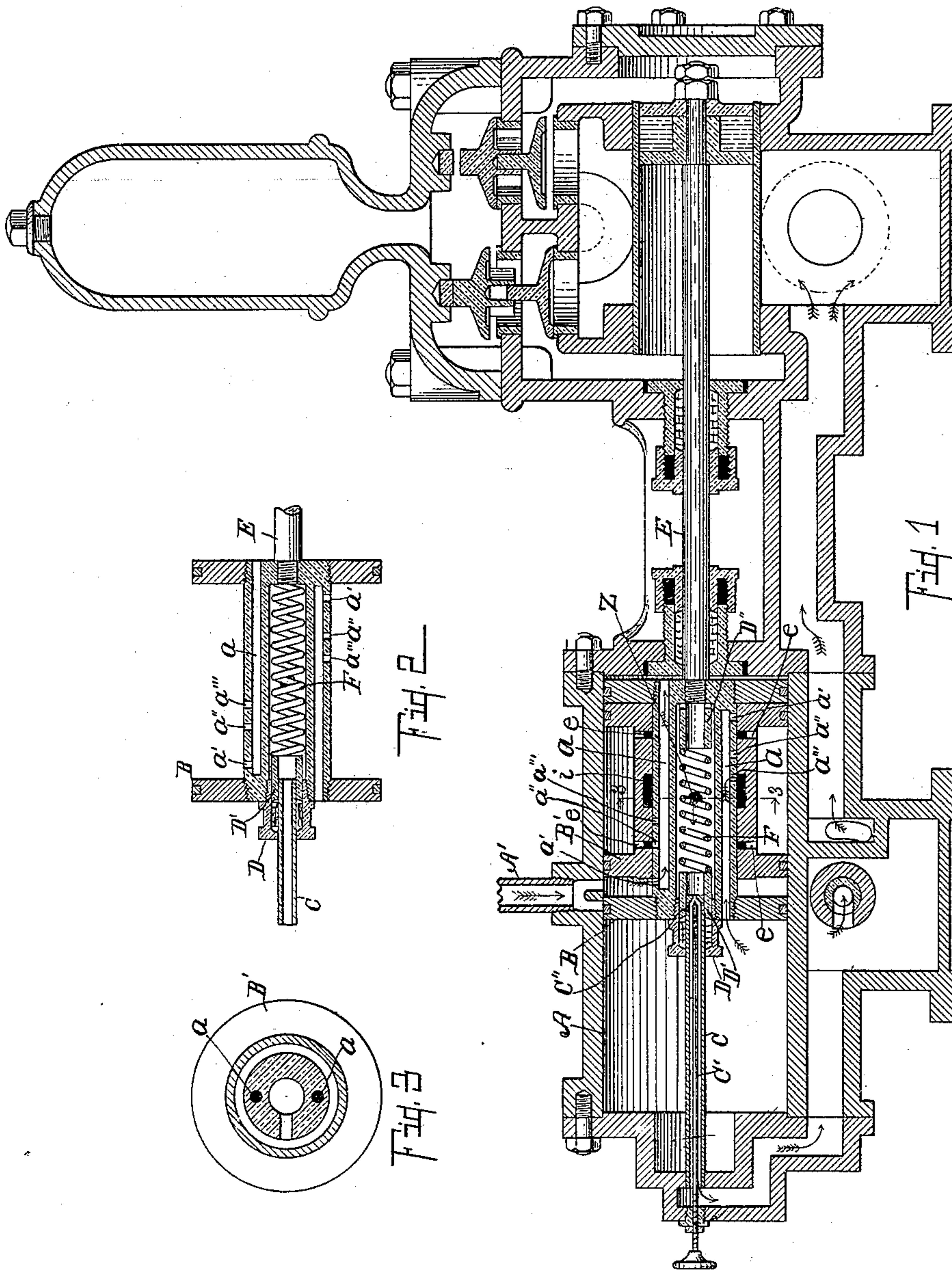
No. 624,233.

Patented May 2, 1899.

I. N. MOORE.  
STEAM ENGINE.

(Application filed Dec. 9, 1895.)

(No Model.)



Witnesses:

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Att'y.



# UNITED STATES PATENT OFFICE.

ILA N. MOORE, OF BATTLE CREEK, MICHIGAN, ASSIGNOR TO THE UNION STEAM PUMP COMPANY, OF SAME PLACE.

## STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 624,233, dated May 2, 1899.

Application filed December 9, 1895. Serial No. 571,569. (No model.)

*To all whom it may concern:*

Be it known that I, ILA N. MOORE, a citizen of the United States, residing at the city of Battle Creek, in the county of Calhoun and State of Michigan, have invented a certain new and useful Steam-Engine, of which the following is a specification.

My invention relates to improvements in steam-engines with steam-actuated valves, and more particularly to a steam-engine adapted for use in a steam-pump, and is an improvement in many particulars upon the engine shown in my Patent No. 454,753, issued June 23, 1891.

The objects of my invention are, first, to make the engine more compact; second, to provide improved means of controlling the exhaust so that the stroke of the piston will start and stop gradually; third, to provide a new and improved exhaust-passage; fourth, to provide a new and improved packing or stuffing-box for use in steam-engine construction, and further objects appearing in the detailed description. I accomplish these objects of my invention by the mechanism shown in the accompanying drawings, in which—

Figure 1 is a vertical longitudinal sectional view through a steam-pump, showing one of my improved engines in that relation. Fig. 2 is a vertical longitudinal sectional view through a modification of the piston. Fig. 3 is a sectional view on line 3 3 of Fig. 1 through the piston and valve.

Similar letters of reference refer to similar parts throughout the several views.

Referring to the drawings, it will be noted that my improved engine is shown in connection with an ordinary double-action pump. It consists of the cylinder A, in which the spool-shaped piston B is located. From each end of the spool-shaped piston independent passages *a* are formed, which extend nearly through to the opposite end of the piston. At the extreme end of the passage *a* a port *a'* is cut just inside the enlarged portion of the spool. A little distance back from that another port *a''* is formed, and a little back of that a port *a'''* is formed. The ports have corresponding ports and passages in the valve B', which will be definitely pointed out. The

valve B' is spool-shaped and reciprocates within the cylinder and upon the body portion of the piston. A broad annular ring *i* is cut into the inside of the center of the body of the valve B' and forms the D of the valve, and smaller annular rings *i' i'* are cut into each end of the same and these together form the valve proper. This valve controls the outlet of steam from the cylinder. A port Z is cut through the center of the body portion of the piston B and is always connected to the D portion or passage *i* of the valve. Ports *e e* open into the annular rings *i* just inside the heads of the head portions of the valve. The spool-shaped valve B' is considerably shorter than the piston B, so that it reciprocates upon the same to give the valve the proper motion. The supply-pipe A' opens into the central part of the cylinder. The steam exhausts through the port Z into the center of the piston, out through the pipe C, down and out through the passages, as indicated by the arrows.

The pipe C is rigidly secured to the cylinder-head and extends through the stuffing-box into the hollow piston, and the piston reciprocates over the pipe C. The gland D' to the stuffing-box comes on the inside and is held in position against the gasket by the coiled spring F, contained in the hollow piston. The inner end of the pipe C contains an opening, the size of which is controlled by the valve C'. Just a little distance back of the end of the pipe C is an enlarged opening C''. The end of the pipe C fits steam-tight into the gland D', so that when the gland D' is out to the end of the same the steam can only exhaust through the port controlled by the valve C'. It will thus be seen that when the piston reciprocates over the pipe C at the start the steam escapes slowly through the small port in the end until the large port C'' is open, when the steam exhausts quickly. This gives the piston a very slow motion in starting, moves it quickly at the middle of its stroke, and slows it at the end, where a collar D'', similar to the gland D', is situated to control the exhaust-ports in the same manner at that end.

Having thus enumerated and specified the



construction of the various parts of my improved engine, I will now point out its operation, starting with the engine in the position shown in the drawings. Steam enters through the supply-pipe A, passes down through the port A', and drives the cylinder toward the left, the steam escaping from the right-hand end of the cylinder through the passage A''' into the passage *i*, out through the port Z, to the center of the piston, escaping gradually through the port in the end of the rod C till it is opened by the gland passing the ports C'', when it escapes rapidly through the pipe C and out through the passage, as indicated by the arrows. When the piston reaches the opposite end of the cylinder, steam enters between the head of the valve and the end of the piston at that end, and the momentum of the valve also carries it to the opposite end, when the right-hand port *a'* will be opened, the left-hand port *a'* be closed, and steam will enter the left end *a'* and will escape through the left-hand passage *a'''* into the D or passage *i* and out the same, as before. The collar D', with its openings at the right end, serves the same function as the gland D' in permitting a gradual exhaust of the steam. When the valve B' is moved to the end of its stroke, the parts A'' will register with the annulus *i'* and steam will be delivered into the passage A through the port *e* continuously until the piston reaches the end of its stroke, when the valve will be moved to its position in that direction and the piston will be started by the entrance of steam through the port *a'* and will be passed to the full portage of the same, as before, when the engine moves in the opposite direction. This gradual exhaust of the steam from the cylinder is of very great value in pumps having very large valves or in apparatus having very large valves, because it seats the valve gradually without giving the same the force of a tremendous blow, and by so doing greatly relieves the strain upon the parts and operates the same with greater safety. The steam being confined in the body of the piston and exhausted in that way permits of an almost direct introduction of live steam to actuate the piston and secures the heating effects of the exhaust to avoid and overcome condensation.

Where it is not desired to control the exhaust from the engine-cylinder as I have indicated, the exhaust-pipe C can be made with a wide-open end, as indicated in Fig. 2, when the construction will be very beneficial and act as an ordinary steam-pump engine, which is desirable in some instances. The gland and gasket are used in my improved stuffing-box in connection with the spring F, are always very effective, and will keep the joint packed until the gasket is entirely worn out. The method of holding the gland and gasket in place is also adapted for use in engines of this class where it is desired to introduce steam through a pipe similar to the pipe C, and the use of a spring in connection with

the gland and gasket, as shown, is valuable for use anywhere.

It will be clear from these statements that my improved engine is capable of considerable variation without departing from my invention.

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

1. In a steam-engine having a steam-actuated valve the combination of the cylinder A, with a supply-pipe A'; at the center; the spool-shaped piston B, a little more than half the length of the cylinder hollow at the center and containing passages *a*, from each end to near each opposite end with ports *a'*, at the inner end and ports *a''*, *a'''*, at a little distance back therefrom opening to the outside of the body portion of the piston and a port Z, at the center; a spool-shaped valve B', adapted to reciprocate upon the body of the piston and fitting the interior of the cylinder containing broad annular groove *i*, at the center and smaller annular grooves *i'*, toward each end with port *e*, opening therein positioned to register with the ports *a'''* and *a''*, respectively during the motion of the valve; and a pipe C, extending from the end of the cylinder into the hollow piston on which the hollow piston reciprocates to deliver the exhaust-steam all substantially as described for the purpose specified.

2. In a steam-engine having a steam-actuated valve the combination of a cylinder with a supply-pipe at the center; a spool-shaped piston therein hollow at the center with a port opening through one side of the body; and passages leading from each end toward the opposite end thereof containing series of ports; a spool-shaped valve adapted to reciprocate upon the body portion of said piston and containing a broad annular passage at the center and an annular passage at each end on its inner surface; the ports opening into the annular passages at the end adapted to register and open and close the ports to the passages in the body in the cylinder alternately and a stationary exhaust-pipe extending from the end of the cylinder into the hollow piston for the purpose specified.

3. In a steam-engine having a steam-actuated valve the combination of a cylinder with a supply-pipe at the center; a spool-shaped piston therein hollow at the center and containing passages and ports; a spool-shaped valve on the said piston to be actuated by the steam from the supply-pipe and exhaust the steam out at the center of the piston; a stationary pipe C extending from the end of the cylinder through the stuffing-box to the said piston through which the steam is exhausted as specified.

4. In a steam-engine having a steam-actuated valve the combination of a cylinder with a supply-pipe in the center a spool-shaped piston therein hollow at the center and containing passages and ports; a spool-shaped



valve on said piston to be actuated by the steam from the supply-pipe to actuate the piston to exhaust steam out of the center thereof; a pipe C, extending from the end of the cylinder into the hollow piston through which steam is exhausted; a gland within said piston; a spring z, for holding said gland against a suitable gasket to pack the exhaust-pipe for the purpose specified.

5. In a steam-engine the combination of a cylinder a piston containing a chamber and adapted to reciprocate within said cylinder a pipe secured to one end of said cylinder and extending through said piston into the chamber within; an engine-valve connected with said chamber; a gasket; a gland within said chamber; a spring to hold said gland against the gasket to pack the pipe as specified.

6. In a steam-engine having a steam-actuated valve the combination of a cylinder with a supply-pipe in the center a spool-shaped piston therein hollow at the center and containing passages and ports; a spool-shaped valve on said piston to be actuated by the steam from the supply-pipe to actuate the piston to exhaust steam out of the center thereof; a pipe C, extending from the end of the cylinder into the hollow piston through which steam is exhausted having a very small port in the end and a large port on the side near the end; a gland within said piston fitted to the exhaust-port to close the large port at starting; a spring z, for holding said gland against a suitable gasket to pack the exhaust-pipe for the purpose specified.

7. In a steam-engine having a steam-actuated valve the combination of a cylinder with a supply-pipe in the center of a spool-shaped

piston therein hollow at the center and containing passages and ports; a spool-shaped valve on said piston to be actuated by the steam from the supply-pipe to actuate the piston to exhaust steam out of the center thereof; a pipe C, extending from the end of the cylinder into the hollow piston through which steam is exhausted having an adjustable port in the end and a large port on the side near the end; collars in said piston to fit over the end of the exhaust-pipe at each end of the stroke to close the large port on the same to make the exhaust slow at the start for the purpose specified.

8. In a steam-engine having a steam-actuated valve the combination of a cylinder with a supply-pipe in the center of a spool-shaped piston therein hollow at the center and containing passages and ports; a spool-shaped valve on said piston to be actuated by the steam from the supply-pipe to actuate the piston to exhaust steam out of the center thereof; a pipe C, extending from the end of the cylinder into the hollow piston through which steam is exhausted having a very small port in the end and a large port on the side near the end, collars in said piston to fit over the end of the exhaust-pipe at each end of the stroke to close the large port on the same to make the exhaust slow at the start; a valve in said exhaust-pipe to regulate the size of the port in the end thereof.

In witness whereof I have hereunto set my hand and seal in the presence of two witnesses.

ILA N. MOORE. [L. S.]

Witnesses:

CHAS. T. ALLEN,  
W. S. WOOD.