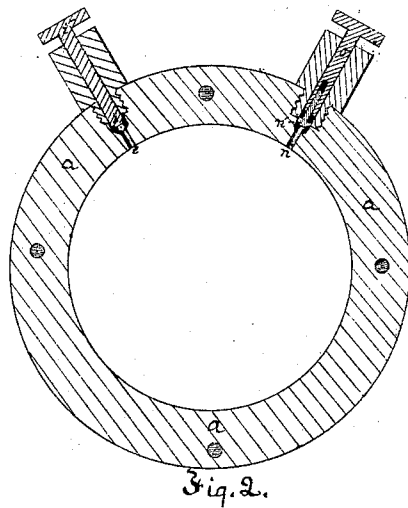
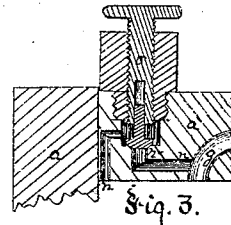
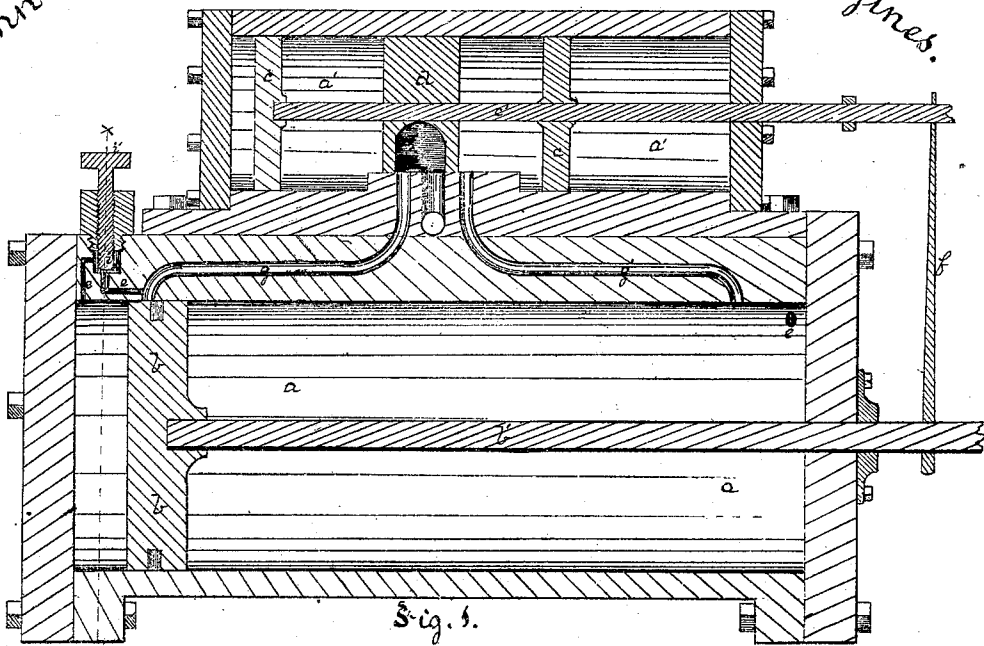


[72.]

No. 118,692.

Patented Sep. 5, 1871.

John M. Cooper: Improvement in Steam Engines.



Witnesses:

R. B. Wenshall
Thos. Kern

Inventor:
John M. Cooper,
by Bakewell Johnston,
his Attys.

UNITED STATES PATENT OFFICE.

JOHN M. COOPER, OF PITTSBURG, PENNSYLVANIA.

IMPROVEMENT IN STEAM-ENGINES.

Specification forming part of Letters Patent No. 118,692, dated September 5, 1871.

To all whom it may concern:

Be it known that I, JOHN M. COOPER, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Steam-Engines; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawing making a part of this specification, in which—

Figure 1 is a longitudinal section of a steam-cylinder and devices connected therewith. Fig. 2 is a cross-section through *xx*, Fig. 1; and Fig. 3 is an enlarged sectional view of the check-valve and ports.

Like letters of reference indicate like parts in each.

My invention relates to the construction and arrangement of secondary ports and valves in connection with a steam-engine cylinder and piston, and, while applicable to different styles of engines, it is especially useful in pumping-engines, particularly where the resistance is great, either from the large amount of water to be raised or from the considerable height to which the water is to be thrown, or from both causes combined. Direct-acting engines are commonly used for such purposes, and one serious difficulty, which in such use is encountered in engines of the ordinary construction, arises from the fact that the water-valves have to operate in a medium which offers considerable resistance to their motions. The object of my invention is to secure in the piston, at the beginning of each stroke, a motion which shall be uniformly accelerated, and, at the end of each stroke, a motion which shall be uniformly retarded, in order that the water-valves may open and close gradually and without strain or jar; and to this end the nature of my invention consists, first, in combining with a cushioning steam-cylinder and piston a secondary steam-port leading from at or near the position of the piston at the extreme end of its stroke back to the exhaust-port, in which secondary port an adjustable throttle-valve is arranged; and, second, in combining a secondary steam-port and check-valve with a cushioning steam-cylinder, piston, and throttle.

To enable others skilled in the art to make and use my improvement, I will proceed to describe its construction and mode of operation.

The steam-cylinder *a* has a piston, *b*, and piston-

stem *b'*, of the usual or any known construction. The steam-chest *a'* contains two pistons, *c c*, one on each end of the stem *c'*, which stem carries and operates the slide-valve *d*. The pistons *c c* are packed so as to operate closely in the steam-chest *a'*, and receive their motions so as to give the requisite throw to the valve *d* by a pair of slide-valves, which, provided with suitable ports, operate in a valve-box on the side of the steam-chest *a'*; or the pistons *c c* may be operated by a knock-er, *f*, which is attached to the piston-stem *b'*, and which moves the valve-stem *c'*, thereby throwing the valves. In the latter case the ports should cross, or other mode be adopted by which the throw of the pistons *c c* shall be in the reverse direction to that of the piston *b*. Such devices are well known, and need not be further described. The main cylinder *a* has the usual steam and exhaust-ports *g g'*, which ports *g g'* open into the cylinder *a* at a little distance from the end of the cylinder, so that the piston *b*, after covering either port *g g'* as it moves toward the end of its stroke, will cushion at such end on the steam so confined in the cylinder, and which is known as "dead" or "spent" steam. The result will be that the piston *b* will be checked up gradually at the end of its stroke. In order now that the piston *b*, as it cushions on the steam after covering the port *g* through which the steam was being exhausted, may stop more slowly, or with a motion more uniformly retarded, I make a small secondary port, *e*, opening into the cylinder at or near the point occupied by the front face of the piston *b* at the extreme end of its stroke, or at any suitable point forward thereof, and leading back into the exhaust *g*. At any suitable or convenient point I arrange in this port *e* a throttle-valve, *i*, of any known construction, either self-acting or adjustable by a screw, *i'*, or otherwise, at pleasure. The size of this port *e*, or of the opening through or under the throttle *i*, is so small that only a portion of the steam in the cylinder *a* on which the piston *b* is cushioning can escape into the exhaust after the piston *b* has covered the exhaust and before it has reached the extreme end of its stroke; and the size of the throttle-opening can be regulated at pleasure, so as to regulate the resistance offered by the steam in cushioning the piston *b*, and thus cause the piston to move to the end of its stroke with a more uniform and slower retardation. But at or about the time the

piston *b* reaches the end of its stroke the shifting of the valves *d* opens the opposite exhaust and supplies the port *g* with live steam, which, however, cannot enter the cylinder through the main port until the piston *b* has uncovered the port.

To start the piston *b* on its return stroke, and to secure a uniformly accelerated motion in the piston *b* from the very beginning of its stroke, I allow the live steam to flow through the port *e* and under throttle *i*, from the port *g*, into the cylinder in front of the piston. But as this will not always give the amount of pressure desired, I open another small port, *n*, from the port *g* to the cylinder in front of the piston *b*, and arrange in it a check-valve, *n'*, so that it will allow the live steam to enter the cylinder, but will not allow the escape of steam through it while the piston is cushioning. This check-valve *n'*, made of any known form, may also be made adjustable by a screw-socket, *o*, or in other known way, so as to enlarge or lessen the size of the aperture through which the steam passes into the cylinder. By the use of the two ports *e* and *n* the live steam can be fed into the cylinder forward of the piston, so as to exert any desirable force

from the instant the piston starts on its return stroke until it uncovers the port *g*. A uniformly accelerated motion will thus be imparted to it, the water-valves will be brought down gradually, and all unnecessary strain and jar avoided.

Such secondary ports and valves I arrange at both ends of the cylinder, the construction and arrangement at the opposite end being the same as that shown and described.

I do not claim, broadly, a cushioning-piston and cylinder, nor a check-valve arranged in a secondary port in connection with such a piston and cylinder, as I am aware both are old.

What I claim as my invention, and desire to secure by Letters Patent, is—

The throttle *i* and check-valve *n'*, arranged respectively in the secondary ports *e* and *n*, in combination with a cushioning-cylinder and piston, substantially as set forth.

In testimony whereof I, the said JOHN M. COOPER, have hereunto set my hand.

JOHN M. COOPER.

Witnesses:

A. S. NICHOLSON,
G. H. CHRISTY.