H. Johnson,

Steam-Engine Attachment,

No. 47,424. Patented Apr. 25, 1865.

Fig: 2.

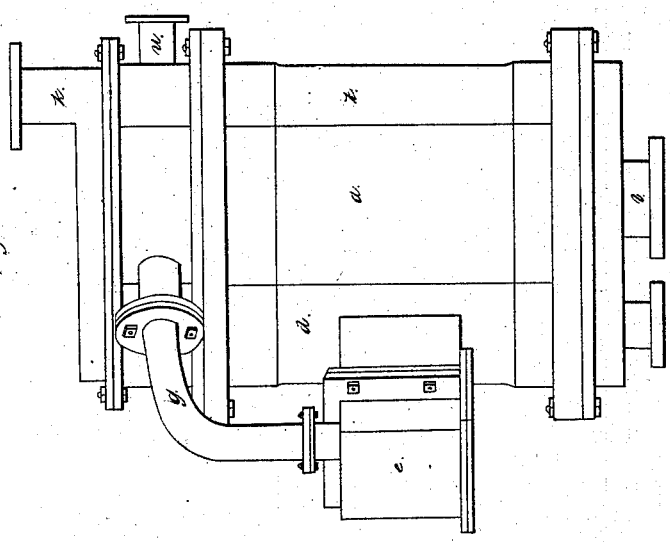
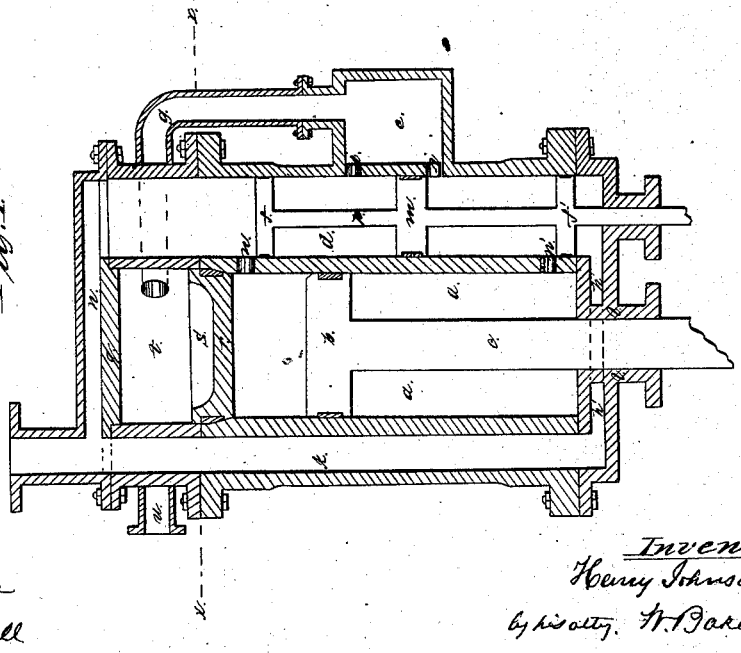


Fig: 1.



Witnesses

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UNITED STATES PATENT OFFICE.

HENRY JOHNSON, OF PITTSBURG, PENNSYLVANIA.

IMPROVEMENT IN STEAM-ENGINES.

Specification forming part of Letters Patent No. **47,424**, dated April 25, 1865.

To all whom it may concern:

Be it known that I, HENRY JOHNSON, of the city of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Cushions for Steam-Cylinders; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, forming part of this specification.

My improvement consists in seating in the cylinder of a steam-engine, a short distance below its head, a circular movable disk or piston, the cylinder being lengthened sufficiently to give room for the stroke of the working-piston below the disk, and causing the live steam from the boiler to pass into and through the space between the cylinder-head and the movable disk on its way to the steam-chest of the engine, so that in case the piston of the cylinder should strike the movable disk, which forms a false head to the cylinder, the live steam in the space between the disk and the cylinder-head (which space communicates directly with the boiler) will act as an elastic cushion, preventing the piston or movable disk from striking or coming in contact with the cylinder-head, no matter how much force of steam is applied to the piston to force it toward the cylinder-head.

This improvement is applicable to the steam-cylinder of any steam-engine on which the piston works toward and from the cylinder-head, but is especially useful in its application to steam-hammers. I shall therefore illustrate my invention in its application to that machine.

In the accompanying drawings, Figure 1 is a longitudinal section through the steam-cylinder, steam-chest, and exhaust-pipe of a steam-hammer. Fig. 2 is an exterior representation of the same apparatus.

In both figures like letters of reference denote similar parts of the machinery.

In the drawings, *a* is the steam-cylinder, having a piston, *b*, working steam-tight therein. The piston-rod *c* passes through a stuffing-box in the lower end of the steam-cylinder in the usual manner. On one side of the steam-cylinder, and parallel thereto, is situated the steam-chamber *d*, through which the steam is admitted into the cylinder *a* from the steam-chest *e* by the balance-valves *f f'*, which work as pistons in the steam-chamber. *g* is the pipe which conducts live steam from the boiler into the steam-chest *e*. The steam-chamber *d* communicates, at top and bottom, with the upper and lower exhaust-passages, *h h'*, both of which open into the exhaust-pipe *k*. The lower exhaust-passage, *h'*, passes around or to one side of the neck *l* of the cylinder, through which the piston-rod *c* works. *i i'* are openings from the steam-chest *e* into the steam-chamber *d*, one, *i*, above and the other, *i'*, below the central piston, *m*, on the balance-valve rod *p*, by which the hammer-piston *b* is operated in its cylinder. *n n'* are the upper and lower steam-ports, opening from the steam chamber *d* into the cylinder *a*.

So far as described, there is nothing peculiar in the construction of the steam-engine. The live steam entering the steam-chest *e* from the pipe *g*, passes into the steam-chamber *d* through the passage *i'*, between the piston *m* and valve *f'*, and enters the steam-cylinder *a* through the lower port, *n'*, raising the piston *b* and piston rod *c*, to the lower end of which is attached the hammer-block, in the mode usually practiced in the construction of steam-hammers. The exhaust-steam escapes at the upper port, *n*, above the valve *f*, into the upper end of the steam-chamber *d*, and passes off, through the passage *h*, into the exhaust-pipe *k*.

When the upstroke or lift of the hammer is completed, it is either forced down by reversing the valves *f f'*, so as to allow the steam to enter the cylinder *a* above the piston *b*, through the upper port, *n*, and the exhaust-steam to escape through the lower port, *n'*, under the valve *f'*, into the exhaust-passage *h'*, or it is suffered to fall by its own weight, without admitting live steam above the piston.

In the use of steam-hammers, as in all straight-cylinder steam-engines, there is danger of the piston striking the cylinder-head on its upstroke with such force as to knock it off; and to remedy this difficulty, as well as to increase the efficiency of the steam-hammer, is the object of my invention, which I will now proceed to explain.

Instead of terminating the steam cylinder just above the level of the upper steam-port, *n*, at the line *x x*, Fig. 1, I extend it above that

point, fastening the cylinder-head *q* a few inches (more or less, according to the size of the cylinder) above the line where the upstroke of the piston is intended to terminate. In the steam-cylinder *a*, just above the upper steam-port, *n*, I seat a circular disk, *r*, which is furnished with packing like a piston, so as to make it steam-tight. The diameter of the steam-cylinder above the line *x x* is somewhat greater than it is in that part (below the disk *r*) in which the piston *b* works, so that the disk *r* cannot descend in the cylinder below the upper edge of the steam-port *n*. The upper part of the disk *r* is cylindrical, or of uniform diameter, while the lower part may be tapering, so as to fit tightly in its seat. The under side of the disk *r* is a plane surface, but the upper side may be hollowed out, so as to form a bowl, *s*, although this is not necessary. Between the top of the disk *r* and the cylinder-head *q* is a cylindrical space, *t*, into one side of which opens the steam-pipe *u*, which communicates directly with the boiler, and at the opposite side of space *t* the steam-pipe *g* is inserted, which conducts the steam to the steam-chest *e*, so that the live steam from the boiler passes, on its way from the steam-boiler to the steam-chest of the engine, through the space *t* and above the disk *r*, upon which it presses with all the force of the steam in the boiler.

The operation and effect of this construction and arrangement are as follows: If the steam is let into the steam-cylinder *a* through the lower steam-port, *n'*, with sufficient force to cause the piston *b* to strike and raise the disk *r*, it is immediately met by the resistance of the live steam in the space *t*, and as the disk *r* fits steam-tight in the cylindrical space *t*, the raising of the disk does not allow the steam from the boiler to get below the disk into the working-cylinder *a*. In order to raise the disk *r*, the steam in the space *t* has to be forced back into the boiler, and as the force of steam in the space *t* is greater than that in the cylinder, and the area of the upper surface of the disk *r* is greater than that of the under side of the piston *b*, the balance of force is in favor of the disk, which presses the piston back to its place. If the upward stroke of the piston should be sufficiently strong to raise the disk *r* so high in the space *t* as to close the openings from the steam-pipes *u* and *g*, the live steam in the bowl *s* of the disk *r* is sufficient to prevent the disk *r* from striking the cylinder-head *q* in any event.

The effect on the working of the hammer of striking the disk *r* with the piston *b* and raising it from its seat is only to increase the force of the downward stroke of the hammer without doing any injury whatever to the machinery or risking the breakage of the cylinder.

Another advantage resulting from my improvement is, that when the piston is raised sufficiently to strike the disk *r* and raise it from its seat a downward motion is immediately given to the piston by the direct pressure of the live steam from the boiler on the disk *r* with so much force as to render it unnecessary to admit the steam through the upper port, *n*, on the down stroke of the piston, and thereby a saving of nearly one-half of the steam is effected.

It will be manifest, from the description which I have given of my invention, that it is applicable to steam-cylinders of various kinds, for wherever the engine is so constructed as that the piston might be forced against the cylinder-head, the movable disk, with the steam-space between it and the cylinder-head, through which the steam passes on its way from the boiler to the engine, may be employed, and will effectually protect the cylinder-head from danger.

The advantages of my improvement over an air-cushion, or any contrivance by which air or any other fluid is closely confined in a space at the end of the cylinder, are very great and obvious, as by my improvement the power applied to resist the impact of the piston must of necessity be greater than that which actuates the piston, and always operative when the piston is at work. Besides that, the free communication between the space which contains the steam and acts as a cushion and the steam-boiler secures more power with greater elasticity than is possible with any arrangement or contrivance previously known or used.

Having thus described my improvement in cushions for steam-cylinders, what I claim as my invention, and desire to secure by Letters Patent, is—

The use of a movable disk or independent piston seated in the steam cylinder above the working-piston, with a steam-space between it and the cylinder-head, through and into which the live steam from the boiler is caused to pass on its way to the steam-chest of the engine, for the purposes of a steam-cushion, and to increase the efficiency of the steam-engine, substantially as hereinbefore described.

In testimony whereof I, the said HENRY JOHNSON, have hereunto set my hand.

HENRY JOHNSON.

In presence of—
ALLAN C. BAKEWELL,
W. BAKEWELL.